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The

Geographical Journal.

No. 1. JANUARY, 1900. Vol. XV.

ON DESERT SAND-DUNES BORDERING THE NILE DELTA.*

By VAUGHAN CORNISH, M.Sc. (Vict.), F.C.S., F.R.G.S., Associate of the Owens College.

In continuation of my investigation of sand-dunes,† I visited Egypt in the spring of 1899. Landing at Port Said on April 13, the afternoon train to Ismailia carried us past the dunes of El Ferdan, the smooth sand-slopes tawny as a lion's skin under the orange glow of a declining sun (Fig. 1). On the sky-line the profile of two successive dunes reproduced as exactly as the eye could judge the profile of blown-sand ripples (Fig. 3, *Geographical Journal*, p. 281, March, 1897). The sands near the railway were beautifully rippled by wind, crossing ripples being common. We alighted at Ismailia.

April 14.—In eight minutes' walk from the Hotel Victoria one is upon the sand-dunes which border Lake Timsah to the south of Ismailia. The dunes, I am informed, were there before the making of the Suez Canal converted the marsh into a lake. Fifty yards from the lake, 15 to 20 feet above a tilled field, the sand at 3 inches below the surface was distinctly damp at 9.50 a.m. The sun was fairly strong in a clear sky, and a breeze was blowing. I was informed that there had been no rain for weeks past. The nearly flat top of the old sand-dune, about 20 feet above the surface of the lake, exhibited some of the larger variety of ripples, such as those of which measurements are given by E. A. Floyer in the *Geographical Journal*, June, 1898. The wave-length was 86 inches, the crest nearly in the middle, the amplitude about 6 inches. A transverse section of the ridge was made. The sand at a depth of

* Read at the Royal Geographical Society, November 27, 1899.

† *Geographical Journal*, March, 1897, "On the Formation of Sand-dunes."

3 inches below the crest (and therefore 3 inches above the trough) was so compact as to stand vertically. The sand was free from any binding vegetation. The section showed strongly marked stratification. Small samples of the sand were collected, and are here recorded with reference numbers, as is done throughout this paper. Particulars of the mechanical analysis of the samples will be given in an Appendix.

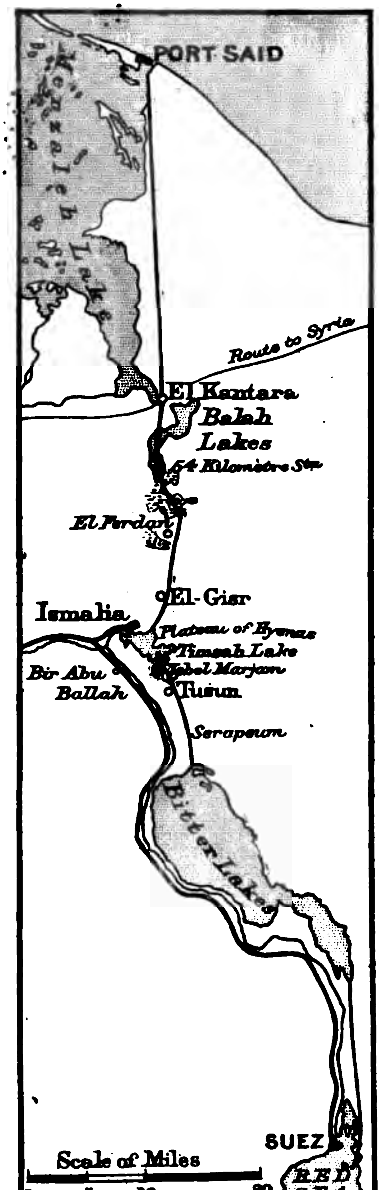


FIG. 1.—MAP OF SUEZ CANAL.

Sample 1.—Taken 7 inches below crest of ripple (1 inch lower than the trough).

Sample 2.—Taken 3 inches below the crest.

Sample 3.—Coarse sand scraped off the top of the crest.

Similar ripples, measuring as much as 11 feet in wave-length, were examined in the afternoon of the same day on the desert north-west of the town.

April 15.—I accompanied my cousin, Mr. E. A. Floyer, and M. Paul Doyen (chef du Secretariat du Service des Exploitations, Compagnie du Canal de Suez) to Bir Abu Ballah. Here the margin of the dune-tract forms a rampart west and north of what was not long ago a salt marsh, but which, after draining, is now cultivated land. The steep rampart of sand, say 30 feet high, faces in various directions, differing in orientation by as much as 90°. The lower portion of the rampart is as steep as the sand can stand, but the upper portion is rounded; there is no knife-edge crest, such as is given by the back-cutting of the wind-eddy. We walked along the summit of this rampart, and it was soon apparent that its sinuosity was not due to wind. The non-cultivated tract being flat, it cannot with probability be referred to the orography of the sand-buried surface. I suppose that the rampart conforms pretty nearly to the shape of the original marsh and of the tract of irrigated land which has replaced the marsh. The capital importance of ground-moisture in determining the formation of a dune-tract, or dune-massif, throughout the sandy districts which I visited became clearer to me towards the end of my stay. This subject, to which my attention was drawn by M. Doyen, is dealt with more fully at the end of the paper.

The surface of this dune-massif is modelled by two sets of waves, of which the crests are nearly at right angles, the ridges running from a little west of north and a little south of west respectively, these directions, and others mentioned in this paper, being compass-bearings taken with a common pocket-compass. Viewed from the cultivated land on the east, the summit of the rampart appears in waves of the familiar ripple form, the longer and flatter slope to the north, the shorter and steeper slope to the south.

Sample 4 was taken from the surface of a heap of material turned out from a drainage-canal which crosses the cultivated land. It consists mainly of quartz-looking particles, with some dust. The grains are not so well rounded as those of the dunes.

Returning to Ismailia, I went to the limit of the Casuarina plantations on the north of the town. Here a dune is in process of formation close to the road which follows the shore of Lake Timsah. It is about 140 feet broad and 8 feet high; the ends are slightly curved forward, and have no cliff. The central part of the lee slope is a cliff, but the summit of the dune is some distance to windward of the top of the cliff (compare the figure given by Captain Younghusband, on p. 99 of 'The Heart of a Continent'). *April* 16.—It will be convenient under this date to describe the observations made on several days of a dune to the north-west of Ismailia, which we came to know as "Doyen's Dune." A part of the crest forms the sky-line on the left in Fig. 25 of the paper on Sand-dunes in the *Geographical Journal*, March, 1897. The accompanying figure (Fig. 2) is a general view of this dune taken on May 13, 1899. I estimate its greatest height at about 40 feet. Its eastern end is on the summit of the rampart of sand which flanks the plantation of Abu Racan, shown in Fig. 25. At its western extremity, on the northern side, it abuts upon a large pool, which is a part of the marsh of Abu Racan. M. Doyen, at my request, had seventeen reeds put in along the top of the cliff at intervals of ten metres, commencing near the eastern, or plantation, end. This line of reeds extended from the eastern extremity of the cliff beyond the highest part of the dune, but did not reach by 70 paces the western extremity of the cliff. Beyond this, again, the dune extends as a rounded swell, until it merges in the undulating surface of the desert further west. Each day of our stay at Ismailia a northerly wind blew steadily for several hours, its strength in the afternoon being that of a stiff breeze. At that time the haze caused by sand flying from the top of the cliff was sufficient to spoil my photograph. The photograph (Fig. 2) was taken in the early morning. The following numbers show the march of the top of the cliff before the northerly wind. The numbers in the first (left-hand) column refer to

FIG. 2.—DOYEN'S DUNE, ISMAILIA.

the upright reeds, No. 1 being at the eastern, and No. 17 towards the western end, the whole distance, from 1 to 17, being 170 metres in a line following the sinuosities of the cliff-top. The highest point is near No. 12.

ADVANCE OF CLIFF-TOP OF DOYEN'S DUNE.
(Points 1, 2, . . . at intervals of 10 metres, going westward.)

	First 11·5 hours' advance.	Further advance in next 23 hours.	Further advance in next 25 hours.
Point 1	66 inches.	— inches.	— inches.
„ 2	16 „	224 „	*nil*
„ 3	22 „	68 „	*nil*
„ 4	24 „	11 „	2 „
„ 5	18·5 „	25·5 „	8 „
„ 6	19 „	18 „	1½ „
„ 7	18 „	21 „	6 „
„ 8	17 „	19 5 „	4·75 „
„ 9	16 „	19·25 „	6·5 „
„ 10	16 „	16·5 „	9 „
„ 11	11·5 „	22·75 „	8·25 „
„ 12	7·5 „	18 „	9·5 „
„ 13	7·25 „	10·5 „	14·25 „
„ 14	8 „	5·75 „	20·50 „
„ 15	9 „	9·75 „	20·25 „
„ 16	4·5 „	16 „	15 „
„ 17	4·75 „	10·25 „	22 „

The average rate of advance of the cliff-top is 0·925 inch per hour, or, excluding the one exceptional advance noted near the western extremity, 0·717 inch per hour. The results may be expressed with

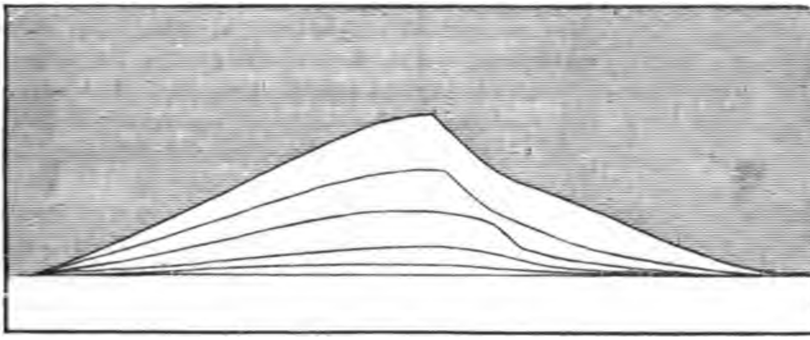


FIG. 3.—STAGES OF DUNE-FORMATION.

sufficient precision if we say that the cliff-top advanced about three-quarters inch per hour. This is the readiest means of obtaining a first notion of the rate of progression of the dune; but, as indicated by Fig. 3,

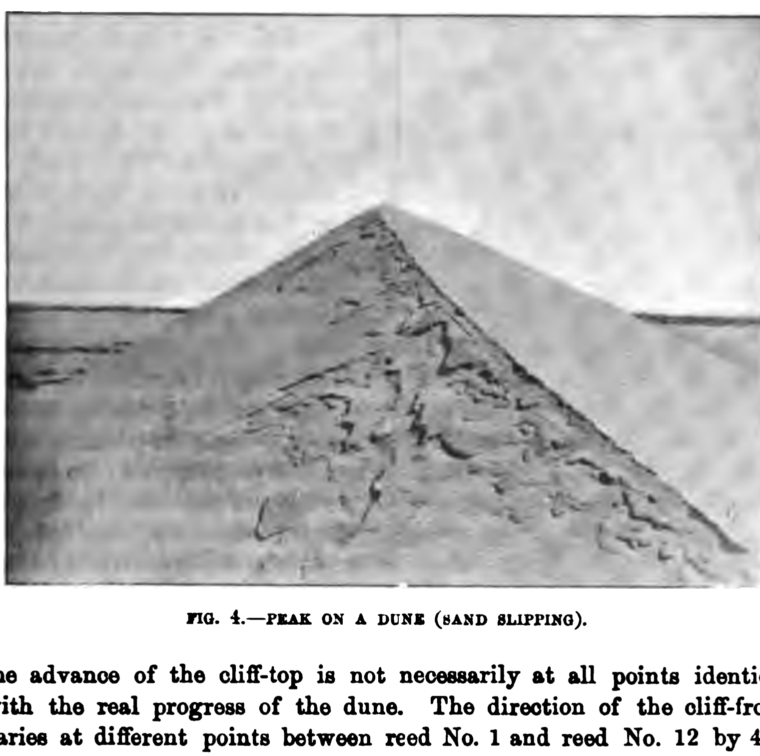


FIG. 4.—PEAK ON A DUNE (SAND SLIPPING).

the advance of the cliff-top is not necessarily at all points identical with the real progress of the dune. The direction of the cliff-front varies at different points between reed No. 1 and reed No. 12 by 45°.

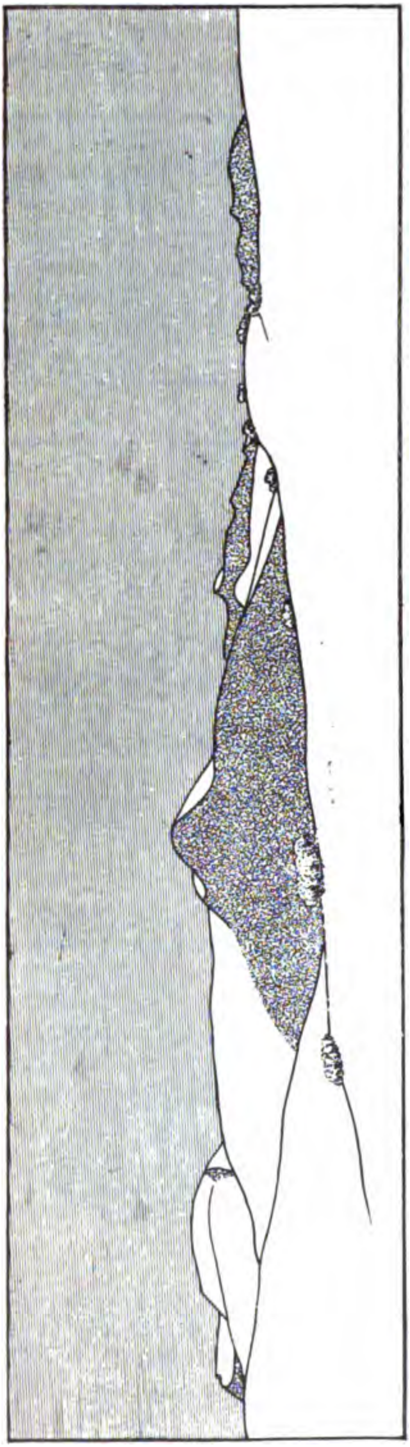


FIG. 5.—TWO PARALLEL RIDGES.

The variation of direction of the ripples on the windward side of the cliff at the same points between reed 1 and reed 12 was 56°. This shows how greatly the direction of the wind is locally modified even on the windward side of the dune by its various height at different points. The deviation from parallelism between ripple-front and cliff-front between reed 1 and reed 12 was from 1 to 4 points of the compass —that is to say, from 11¼° to 45°. This illustrates the fact that the march of the sand is not necessarily at right angles to the face of the cliff.

This is a good example of a dune the greater extension of which is transverse to the wind. On the lee side the direction of the wind is, locally, deflected through 90° in the horizontal plane. The sand comes sweeping round the ends, especially round the western end, and travels towards the middle, at the same time sweeping upwards and backwards. The activity of the wind on the lee side, and the increased capability for sorting which is conferred by the upward action of the eddying motion, is very striking. The lower part of the lee slope has a fairly hard surface, and is well rippled, the ripples facing in the reverse direction to those on the windward slope of the dune. The upper part of the lee slope of the more developed and middle part of the dune is the well-known straight cliff which has a soft, unrippled, slipping, plane surface. It has been customary to ascribe this slipping cliff to the pushing of sand-grains over the crest by the forward action of the wind and their downward rolling. This explanation implies that the cliff is constantly refaced by sand-grains thus driven forward from the surface of the windward slope. What I saw on this and other dunes during my stay in Egypt convinced me that this notion is incorrect. The cliff is due to undercutting by the backward-acting eddy. Were the sand coherent, an overhanging cornice would be formed, as I have seen happen during an easterly gale on a sandhill at Poole Haven. I have watched the same process when lying under a bank of drifting snow on the hills above Innsbruck (January, 1898). The loose dry sand, however, slips, so that

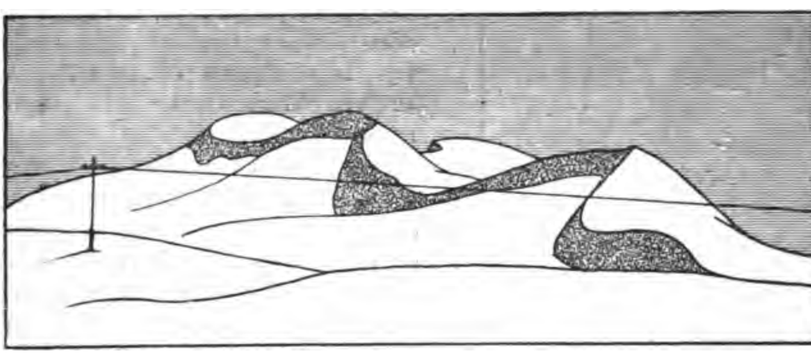


FIG. 6.—A CURIOUS TRIPLET.

the spraying sand-wave has not the cusped form, but presents the curious anomaly of a straight line interpolated between curves moulded by the wind.

Fig. 3 is from a drawing made at the western end of Doyen's Dune, somewhat generalized to represent what appeared to be the aspect of the sand-dune profiles at successive stages of development. It is not precisely a diagram, for the intent was to represent the appearance of the slopes, which is generally steeper than reality. I hope in the future to replace this figure by careful measurements; meanwhile the following description of the probable course of development of the dune profile must suffice. The case considered is that in which the eddy on the lee has not cut down to hard rock. At first both windward and lee slope are very gentle; the highest point is near the middle. The summit probably moves to the leeward of the middle point, the lee slope certainly becomes steeper. A slipping cliff is formed on the upper part of the lee slope when the eddy has gained sufficient strength. The top of the cliff is worked back towards the summit; the windward slope meanwhile

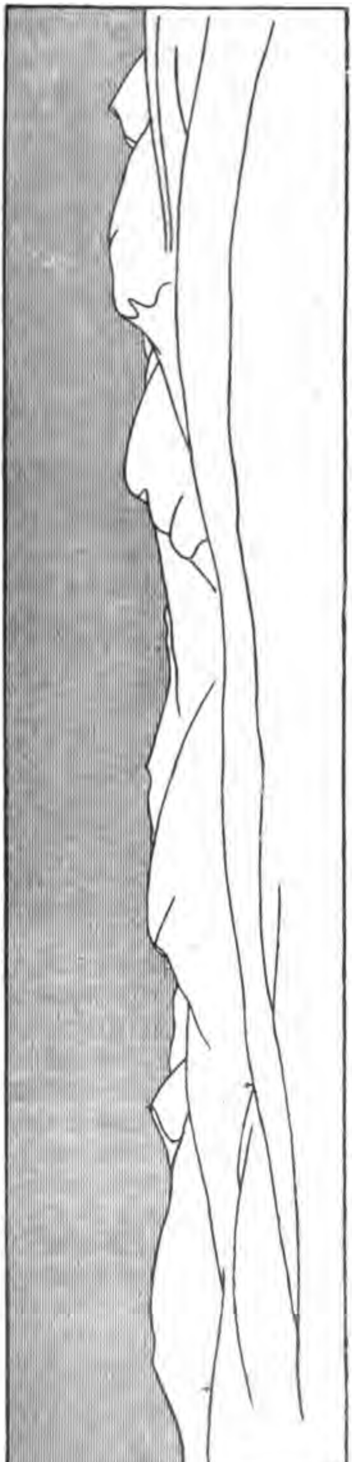


FIG. 7.—FOUR PARALLEL RIDGES.

becoming steeper. Finally, windward and lee slope become of nearly equal average steepness, and the top of the cliff coincides with the summit of the dune.

On April 17 I went in a steam-launch of the Canal Company to those dunes on the south-western shore of Lake Timsah, which form so beautiful a feature in the view from the landing-pier at Ismailia. Fig. 4 shows a lee slope taken at the moment of slipping. The form of the peak almost produces, with the aid of perspective, the appearance of the pyramids.* The cliff-top is composed of constituent ripples, which make the edge minutely wavy.

On April 18 no field-work was done. On April 19 I started on a short expedition to the great dunes on the Syrian route from Kantara, of which route a map is given by A. R. Guest and A. McKillop in the *Geographical Journal*, March, 1899, p. 283. I left Kantara at 9.40 a.m. with four attendants, camels, tent, etc. At 2.10 p.m. we reached the palm trees of El Ookha, and resumed the march at 4.15 p.m., over round-backed sandhills somewhat similar in shape to rolling chalk downs. Later on we came to the fully developed dunes. We camped at Bir Nisf at 6.30 p.m. On April 20 we started at 5.45 a.m., still following the telegraph line eastwards. I sketched the views which

* If the form of the pyramids was really suggested by a feature of the landscape, I think the peak on a dune ridge is a more likely origin than the conical hills left by erosion in the rocky desert.

I photographed, which was fortunate, as most of the photographs were over-exposed. The forms can be represented by an outline drawing, for there is no visible detail. The lines represent the sky-line, the top of the cliff, and the summits of the ridges. Fig. 5 is looking north at 6 a.m. Fig. 6 looking north at 6.50 a.m. The shading is the only alteration made in the sketches after leaving the spot. At this early hour the scenery is bizarre and strange, the contrast of light and shadow being quite lunar in its intensity. This is not to be wondered at, considering

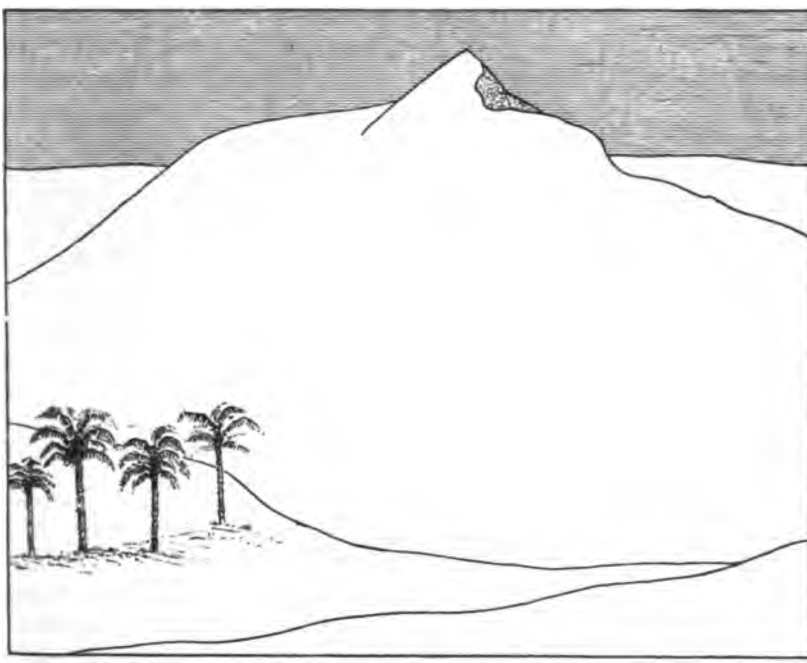


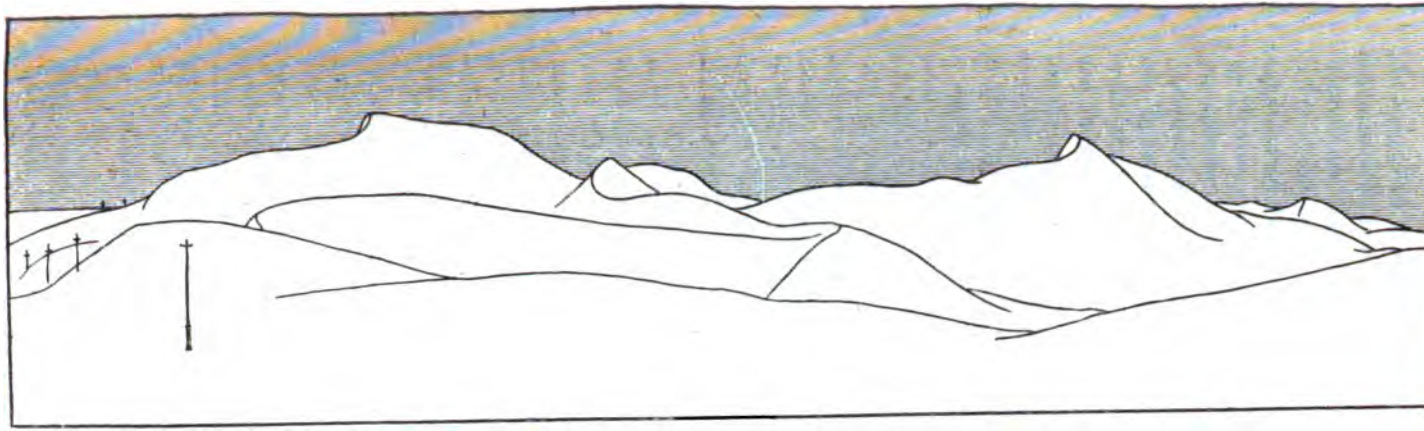
FIG. 8.—ABU RAMLE.

that the *arêtes* are only one sand-grain broad. Moreover, the absence of detail on the surfaces of pure blown sand, the steep slopes and bold forms, together with great clearness of definition and a deathlike stillness, combine to produce an impression of being surrounded by lofty mountains. It requires a distinct effort of reasoning to dispel the illusion of being surrounded by mountains of 3000 metres instead of hills of 300 feet. Unfortunately, photographs do not reproduce the illusion. Fig. 7 is of four parallel ridges of sandhills on the north; the whole distance from the first to the last ridge may be 3 miles, but the distances are difficult to judge. The ridges run approximately east and west. The south is at present the lee slope, but in most of the large dunes here the crest seems to be turned back and twisted by the present northerly winds, the main windward slope being on the westerly side. There were no vertical or overhanging cliffs. These, I expect, are formed by violent winds quickly stripping the loose surface, and then carving the compacted sand below. Fig. 8 is a sketch of Abu Ramle (the Father of Sand), the furthest point reached. We reached Bir Nisf again at 9.30 a.m., and retraced our steps towards Ookha. Fig. 9 is looking south at 10.15 a.m., a typical undulating dune country, recalling snow surfaces. Presumably there is a great depth of sand below the troughs of these gentle undulations. On the road back it seemed to me that beneath the visible swells there was a longer undulation which I was tempted to compare with the long heave of the ocean invisible in presence of shorter steep waves, but which in absence of information

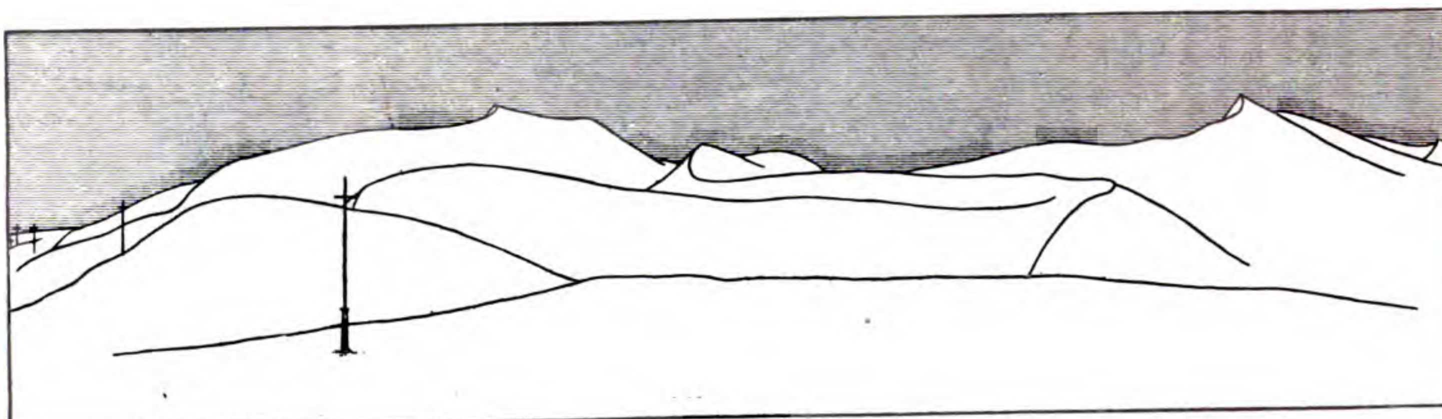
FIG. 9.—ABU RAMLE.

one must admit to possibly follow the configuration of the *bottom* of the dune tract. Fig. 10 gives a sketch taken north of the route on the afternoon of the 19th (above), and a second which was, in forgetfulness, taken from nearly the same spot at 10.55 a.m. on this day, the 20th (below). Their reproduction shows how far my sketches are consistent. The distance between the telegraph-posts is 80 metres. Fig. 11 is a sketch taken at 11.45 a.m., looking back towards Kantara; the foreground yellow sand in rounded undulations, the distance a plain, first yellow with brown dots, afterwards brown with yellow dots, as the proportion of clean brown sand diminishes. The dots are bushes. We arrived at Ookha at 12.30. Fig. 12 is from a photograph under the palm trees there, showing the rampart of the plateau of sand on the south of the damp spot called the Wells.

Samples 9 and 10 were collected on this slope. I noticed, on examining the sand on the spot with a lens, that the larger grains were better rounded than the small ones, which suggests that the former have been longer exposed to the action of wind, that the latter



Upper part.



Lower part.

FIG. 10.—CONCORDANT SKETCHES.

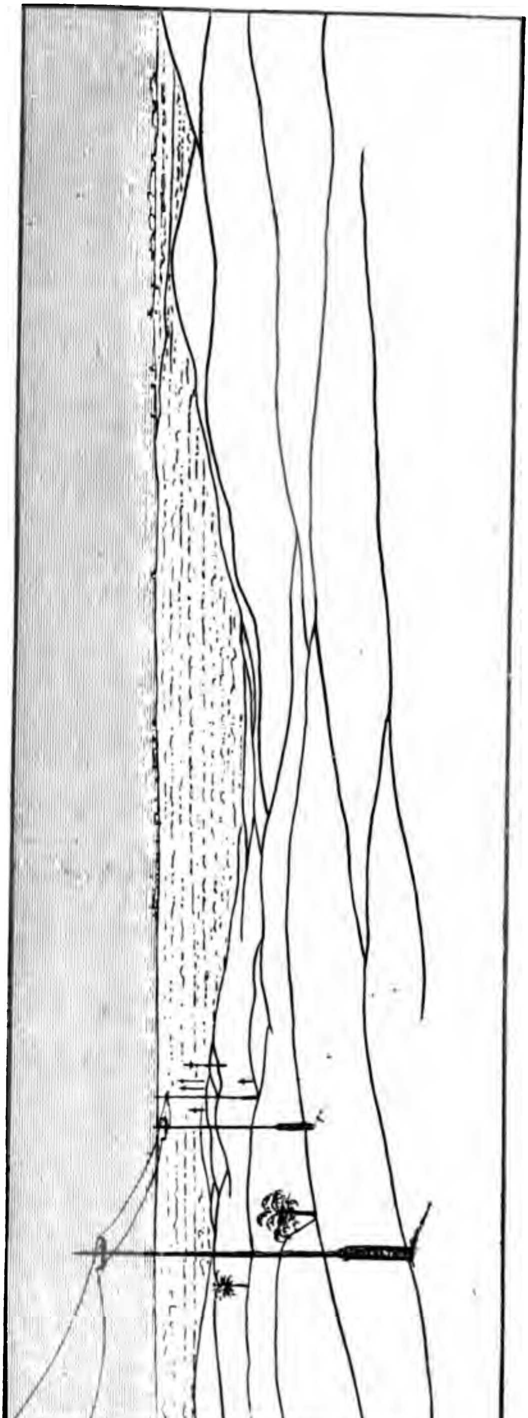


FIG. 11.—LOOKING BACK TO KANTARA.

are, in fact, chips, and that the comminution of the sand-grains proceeds not by grinding but by breakage. I have repeatedly observed the same thing on shingle beaches.

The average size of the surface layer is much larger than that of the lower layers. The present (northerly) winds blow up this slope.

Sample 11 is coarse sand scraped from the surface on the plateau above this slope.

Sample 12 is an average sample of the top layer of a rounded swell beyond (south) of the last.

Sample 13, from the same spot, but 3 inches below the surface. This sand was very compact, and stuck to the sides of the glass sample-bottle. The day had been extremely hot, and there was no evidence of rain having fallen recently, and there was no surface-water at the "Wells," some 40 feet below. The seeping up and retention of moisture by the sand-dunes is undoubtedly of considerable importance to an understanding of their properties.

Fig. 13 is a sketch taken from this spot, looking eastward. The great dune is called Abu Assab; it is said to be 500 feet high. In this extensive view all was pure yellow blown sand, except a few shrubs.

April 21.—We set out for Kantara at 5.10 a.m., and at 6 a.m. I made a second sketch (Fig. 14) of Abu Assab. On the right is the long south and west slope, on the left a part of the northerly slope, which is now the windward side. The dark shadow is the steep lee face produced by the present northerly winds. Apparently the main outlines of the hill are determined by westerly winds, but the top is turned back and twisted by the present northerly wind.* I subsequently saw the main

FIG. 12.—RAMPART OF SAND, CLOSE TO A "WELL."

outlines of this dune distinctly from the deck of the R.M.S. *Austral* on the canal, between Kantara and Port Said, at a distance of 17 statute miles.

Sample 14 was taken at 8 a.m. from a mound near a bush. It has the brown tint which characterizes the plain east of Kantara. The level of the sand here is obviously being lowered. The erosion is mainly due to the winds coming from a little south of west, as is shown by the direction of the ridges left behind the bushes. The marks of erosion by rain are also frequently visible here, whereas among the dunes they were strikingly absent. The general lowering of level in this place

* I suggest that the violent winds from a little south of west do most of the *transport of sand*, and the ordinary northerly winds most of the *modelling of the surface* in this and neighbouring localities.

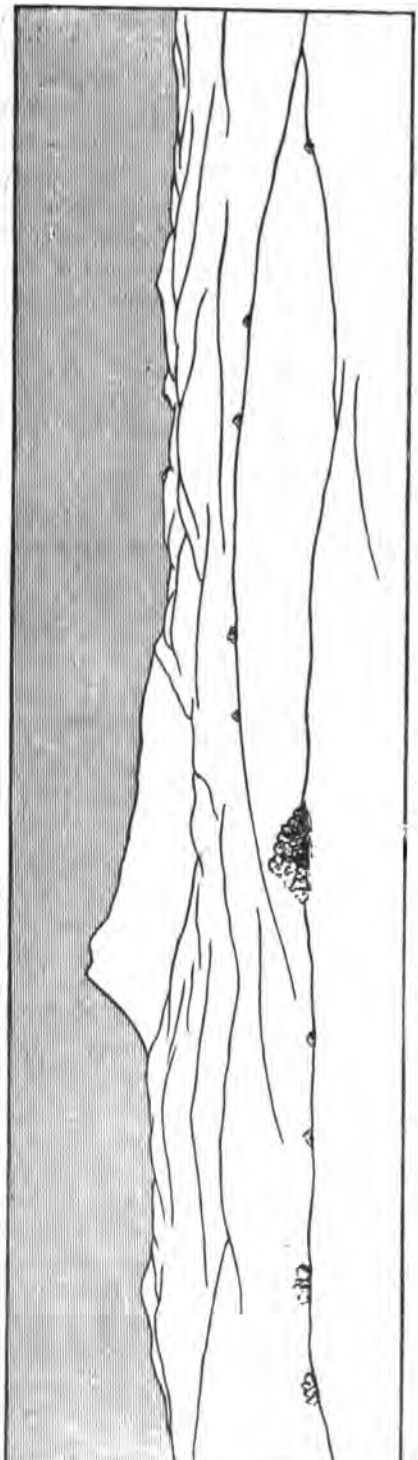


FIG. 13.—UNDULATING SANDS, ABU ASSAB IN THE DISTANCE.

where bushes abound, and the accumulation in the near neighbourhood where such obstructions are few, is an instructive example of the insufficiency of the "casual obstruction" theory to explain the origin of dunes. I arrived at Kantara at 8.45 a.m. Returning to Ismailia by train, I was struck by the contrast between the fresh yellow sand-surface west of the canal, and the old, brown, vegetable-stained sand on the east. Presumably the cutting of the canal is largely responsible for this difference. A large sand-dredger was at work near by.

On April 22 I accompanied MM. Tiffnay and Doyen on an inspection of the plantations on the west side of the canal, designed to arrest the drifting sand. The positions where the sand-drift is most troublesome are, of course, not where dunes occur, but where, in the absence of any retarding influence, the sand travels freely in a thin film over the plain. At Toussoum the casuarina trees had been planted two years. They are watered with a little sweet water, and appear perfectly healthy. In the plantations, which are close to the canal, are also mimosa, acacia, tamarisk, and other trees and shrubs, but the casuarina is the mainstay. It grows rapidly, attaining, at Ismailia, a height of nearly 60 feet in twenty-five years. It is said to be capable of drawing its supply of water from a considerable depth. The foliage is feathery, such as cheats the wind of its force. The tree will not stand frost. Leaving Toussoum in the steam-launch, I observed that there was a 2-foot cliff on the west bank of the canal, except where reeds (*A. gigantea*) have been planted. These afford an almost perfect protection against the wash of the steamship waves. Their roots are kept moistened by sweet water from a little sweet-water channel on the bank. Landing at Serapeum, we visited another plantation of casuarina trees which have grown from 50 cm. to 3 metres in two and a half years. They are at present supplied with sweet water, but it is thought that it will not be necessary to continue this for more than a year or two, as there is water at 3 metres, which by that time their roots should reach. Here, also, reeds (*A. dona*) are grown for use as temporary barriers against the drifting sand. Altogether we visited 3½ kilometres of plantation.

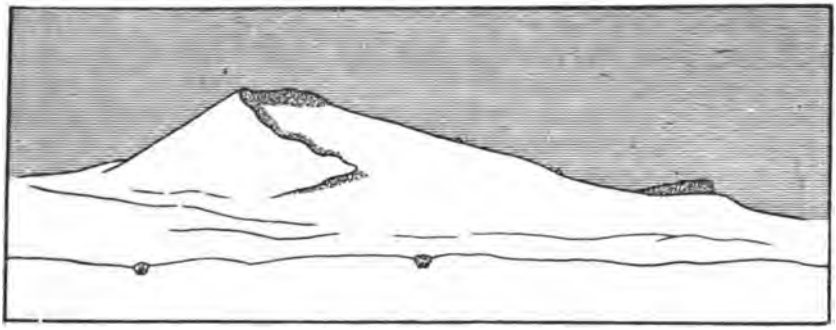


FIG. 14.—ABU ASSAB.

On April 23 I left for Cairo by the railway. Subsequently (May 12) I did the same journey in the reverse direction. Between Ismailia and Abu Hammad (Fig. 15) the influence of ground moisture in causing the formation of dunes is strikingly illustrated. South of the Wady Toumilat is visible a plain dotted with scrub, and bordered on the south by mountains. No dunes were seen here except just along the south border of the moist valley, where they form a conspicuous feature. To the north of the Wady the ground rises somewhat rapidly. Here there is a stony plain, scored by rain-erosion, without dunes. I am informed that sand blows freely about this plain. Whether the formation of a dune-massif by ground moisture is wholly owing to increased mechanical coherence of sand, or whether it is assisted by electrical discharge, I do not at present know. That electrification plays some part in sand-transport is likely enough, considering the mobility of electrified sand. At Tel-el-Kebir, on the north of the line, may be seen the plantation undertaken by the Government for experiments in acclimatization of plants in the desert.

April 24 to 27 was spent in Cairo, and on April 28 I went to Helwan, where the principal rock is limestone.

On April 29 I went up the Wady Hof near Helwan, where both wind-erosion and water-erosion are finely shown. Fig. 16 shows wind-cutting of the cliff, and a talus of the residual fragments. The portion of cliff shown in the photograph is about 60 feet high.

Sample 16 is a specimen of the sand which occurs very scantily in the Wady.

FIG. 15.—MAP OF THE DELTA.

April 29.—I rode eastward from Helwan. Where no principal Wady has yet been cut the rain-water wanders very freely in search of the lowest level, as is easily seen by the mud-channels. There is a good deal of salt about, which probably increases the erosive effect of rain by causing the soil to cake. This will prevent the rain sinking in, thus favouring its accumulation in channels, where, however, the salts no longer constitute a sufficient binding material. Probably the length of drought is almost as important as the quantity of rainfall in determining the amount of water-erosion, for it is the drought which hinders vegetation, and otherwise assists the rain when it comes.

On May 2 I left Helwan on a visit to Mr. Floyer's plantations on the western edge of the delta north of Menashi. The train left Cairo at 2.30 p.m., and stopped to set me down at 3.40, where a trolley was in waiting, which conveyed me to the rest-house. Bounding the view on the west are furrowed hill-slopes, composed, I understand, of a coarse gravel or conglomerate, with sand in the troughs between the ridges, nestling against the southern flanks of the latter. The ridges are nearly bare of sand, and brown in colour. The general effect reminds one of snow clinging to the shady side of the valleys

FIG. 16.—WIND-ERODED CLIFF, AND TALUS, WADY HOF.

on the spurs of a mountain-side. Mr. Floyer's efforts are directed to reclaiming a flat strip (about 40 kilometres long by 3 or 4 wide) between these hills and the westernmost branch of the Nile. The desert sands have not only driven back cultivation from a great part of this strip, but in places have deeply buried the fields to the east of this branch of the Nile. The Nurseries are between the railway and the stream, where the plants can be readily watered. In one of these the casuarina were being re-potted. Both here and in other nurseries where the trees have been planted out, their general healthiness is remarkable; it is almost impossible to find one drooping. The men employed in tending them are peasants from the neighbouring village, with no special training, but they seem to have an inherent or inherited aptitude for the work, which they do with a will, and with pride in the growth of individual trees. One casuarina of a year old, having shot up to the unusual height of 2 metres, the men have named "Kitchener Pacha." The others of this nursery of the same age are rather less than 1 metre; all were grown from seed in practically pure sand. The lines of trees are as regular and straight as in any English nursery. Near by I saw a casuarina which had been for six months standing in a bucket of water, yet appeared perfectly healthy, which

FIG. 17.—AGAVE RIGIDA SISALANA.

shows how well suited the tree is to a district subject to periodic inundation. Ground-nuts planted at foot of the casuarina serve to fix nitrogen, to shade the ground, and as an index of proper watering. They are also worth something for oil. Near by, the casuarina were being planted away from the canal, entering on their proper work in the desert itself. The method of planting is as follows. An iron cylinder, 14 cm. diameter and 60 cm. long, is sunk in the sand. The workman scoops out the sand (they can burrow in the material with surprising facility) and fills the cylinder with a good light mould.

The cylinder is then removed, and the tree is planted in the mould, so that it has nourishment provided until the roots have gone down 60 cm., when the damp sand is reached. A man can plant sixty casuarina per diem in this way. The wage is one franc a day. Fig. 17 shows a fine plant of *Agave Rigida Sisalana* further out in the desert. Being more distinguished than his fellows, the men have called him "Sheikh-as-Saadat." The figure in the photograph is that of Mr. Floyer. The "Sheikh" has been two years in the desert without attention, and has nine well-grown suckers. Other plants near by have eight, nine, twelve, and thirteen suckers. They have flourished exceedingly without watering, and Mr. Floyer expects that they will rapidly cover the neighbouring desert. The fibre, I am told, is worth £34 a

FIG. 18.—SAND-GRAINS, LEE OF ARTIFICIAL DUNE (MAGNIFIED).

ton, and the manufacture is extremely simple. The casuarina also has considerable value in a country where even firewood is imported to the value, I am told, of £30,000 per annum.

On May 3 Mr. Floyer and I left the rest-house (north of Menashi) at 6 a.m., and boarded the train for Terieh. On the right hand I could see islands of blown sand among the cultivated lands of the delta. After Katatbeh we passed through a belt of land which is still cultivated, showing what can be done about here. An old ruin near by supplies a nitrogenous manure. There is a bank of sand on the west of the line at the railway-station, Terieh, produced by a reed fence placed to check the sand-drift. Fig. 18 is a microphotograph of a portion of *sample* 21, taken on the lee side, and near the summit of this artificial dune. The want of uniformity of size of grains should be noticed. The artificial dune was round-topped; there was no very active eddy here to perfect the work of sorting.

At Terieh I noticed that black earth is brought up in well-making from below the sand. Below the black earth, Mr. Floyer informs me, there is coarse sand. These facts point to former cultivation. Fig. 19 is a photograph (looking north) of a cemetery wall 6 feet high, at Terieh, banked up by drifting sand on both sides. The top of the wall keeps free of sand, which is usual, but worthy of remark.

Sample 22 is from the eastern side of the wall.

Sample 23 is from the western side.

FIG. 19.—CEMETERY, TERIEH.

Sample 24 is from the sandy plain, taken between the cemetery and the village.

After returning by train to the rest-house near Menashi, I took *sample* 25 from the top of a small dune, where grass had prevented rippling. I returned the same day to Helwan.

On May 4, half a mile north of the town of Helwan, between the railway and the quarries, I collected *sample* 26 by scraping from the surface of the ground within the space of a few square inches. I noted that there appeared to be round about a sufficiency of hard sand-sized grains to form dunes, if only they had formed a sufficiently large *proportion* of the material in which they occur. Some scrapings from the top layer of the crest of ripples appeared to contain quartz grains, with much fine, soft stuff. Taking a handful of the pulverulent ground, I threw it into the air: stones dropped down straight to the ground, and a copious cloud of dust, best seen by its shadow, floated away in the northerly breeze. The range of size of the material is too great, and the proportion of sand-sized particles too small, for the ready formation of dunes. Their absence is not due to lack of wind-action, as is well illustrated by the wind-cut tables hard by, one of which (height about 4 feet 6 inches) is shown in Fig. 20. The action of the wind upon the rocks here produces stones and dust; sand-sized particles can also be found. Is the almost complete absence of sand-dunes connected with the too-rapid formation of dust from stones, and the necessary consequence that sand-sized particles are kept in a hopeless minority?

FIG. 20.—WIND-FORMED TABLE, HELWAN.

On May 7 I crossed the Nile to Mariette's House, in order to see the country near the pyramids of Sakhara. Here (west of the Nile) are rolling hills of hard gravel, similar to those which border the plain west of the country from Menashi to Terieh. Lying in the more sheltered spots is a scattering of golden sand, which gives the country a tint very different from that of the desert on the east of the Nile, near Helwan. In this connection I quote the following passage from a letter by Mr. Floyer (March 9, 1899), in which he says: "[Riding down the east bank, between Halfa and Assuan], it was easy to see the hills on the west bank covered with golden sand pouring into the Nile. There is on the east none of this golden sand at all."

In crossing the Nile this day I found on the west side a sandy foreland exposed by the subsiding waters of the river, which were then near their lowest level, on which, within the space of a few hundred acres, I saw a greater variety of forms of dunes than I met with during the rest of my tour. They were small—the highest not more than 4 feet—but perfect dunes; by no possibility to be confused with ripples. Their daily observation throughout a fall and rise of the Nile would have been an ideal exercise in the study of sand-dunes. Even the three visits I was able to pay to the sandy foreland yielded results which I believe to be of considerable interest.

Fig. 21 (Plate I.) is looking up-wind (N.N.E.). The steep lee cliffs stand out strongly. It will be noticed that the dunes are in transverse ridges, but that these ridges undulate. The view looking down-wind, the lee cliffs not being visible, showed no such striking contrast; indeed, the photograph is so faint that I have not had it reproduced. The sand is Nile sand (*sample* 27), fine, glittering, micaceous, splintery; quite unlike the rounded quartz sand of the samples I collected in the desert. During most of the time I spent on the foreland the sand was flying briskly. Fig. 22 (Plate I.) shows longitudinal ridges piled up against lee cliffs. The structure is readily understood when one watches the sand sweeping round from both ends of the cliff. I suppose it to be similar to a structure described by Dr. Blandford: * "From the north-east corner of most of the high hills near Bálmir a long ridge of sand runs out, evidently developed by the wind under the lee of the hill." It is not difficult to see that if the wind should continue sweeping out the sand from the depressions between the higher portions of the transverse ridges shown in the photograph, and depositing a part of it thus behind the highest part of the cliff, the longitudinal ridge thus formed may play an important part in a conversion of transverse into longitudinal dunes. I first saw these dunes in the morning; on my return in the afternoon the wind had increased, and there was a haze of flying sand 20 or 30 feet high over the foreland. In many places, where in the morning there had been loose sand, the wind had now cut down to the damp, compact floor, and the ripples appeared distinctly larger. Fig. 23 (Plate I.) shows a small dune, about 2 feet high, produced by a reed fence. The crest of the cliff is parallel to the fence, although, as shown by the surface-markings on the sand, the fence is not at right angles to the wind. Fig. 24 (Plate II.) is a perfect example of one of those singular structures known as fuljes in Arabia.† This was only 30 yards from the river, off which the wind was blowing. The photograph was taken looking down-wind at 5.15 p.m. The circular floor of compact material is about 12 feet in diameter. On the left there is a double ridge. I was able to watch the process by which this was being formed, sand coming to it from the left

* "On the Physical Geography of the Great Indian Desert," *Journ. Asiatic Soc. of Bengal*, vol. 45 (1876), p. 98.

† *Geographical Journal*, March, 1897: "Sand-dunes."

FIG. 21. Train of Dunes, looking upwind.

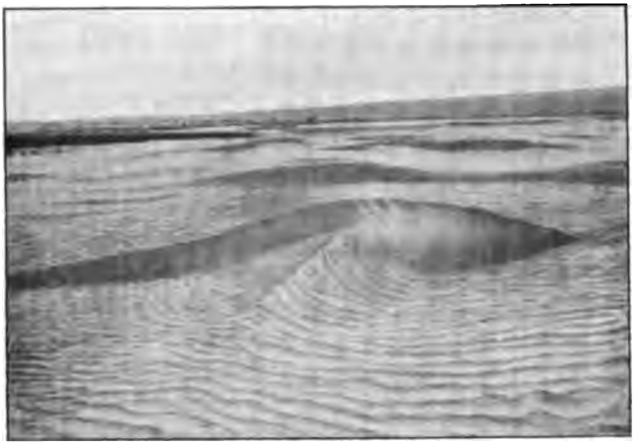


FIG. 22. Longitudinal Ridge developed under the Lee Cliff.

FIG. 23. Dune formed by Reed Fence.

and from the right, the latter sweeping in swirls across the floor of the fulj. The compact floor was somewhat eroded by the wind, showing a sort of erosion-rippling. I stuck a reed cane in the sand at the summit of the cliff and at the leeward edge of the floor in order to be able to observe the progress of the fulj.

Next day, May 8, I returned to the foreland, where I landed at 8.15. The cliff-summit of the fulj had advanced $18\frac{1}{2}$ inches in the fifteen hours, *i.e.* at an average rate of $1\frac{1}{4}$ inch per hour. [In the next forty-eight hours it advanced $29\frac{1}{2}$ inches, or 0·66 $\left(i.e.\ \frac{6\ \mathrm{H}}{10}\right)$ inch per hour, *i.e.* for the whole sixty-three hours average rate = 0·76, say three-quarters of an inch per hour.] The wind was now not nearly so strong as last night, and the troughs on the lee side of the cliffs were for the most part scattered over with loose sand. On the previous day I had been struck with the small ratio $\frac{\text{length}}{\text{height}}$ which was in places presented by several succeeding dunes. I had measured short series presenting ratios $\frac{\mathrm{L}}{\mathrm{H}}$ 11 and 13 respectively. As the eye became accustomed to the maze of forms, I began to suspect, however, that there was some compensating arrangement, such as would make the dunes flatter than ripples * along one profile and steeper along a neighbouring profile of the same ridge. I therefore marked out a line accurately up and down wind, and measured heights and lengths along this line with a tape as exactly as I was able to do without assistance. This set of measurements commences about 40 yards from the Nile, and proceeds downwind to the end of the group of dunes, hard ground succeeding.

Length (L), inches.	Amplitude (H), inches.	Length (L), inches.	Amplitude (H), inches.
396	35·5	Bt. forward 5100	Bt. forward 325
624	32	420	7
432	32	360	9
648	18·5	216	17
360	14	360	16
300	26·5	348	11
264	6	360	7
252	27	180	6·5
426	32·5	192	21·5
330	37	414	35
486	35	450	14
348	12	378	11
234	17	—	—
—	—	Total L 8778	Total H 480·0
Cd. forward 5100	Cd. forward 325·0		

$$\frac{\text{Total L}}{\text{Total H}} = 18·3$$

* The usual ratio $\frac{\text{length}}{\text{height}}$ for ripples is about 18 (vide *Geographical Journal*, March 1897, and June, 1898).

The individual ratios $\frac{L}{H}$ vary from 8·92 to 60·00. (The measurements of May 10, with assistance and better appliances, gave a concordant result. See *post.*)

On the higher portions of the foreland, to leeward and further from the river, barchans (or medanos) occur, of which Fig. 25 (Plate II.) is an example. The photograph is taken looking in a westerly direction, at right angles to the wind. The height is about 3 feet. The darker parts of the foreground are the eroded compact floor, with erosion-rippling. Round the edges of the barchan is scattered yellow quartz sand, a residuum after winnowing away of much of the micaceous river sand. I also found shallow lenticular patches of sand with the sections parallel to, and at right angles to, the wind, both symmetrical, which appeared to be the embryo of the barchan, when the latter is formed by deposition of sand upon a hard floor. It is, however, not difficult to imagine that in some cases barchans may be residual forms. Thus, if the wind continued to blow away the sand from the spot shown in Fig. 24 (Plate II.), and, the Nile having reached its lowest point, very little more sand were supplied, the floor of the fulj might be left as a bare space half enclosed by the horns of a barchan, the windward side of the fulj being the lee cliff of the barchan.

Sample 28 was taken on the lee side of the foreland from the lee of the crests of the ripples. In this part of the tract the yellow quartz sand is conspicuous. Presumably this part of the foreland has been longer exposed to the action of the wind, and the quartz grain has been purged from the micaceous "chaff."

I may here remark that small dunes, such as those with which we are now dealing, indicate what the forms of big dunes would be if winds did not vary. My next visit to the foreland was on May 10. I had obtained the loan of accurate measuring appliances, and I was fortunate in the kind co-operation of a practised surveyor, Mr. G. T. Ogilvie. Landing at 8 a.m., with a man to assist in putting in the stakes, etc., we laid down an accurate 200-metre line in the up-and-down-wind direction, not far from my line of the 8th instant. The amplitudes of twenty-three ridges were carefully measured along this line, their aggregate amplitude being 1081 cms., and the sum of the twenty-three wave-lengths 19,340 cms. Therefore—

$$\frac{\text{Total wave length}}{\text{Total amplitude}} = 17{\cdot}9$$

This differs from my previous result by 2·2 per cent. These results for true dunes (though small ones) differ very little from those previously obtained for ripples. I had measured on the Dorset coast twelve sets of ripples of blown sand from 0·06 to 0·34 inch H,

PLATE II.

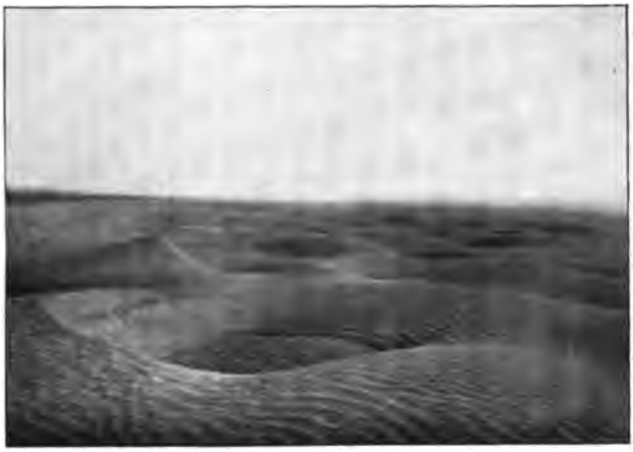


FIG. 24. A Fulj.

FIG. 25. A Barchan.

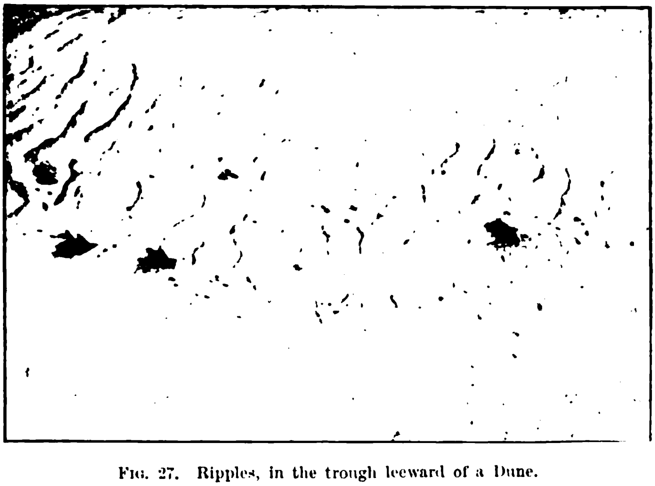


FIG. 27. Ripples, in the trough leeward of a Dune.

which gave an average $\frac{L}{H} = 18{\cdot}4$. These were for the most part measurements of one or two individual ripples. E. A. Floyer had measured six of the largest kind of ripples on the El Arish route, and obtained $\frac{L}{H} = 17{\cdot}7$, with H varying from 6 to 10·6 inches. For my later measurements of ripples, see p. 27. I now require a set of measurements across a train of big dunes, in order to see if the ratio of about 18 still holds. It is a singular circumstance that $\frac{L}{H} = 17$; 18 is a usual value for the average of a train of waves during a storm in the open sea.

FIG. 26.—ABU RACAN, ISMAILIA.

The undulating crests of the transverse dune ridges observed on the foreland contrast with the almost absolutely uniform ridges of ordinary accumulation-ripples of blown sand. The growth in amplitude of the former had probably been accompanied by a lowering of the mean level. The trough was now on a hard floor. The progress of the ridges was relatively slow (I have observed ripples moving thirty-five times as fast, or 0·44 inch per *minute*), and any slight inequality would under these circumstances, and with a scanty supply of sand from windward, tend to increase, so as to give a markedly serrated crest.*

* Cf. *Geographical Journal*, June, 1898, "Sea Beaches and Sandbanks," § 13 (*c*).

The remarkable point about the measurements made on the foreland is that they appear to indicate an exact compensation between the diminution of amplitude thus brought about at certain points of a transverse ridge and the increase of amplitude at the intermediate positions.

On May 12 I returned to Ismailia, and on May 13, at 7 a.m., was at Abu Racan, the plantation to the north of the town already referred to. The trees were planted with the purpose of retarding the progress of the sand-drift and of the dune already formed near the marsh, so that the photograph is not, as might be supposed, the picture of a failure. Indeed, the healthiness of the trees when buried so many feet in sand is very satisfactory and encouraging. It is hoped that the casuarina

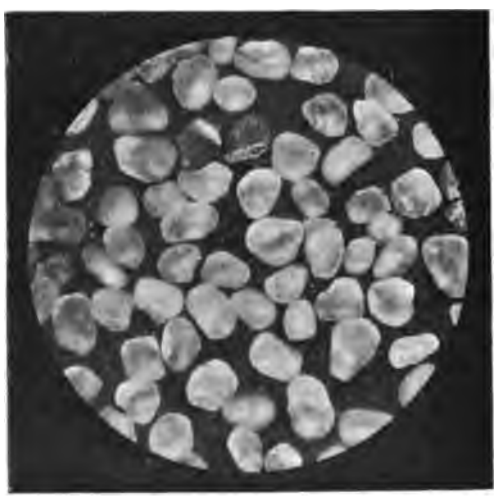


FIG. 28.—SAND-GRAINS FROM LEE CLIFF OF NATURAL DUNE (MAGNIFIED).

will continue healthy as long as the top of the tree is free of sand and the roots are down to the moisture. Fig. 26 shows how the rampart of sand faces this way and that, following the boundary of the former marsh and the present plantation. Fig. 27 (Plate II.) is taken from a position upon, and near the western end of, the cliff-top of Doyen's Dune, looking, from an elevation of about 18 feet, downwards at the large erosion ripples on the leeward in the trough, beyond the lee face of the dune. These ripples have a position as if due to west wind, but in point of fact a north wind comes to them from the west side, being deflected by the dune. The light is from the east, that is from the reader's left hand. The greatest wave-length, according to my recollection, was about 5 feet. The irregular wave-fronts contrast strongly with the straight wave-fronts in places where the wind flows parallel to the surface, and where sand-supply is plentiful. The crests, also, are nearly in the middle, instead of being close to the lee end. On the other hand, it is precisely in positions such as that of the ripples now photographed that ripples grow to large size. At a spot near the foot of the cliff, at the top of the eddy slope and near the west end of the cliff, one could clearly see the difference in character of ripples according as the wind strikes up or follows the slope. The great amount of sand which had been winnowed on the spot photographed was indicated by the extreme coarseness of the sand on the crests of these ripples. When I have made a mechanical analysis giving the percentage of the different sizes of sand in such places, the ratios between the total quantity of sand winnowed, the "chaff" blown away, and the heavy stuff left, should be calculable. The immense amount of sorting at this spot is presumably due to the upward suction of the air here, due to its position to leeward, and near the end of, the foot of the dune cliff. It is easily understood that the difference between the resistance of large and of small sand-grains is greater for lifting than for rolling.

Not far from the spot photographed, also on the lee of, but further from, the dune, I selected for measurement a long train of moderately large ripples. As well as I could judge, the air here (during the northerly winds) could have a very slight upward tendency, but there was no wind at the time.

MEASUREMENT OF A TRAIN OF 36 RIPPLES* NEAR DOYEN'S DUNE, ISMAILIA.
(In eighths of an inch.)

Wave-length, L.	Amplitude, H.	Wave-length, L.	Amplitude, H.
176	8	Bt. forward 3186	Bt. forward 201·5
156	11	236	11
86	6·5	310	15
220	10·5	256	15
166	11	169	11
176	12·5	204	12
92	8	192	16
104	6	283	18
187	16·5	54	1
151	10·5	298	15
231	12·5	209	9
168	11	146	3
193	10	143	10·5
192	11·5	280	16
187	14	115	8·5
102	6·5	219	12·5
148	11	364	22
260	13	222	16
191	11·5	130	10·5
Cd. forward 3186	Cd. forward 201·5	Total L 7016	Total H 423·5

$$\frac{\text{Total L.}}{\text{Total H.}} = 16{\cdot}57.$$

* *I.e.* Thirty-seven ridges, comprising thirty-six waves.

The individual ripples are distributed pretty uniformly between $\frac{L}{H} = 11 \cdot 3$, and $\frac{L}{H} = 23 \cdot 2$, but with two, exceptionally flat, of $\frac{L}{H} = 48 \cdot 7$ and 54 respectively.

Sample 29 was collected by pushing the bottle into the unrippled face of the lee cliff near the centre of the dune. The material looks wonderfully uniform. Fig. 28 is a microphotograph of a portion of the sample. The magnification is the same as in Fig. 18 of the less rounded and less uniform sand of the dune at Terieh (one artificially produced by the erection of a fence of reeds).

On May 14 I was rowed across Lake Timsah, and visited some small scattered sandhills occurring within a mile or two of the eastern shore. There was a good deal of vegetation upon them, but the sand was being swept away from around the bushes. Our ship arrived in the small hours of the 15th, and we left Ismailia for England. In conclusion I must add that I was much assisted in making the best use of my time while in Egypt by my cousin, Mr. E. A. Floyer. I have also to thank M. Paul Doyen and officers of the Suez Canal Company and of the coastguard for their kindness to us during our stay at Ismailia. I have also to thank Mr. G. T. Ogilvie for helping me in measurements made during some hours of choking sand-drift. Whilst in Cairo I received valuable information from members of the Survey as to dunes west of the Nile, but this has not been drawn upon for the present paper.

Note on the Effect of Ground Moisture in Formation of an Accumulation of Blown Sand, or "Dune Massif."

Monsieur Courbis, in a memoir entitled 'Les dunes et les eaux souterraines du Sahara,'* contends that ground-moisture is the pre-existing condition which determines the localities in which blown sand accumulates in the desert. M. G. Rolland † had previously specified the causes which in his opinion determine these accumulations, the "Chaînes de dunes," or "grandes dunes," the orientation of which, as he points out, have nothing in common with that of the elementary dunes, or sand-waves, into which their surface is moulded by the wind. Of these causes the prime is, in his opinion, the orography of the country acting by modification of the transporting power of the wind, particularly where "les accidents topographiques permettent au vent une expansion qui diminue sa vitesse." Replying to M. Courbis in *C. R. de Soc. de Geogr.* (Paris), 1890, p. 158, he admits that moisture is a cause of stability of dunes when formed. "Je suis d'accord avec M. Courbis quand il voit là une des raisons pour lesquelles les grandes dunes restent stationnaires. Avec lui, je dirai que les sables entassés acquièrent en s'humectant une pesanteur plus grande et une certaine cohésion, plus de stabilité et plus de force de resistance contre le vent. J'ajouterai qu'a par faveur de cette humidité, il se développe au pied des grandes dunes une vegétation spontanée, que l'on voit constamment tapisseur leur lisière et qui contribue encore davantage à les fixer. Mais ec sont là des phénomènes posterieurs au dépôt des grandes dunes, et, dans la

* *C. R. de Soc. de Géographie* (Paris), 1890.

† *Bull. de la Soc. Geol. de France*, 3e serie, t. x. 1881.

généralité des cas, ce n'est pas humidité *pre-existante* du sol qui a motivé leur dépôt. Cela est vrai parfois, mais ce n'est qu'un cas particulier, et non une loi général. Un fait au contraire vraiment général au Sahara est que la surface du sol est très séche; même dans les dépressions artésiennes, la nappe ascendante supérieure ne se trouve le plus souvent qu'à 2 ou 3 mètres au-dessous de la surface, s'il fallait que le sol fût humide pour que les dunes puissent s'y déposer, il y aurait relativement bien peu de dunes au Sahara."

The dunes described by me in the present paper are situated in flat country, and the extent of the marshes and damp places precludes the notion of the moisture being entirely or mainly due to what has been collected after the formation of the dunes. In seeking the most accessible dunes I was led round the border of the delta (the dunes south of Wady Toumilat and those on the route to El Arish border on former branches of the Nile). This fact alone would have been of itself suggestive, even if I had not repeatedly, at Lake Timsah, Bir Abu Ballah, Abu Racan, Lake Mahsama, and elsewhere, found the dunes fringing lakes and marshes. On the "sandy foreland" of the Nile I was actually able to watch the largest of the dunes there being formed up against a backwater near the lee side of the foreland. Thus, although pre-existing ground-moisture may be merely an occasional cause of accumulation of blown sand in the Sahara south of Algiers (as to which M. G. Rolland speaks with probably greater weight of experience than any one else), it is in my opinion the principal factor in the districts which were visited by me in April and May, 1899.

Next, as to the effect of moisture in "fixing" dunes. The compactness and immobility of the slightly damp sand is very striking, and has been commented upon by M. Courbis and M. Roland. Nevertheless, the wind dries the surface, and I watched these dunes "smoking" freely every afternoon when the heat had raised the wind. I even measured a fairly rapid advance of the crest of Doyen's dune, three-quarters of an inch per hour. Mr. Floyer has more than once raised the question with me, "Do these dunes *really* move?" I expect that the doubt expressed in this question is justified, and that in many cases the dunes he and I have visited, separately or in company, are *stationary waves*, the structure persisting in the same place on account neither of complete immobility of material, nor of magnitude too great for winds to transport perceptibly, but of permanence of the inducing cause.

I proceed to examine more closely into the mode of accumulation of blown sand (formation of a dune massif) in a desert through the operation of a cause, such as ground-moisture, which does not modify the wind. I remark in passing that we have here at first a heterogeneous accumulation of sands, since there are no eddies such as are caused by rigid angular bodies. Wind cannot erode below a thick covering of sand; therefore there can be no great accumulation of wind-formed sand at the place of erosion. Again, since winds are not absolutely constant in direction, the sand derived from a given area of, *e.g.*, Nubian sandstone are spread by the winds over a larger area. Thus, erosion of a sandstone rock to a depth of 1 cm. will result in the spreading of a film of sand over the neighbouring desert, the thickness of which will be only a fraction of a millimetre. This sheet of sand is shifted hither and thither by the winds. The annual resultant motion of each sand-grain may be small, but the total length of its highly irregular annual path is great.

The amount of sand which annually passes over any spot in the middle of the desert depends, not upon the small resultant motion of a sand-grain, but upon the whole length of its irregular path. I emphasize this deduction because, for me, it removes a difficulty in understanding the great rapidity with which sand-dunes sometimes appear to be formed.

Suppose the wind to blow in a desert for two hours per diem during a hundred days of the year with sufficient force to shift sand pretty freely. If one watches an individual sand-grain when a moderate wind is blowing, one sees that its motion is generally intermittent, with relatively long pauses, but that when it moves at all it generally moves rapidly, I think at a rate of more than 1 kilometre per hour. Let us take the speed to be only 0·5 kilometre per hour, and the time of actual motion of any one sand-grain one-tenth (*i.e.* 0·2 hour per diem) of that during which the wind is blowing with the stipulated force. We then have for the total annual course of each individual sand-grain

$$0·5 \times 0·2 \times 100 \times 100{,}000 = 1{,}000{,}000 \text{ cms.}$$

If the sand-grains have an average diameter of 0·05 cm., a continuous single layer would contain 400 per sq. cms., supposing them spherical. If we take one-fiftieth of this number, 8 grains per sq. cm., as a fair scattering of such sands over a desert, then such a scattering is equivalent to a continuous sheet of sand of 0·001 cm. thickness. Take an area of 1 sq. cm. in the midst of the desert. The area of the sand-sheet which will annually pass over that sq. cm. will be 1,000,000 sq. cm. If the whole of this sand were accumulated there it would have a thickness of

$$1{,}000{,}000 \times 0·001 = 1000 \text{ cms.,}$$

or 10 metres. Practically the travel of sand is not completely stopped. I think a diminution of one-half in the mobility of the sand is not an excessive estimate of the effect produced in places where dunes grow, *e.g.* where there is ground-moisture. Perhaps other observers may not concur in this estimate, so let us take the case of a proportional retardation of only one-fifth. Even this would produce a dune 2 metres high in one year.

After the reading of the paper, the following discussion took place:—

The PRESIDENT: I had hoped that Mr. Blandford might have been here to illustrate Mr. Vaughan Cornish's paper from his knowledge of the deserts of India, and that Sir Thomas Holdich might have been here to illustrate the paper from his knowledge of the sand-dunes of Baluchistan. I believe we have the pleasure of welcoming Mr. Hogarth; perhaps he will say something on the subject connected with his knowledge of the sand-dunes in Asia Minor.

Mr. D. G. HOGARTH: I have made no scientific observations, but have been over a good deal of Mr. Cornish's ground between Kantara and El Arish, and the only contribution I can make is by asking him one or two questions.

I have no doubt he has noticed that there is a great deal of difference in the motion of sand at different times under what would appear to be a wind of much the same strength; sometimes it appears to be moving under a light wind most, at other times under a strong wind. Has he anything to add to the theory that electric action has something to do with the pace at which sand moves? Electrified sand is supposed to move much more quickly than ordinary sand.

The only other thing I wish to ask him, as I didn't hear the discussion three years ago on fuljes, although I have always been interested in them, is how the wind comes to create pits on such an enormous scale as are found in the northern parts of Arabia, some 200 feet in depth; and whether it is true that these are excavated, and if the ground which is left bare is really the under-lying stratum below the thick covering of sand. I should like to ask him, also, whether he ascribes the formation of pits on that enormous scale to the gradual action of the wind, or the unusual action of such great storms as leave traces on the desert that are not effaced in a century.

One of the most curious things in a desert is to find one's self surrounded by every feature of an ordinary landscape—deep valleys and deep water-cuttings, and yet no rain falls during the many years one may be in the country. The ordinary rain or wind appears absolutely unable to create such phenomena as fuljes, and it occurs to me that these pits on a very large scale may be due to a great storm, and that the ordinary wind, while unable to create them, is able to keep them open.

Dr. J. W. Gregory: I am afraid that this is not a paper likely to lead to much discussion, as, illustrated by Mr. Cornish's photographs and his abundant array of fact, his explanations seem conclusive. I should like to express the pleasure with which I have listened to his interesting and suggestive paper. The subject is one which has been rather neglected by English geologists, though it is of considerable practical importance, and when studied with the careful and accurate methods of Mr. Cornish, is found to yield very interesting theoretical conclusions. I should like to ask him whether he has made many observations on the permanence in position of dunes of which the whole material is moving forward. I was struck with a case close by Lamu, where dunes 150 feet high have gradually moved inland and buried the site of the old Portuguese town of Shella; the sand was moving at a fairly rapid rate, while the dune was moving infinitely more slowly. I had not time to make many observations in different conditions of wind, but it seemed to me that the eddy under the lee side of the dune carried the sand at right angles to the direction of the dune down into the estuary, where the tide swept it out to sea; again it was piled up on the beach and gradually swept up the windward slope over and over again. The motion of the sand was rapid compared with that of the dune, which was very slow. I hope we shall have further contributions from Mr. Cornish, especially if he could study in the same way the dune-formation in regions of volcanic sands, in which the material is of higher specific gravity, and especially, unless he has already studied it, the formation of snow dunes, as we may call snowdrifts, where we have the same series of phenomena with a material of lighter specific gravity. I should like to ask whether the same ratio of height to length holds in such cases.

Prof. Bertrand: I should like to point out how very much I have been struck with the accuracy of the observations of Mr. Cornish. It has been my good fortune to see high sand-dunes in the province of Tarapaca, about 1000 feet high, where the railway passes through them. Further south there are sands creeping along the hills more than 3000 feet above the level of the sea. These should make, I think, an interesting subject for those who may wish to make observations there. I think the engineers of the nitrate railways have made some observations, because the sand interferes with the track. I have also seen fuljes, such as have been thrown on the screen, and I can endorse the accuracy of the observations as to the different aspects of the dunes at different times of the day. They have struck me in just the same way. I think, if the materials are the same, it may be expected that the same phenomena will be repeated in different quarters of the Earth.

The President: Before asking Mr. Cornish to answer the questions that have been put to him during the discussion, I will add some questions which have been asked in letters from two geologists.

Mr. Teall says: "Some of our triassic and permian sandstones are composed of beautifully rounded quartz grains, exactly like those so common in desert sands. I wonder if Vaughan Cornish, with his intimate knowledge of the structures of sand-dunes, could prove that they represent fossil deserts? It has been suspected, but never proved."

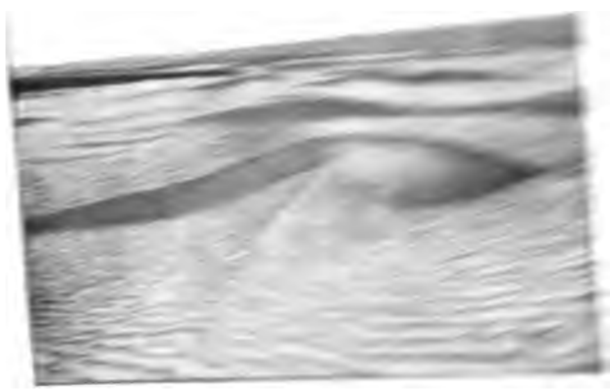
Mr. Clement Reid says: "I do not feel at all clear as to the exact part played by moisture in the sand; for with a strong dry wind the sand seems to travel freely on a tidal flat, unless it is so wet as to give a noticeable reflection. Hollows between foreland exposed by the subsiding waters of the river, which were then near their lowest level, on which, within the space of a few hundred acres, I saw a greater variety of forms of dunes than I met with during the rest of my tour. They were small—the highest not more than 4 feet—but perfect dunes; by no possibility to be confused with ripples. Their daily observation throughout a fall and rise of the Nile would have been an ideal exercise in the study of sand-dunes. Even the three visits I was able to pay to the sandy foreland yielded results which I believe to be of considerable interest.

Fig. 21 (Plate I.) is looking up-wind (N.N.E.). The steep lee cliffs stand out strongly. It will be noticed that the dunes are in transverse ridges, but that these ridges undulate. The view looking down-wind, the lee cliffs not being visible, showed no such striking contrast; indeed, the photograph is so faint that I have not had it reproduced. The sand is Nile sand (*sample* 27), fine, glittering, micaceous, splintery; quite unlike the rounded quartz sand of the samples I collected in the desert. During most of the time I spent on the foreland the sand was flying briskly. Fig. 22 (Plate I.) shows longitudinal ridges piled up against lee cliffs. The structure is readily understood when one watches the sand sweeping round from both ends of the cliff. I suppose it to be similar to a structure described by Dr. Blandford: * "From the north-east corner of most of the high hills near Bálmir a long ridge of sand runs out, evidently developed by the wind under the lee of the hill." It is not difficult to see that if the wind should continue sweeping out the sand from the depressions between the higher portions of the transverse ridges shown in the photograph, and depositing a part of it thus behind the highest part of the cliff, the longitudinal ridge thus formed may play an important part in a conversion of transverse into longitudinal dunes. I first saw these dunes in the morning; on my return in the afternoon the wind had increased, and there was a haze of flying sand 20 or 30 feet high over the foreland. In many places, where in the morning there had been loose sand, the wind had now cut down to the damp, compact floor, and the ripples appeared distinctly larger. Fig. 23 (Plate I.) shows a small dune, about 2 feet high, produced by a reed fence. The crest of the cliff is parallel to the fence, although, as shown by the surface-markings on the sand, the fence is not at right angles to the wind. Fig. 24 (Plate II.) is a perfect example of one of those singular structures known as fuljes in Arabia.† This was only 30 yards from the river, off which the wind was blowing. The photograph was taken looking down-wind at 5.15 p.m. The circular floor of compact material is about 12 feet in diameter. On the left there is a double ridge. I was able to watch the process by which this was being formed, sand coming to it from the left

* "On the Physical Geography of the Great Indian Desert," *Journ. Asiatic Soc. of Bengal*, vol. 45 (1876), p. 98.

† *Geographical Journal*, March, 1897: "Sand-dunes."

PLATE I.



our sand-dunes seem always to be sufficiently moist for the growth of moss. Inland dunes are scarce in this country, except in west Norfolk. I have only come across one low ridge in this neighbourhood (Fordingbridge), though I should imagine that much of the material in the soil, and the matrix of the clay with flints, have been moved by the wind, especially during the Glacial period."

Mr. Vaughan Cornish: With regard to the mobility of sand under a wind at one time, and its apparent immobility under wind of like force at another time. The only explanation which I have at present is that to which Mr. Hogarth has referred, viz. that electricity has something to do with it. As soon as I came back from Egypt, I started working on the subject, and found myself getting involved in an atmosphere of atmospheric electricity, and if I had gone on thus I should never have got this paper written, at least in any reasonable time, and so I put this aside for the present.

As I said in my paper, in many cases the dunes appear to be stationary waves, the structure persisting in the same place owing, not to complete immobility of material, but to the permanence of the inducing cause. That is practically what Dr. Gregory has said just now, in a less jejune manner.

With regard to the forms of snowdrift, I have some notions on the subject, and have made a few observations, but I have not hitherto been very fortunate in opportunities of observation. I did get some at Innsbruck, and lay out under the drifts to see what was going on. I hope soon to add to these observations.

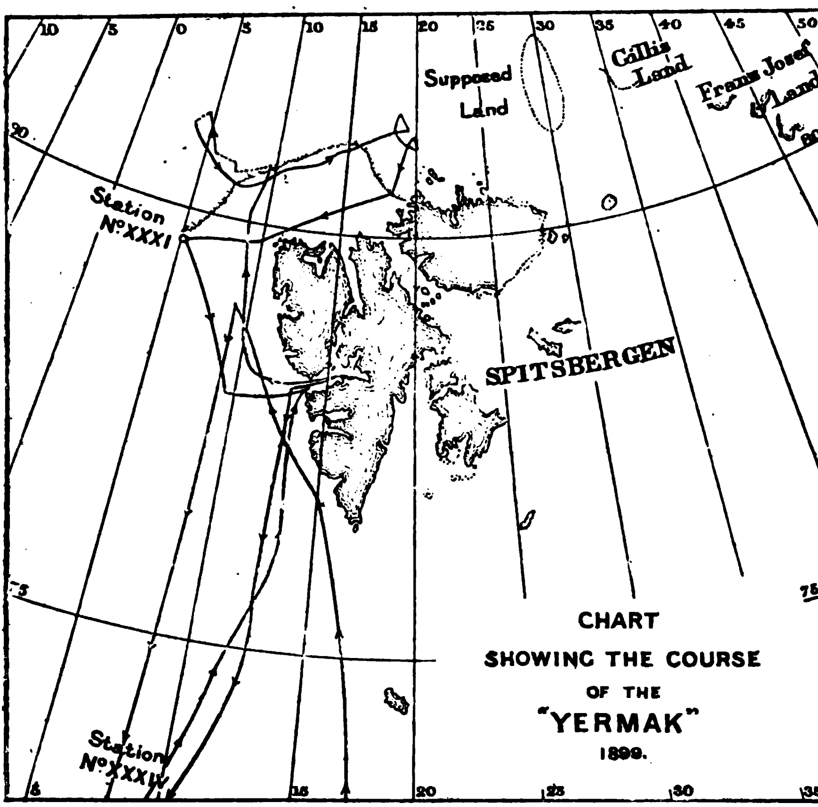
The President: Mr. Vaughan Cornish has devoted several years to the study of a branch of physical geography which has hitherto received little attention. He has done this in a most workmanlike way, first on the beaches in England, and now he gives us an interesting paper on the results of his studies in Egypt. I have no doubt that the object of his study will become a regular branch of our science, when a larger number of observations has been accumulated. I believe, although Mr. Vaughan Cornish has found examples of almost every form of sand-dune in Egypt, that he will think it necessary to visit other countries. I hope to hear of his having studied the sand-dunes of Holland and the Landes of France, and the sands of the deserts of India and Central Asia, and the medanos of South America, both on the east and west coasts. I hope he will visit the arctic regions and examine the *sastrugi*, described by Baron Wrangel. I am assuming that Mr. Vaughan Cornish will have to carry his investigations into almost every continent, for as he is the only one amongst us who is devoting his attention to this subject of kumatology, I am convinced that he will have to trust to his own efforts. Eventually others will follow in his track, because it is a fascinating branch of study, and we shall have established as one of the branches of our science, kumatology, or the study of waves. Mr. Cornish does not confine his attention to the sand, but it extends to any material met with in waves.

The paper has been extremely interesting, and beautifully illustrated, and I am sure you will wish me to convey to him a unanimous vote of thanks.

THE "YERMAK" ICE-BREAKER.

By Vice-Admiral MAKAROFF, of the Russian Imperial Navy.

The old way of travelling in the polar regions was by means of dogs and sledges. Dr. Nansen proposed to travel with the ship, making her so strong as to resist the pressure of the polar ice. He succeeded in this perfectly well; his ship could stand the attacks of the polar ice, and his defensive tactics proved to be very efficient. Just at the time when Dr. Nansen proposed to build his *Fram*, I had the idea of adopting offensive tactics against the polar ice. I was engaged at that time with my service, and did not then see my way to disclose my ideas, but I made some preliminary preparations. I wrote to Dr. Nansen a letter in which I stated that I was entirely of his opinion, that he would be carried by the currents somewhere in the direction he imagined, and advised him that help should be sent for him to Franz Josef Land. My letter to him and his answer were duly published in the Russian



newspapers and in geographical publications. I thought it quite possible that he would not complete his voyage in three years; I also thought that, if in four years nothing was heard of him, people would be anxious to send help, and that would be a good pretext for collecting money.

In my opinion the best way to penetrate into the arctic regions is by means of a powerful ice-breaker. Certainly I did not wish to mention in my letter to Dr. Nansen that I would go and help him, because, being on government service, I could not dispose of myself. But I asked him in my letter if he had any intention of leaving any trace of his voyage. He replied that he intended to put on every island that he might discover, a pole with a small Norwegian flag on it, and under that pole a letter with information about the voyage of his ship. Fortunately for Dr. Nansen, the current carried him on very well, and on my return from the Pacific station, I was happy to learn that he and his *Fram* had safely returned home. Of course that deprived me of my excuse for collecting the necessary money for building a large ice-breaker, but I found another motive, this time purely commercial. I proposed to build an ice-breaker which in winter-time might clear the way through the ice to the port of St. Petersburg, and in summer-time help the navigation to the Siberian rivers flowing into the Kara sea, barricaded by ice almost during the whole summer.

The ice-breaker was built here in England by Sir W. G. Armstrong, Whitworth & Co., Ltd., and the name of the conqueror of Siberia, *Yermak*, was given to her. Her length is 305 feet; breadth, 71 feet; displacement with 3000 tons of coal, 8000 tons; and in this condition she draws 25 feet. Her bow is inclined 70 degrees from the vertical; her stern is 65 degrees, and her sides are 20 degrees from the vertical. In whichever direction she moves in the ice, she is bound to rise on it, and break it with her weight. She has four engines, working four independent propellers, one in front and three at the stern. Each engine develops 2500 horse-power, so that the total force of the ship is 10,000 horse-power. The ship has a double bottom and double sides; she is divided into forty-eight compartments, every one of which was tried by filling with water as high as the upper deck; one compartment in the fore part of the ship, one at the stern, and two at both sides, are specially designed for changing the trim and heel of the ship. In the centre of the *Yermak* is situated a powerful pump, which can take water from any of these compartments and pump into the other. Each propeller is supplied with extra auxiliary engine, so that the main engine can be disconnected if necessary, and the propeller worked from the auxiliary engine. This was meant to give economy of fuel when the ship has to go under ordinary conditions, and reduces the number of mechanical staff. The ship has a rolling chamber to keep her steady, and a lifting crow's-nest, which affords facilities for directing her through the ice.

I selected a very distinguished officer, Captain Wasilieff, to command the *Yermak* during the experiments, but I was on board myself on every important occasion.

Her maiden voyage was from Newcastle to St. Petersburg. We entered the ice at the meridian of Revel, and had to force our way through 160 miles of ice. It never occurred to any one that the ship would go to Cronstadt in winter-time, and our entering Cronstadt harbour caused quite a sensation.

The limits of this paper does not allow me to give details of our performance in the Baltic. Soon after our arrival in Cronstadt, a telegram was received that thirteen steamers were caught in the ice near Revel, and some of them were in danger. The *Yermak* went at once to Revel, and opened the way for these and other steamers, the total being forty-one, partly blocked in the ice, and partly waiting in Revel harbour and other ports for several weeks. This work done, the *Yermak* proceeded again to Cronstadt, and helped forty steamers going to St. Petersburg. After this was done, the ship proceeded to Newcastle to take in a supply of coal.

The ship was built for the Kara sea, where is one year's ice, but it was resolved to try the ship in heavy polar ice. In the month of June

ICE-HUMMOCKS 22 FEET HIGH.

we made our first trial in the polar ice, and found that the ship had to be strengthened and the forward propeller taken out. Then we returned to Newcastle, and on August 6 we entered again the polar ice. This time we were in the ice two weeks, covering during that period 230 miles in 87 hours.

We entered the ice to the north-west of Spitsbergen, on August 6 at noon, and in eight hours made, in the ice, about 30 miles to the north, going always in a zigzag route. Then we stopped almost for three days, examining the ice and the ship itself. During that period we were drifted west-south-west at the rate of 10 miles a day, the wind being north. Then we made again 10 miles to the north, and stopped for a day, and in eleven hours made 30 miles to the north again, the wind always blowing from a northerly direction. At this last place we met

D 2

an ice-floe 14 feet thick; stopped to examine it for a day, and as the pressure of the ice increased every hour considerably, without evident reason for this, I thought that we were too much to west, and that this was not the route for the ice-breaker. After considering the matter, I came to the conclusion that in this locality pressure of the ice should be almost constant; the direction of the movement of the ice to the north of Spitsbergen is west-south-west, while on the western part of it, it is south-west by south. There ought to be something that compels the whole body of ice to change its direction almost suddenly as much as three points. I presume that this change is due to the position of the Greenland coast, which stops the westerly progress of the ice. Owing to this a heavy pressure is accumulated on the north-eastern side of Greenland, which interferes with the drift of the ice of that locality to the south. The ice remains there for many years, growing in thickness. Is it not due to this that Nares met on the coast of Greenland heavy ice, to which he has given the name palæocrystic? Certainly this is only my conjecture, but it looks at present rather probable. If it is so, this locality is not a place through which one would advance fairly ahead, even with the powerful ice-breaker.

The pressure of ice was so considerable, and the ice so heavy, that it took me four hours to make two miles to the south. After this the ice was less thick, and we went at our usual rate, making 2½ miles an hour; later on the ice became still easier, which allowed us to go more quickly. After we covered about 60 miles we found open water, followed the boundary of it, and entered the ice again to the north of Seven Islands. In this place we had much of the hummocky ice, but that did not stop the progress of the ship.

On August 14 the weather was very clear, no clouds on the horizon, and the air very transparent. We saw to the east of us a land which is not marked on the map. We did not see that land directly. We saw it only by the refraction of the air, but we saw it distinctly from six o'clock in the evening to eleven o'clock the next morning, and took the bearings of it. It could not be Franz Josef land, the nearest part of which was at that time at a distance of 260 miles from us. Neither was it Gillies Land, which was at the distance of 160 miles. We believe we saw undiscovered land, and if we estimate the distance to be 100 miles, that land should be no less than 60 miles long.

On August 16 we directed our course to the south, and we saw four complete table-shaped icebergs from 40 to 60 feet high, and many *débris* of icebergs; one of them was completely covered with moraines. We picked up some stones from it. A little piece of metal was found between the stones, and there are signs of metal in the other stones. It has not yet been examined by any geologist, so that I cannot say much about their nature. Neither can I state from what land they come. Maybe they come from the land which we supposed we had seen.

During the whole voyage we had an opportunity of studying the nature of the polar ice, the *Yermak*, with her powerful cranes and winches, offering a very efficient means for this. Our usual way was to cut a piece of ice, or to find one of a suitable size, and to lift it on deck. The pieces which were found in the water were liable to melt, although the water had a temperature of 29°·3 Fahr. This melting affected the superficial part of the block of ice, and the interior of it was as strong as might be. A block of ice being brought on deck, holes were drilled into it at different depths, and the thermometer introduced. Generally the temperature of the ice at that late season, at the surface, is not far from

GOING THROUGH EASY ICE.

freezing-point, and in the lower strata it corresponds to the temperature of sea-water.

On one occasion we had a good chance of taking the temperature of an ice-floe, 14 feet thick; a piece of it, broken by the *Yermak*, was found floating on its side. We found that the temperature inside of it was 28°·2 Fahr., *i.e.* 0·5° below freezing-point of sea-water. I am not sure whether it shows that such thick blocks do not lose entirely, during the summer, their excess of cold received in winter.

After the temperature of the block of ice was taken, we used to cut at different depths oblong pieces of a certain size, and by submerging them in water, study the specific gravity of the ice. Experiments were made with twenty-six samples, and they have shown that the floating part of the ice is within the limits of 6·5 per cent. to 16·4 per cent., while the average is 12·0 per cent.

After experiments on the floating of the ice, oblong pieces were subjected to the trial of breaking. The strongest ice was found to be glacier ice, which required 180 lbs. to break the oblongs. The weakest ice proved to be that from the floe, 14 feet thick, and required 63 lbs. to break it; the average of the other ice shows that 110 lbs. are required to break the same oblong. After this we melted the ice from different depths of the floe, and we tested the melting-point. It proved to be very near to the freezing-point of fresh water.

The exterior part of the ice in water is spongy, with canals and holes in it; it looks from the top like lace. The ice of this spongy part has the lowest melting-point visible, from 31°·3 to 30°·6. We subjected the sea-ice to the influence of a current of salt water, 29°·8 Fahr., and found that ice melts in that temperature very easily. It is rather remarkable that ice melts in water the temperature of which is more than two degrees below its melting temperature.

After the melting-point of the ice was determined, we measured the specific gravity of the liquefied ice; it was proved that this water contained generally very little salt indeed. Surface ice gave almost fresh water, but the ice at the bottom of the floe contained a little more salt, salinity varying from 0·01 to 0·69. The latter high salinity is obtained from the liquid ice of the spongy part of the floe.

Direct measurement of the ice-floes has shown that the ice-ridges have generally the height of 10 to 14 feet. It is not unusual to meet an ice-ridge 16 feet high. One separate ice-ridge was 22 feet high, while on one occasion we saw a detached piece projecting something about 6 fathoms. We did not reach it, and consequently could not measure it, so that this last figure is estimated by eye.

There is no difficulty in measuring the superficial part of the ice, but it is not so easy to obtain a proper knowledge of the depth to which the ice-ridges extend below the water-line. The direct boring of the ice gives good figures. We had an ordinary boring-machine, but that did not answer the purpose well enough, because the progress of boring was rather slow. Then we arranged a steam-jet, which melted a hole in the ice, and answered the purpose admirably; but unfortunately we were short of pipes, and could not reach the lowest part of the ridges. The direct boring showed the thickness of ice and water layers, or spaces in the direct vertical line. These are the figures:

First boring—

	12 feet ice.
	2 „ water.
	3 „ ice.
	2 „ water.
	4 „ ice.
Total ...	23 feet.

Second boring—

	21 feet ice.
	2 „ water.
	3 „ ice.
Total ...	26 feet.

Then we tried to pass under the ice-ridges a float with Thomson's sounding-tube attached to it. We put the float on one side of the ice-floe, and passed the rope around it to the other side; a little weight was generally attached at one fathom distance from the float. When the rope sank properly, we pulled it to the other side of the floe; sometimes all this manœuvre was done with the boat, and sometimes with the ship itself, her three propellers giving facility for such complicated manœuvre. The float passed under the chain of ridges, but of course it did not get to the lowest part, which might project somewhere. Often the sounding-tube has shown 4 to 5 fathoms' depth, but some-

HUMMOCKY FLOE.

times it has shown 7 fathoms. Separate pieces may project below to the depth of 8 or 9 fathoms, so that the ice-floe may touch the ground at that depth, but probably will not properly settle itself until the depth of 5 or 6 fathoms is reached.

Hydrological observations consisted in determining the specific gravity of water at different depths. Below I give the specific gravity and temperature of water at two stations, one being on a parallel of the north part of Spitsbergen, another on the parallel of North Cape.

Station No. 31, August 20. 79° 41′ N., 40° 58′ E.			Station No. 34, August 23. 73° 22′ N., 10° 20′ E.		
Depth, fathoms.	Temperature, Fahrenheit.	$S. \frac{17 \cdot 5}{17 \cdot 5}$	Depth, fathoms.	Temperature, Fahrenheit.	$S. \frac{17 \cdot 5}{17 \cdot 5}$
0	31°·6	1·0248	0	41°·6	1·0270
14	36°·5	1·0265	27	40°·0	1 0270
27	33°·3		54	38°·6	1·0270
33	35°·6	1·0268			
88	36°·4	1·0270			
437	31°·6	1·0268	437	31°·9	1·0270
820	30°·4	1·0269	820	30°·2	1·0270
1093	30°·1	1·0269	1093	30°·1	1·0271
1367	30°·1	1·0270			

On examining the figures of both stations, one cannot fail remarking that from the depth of 100 fathoms to the bottom the temperature and specific gravity of water are almost the same. In the upper strata of station No. 34 the water on the surface is the same as at the bottom, visible Gulf Stream water; while at station No. 31 the water of the upper strata is much influenced by fresh water from ice and precipitations. It is remarkable that on that station the superficial water is cold; then comes a warm layer, then again cold, then warm and cold again.

Cold water at the lower strata at both stations has a temperature of 30°. Such a low temperature is not met in the Atlantic to the south of the Thomson ridge. The water acquires such a low temperature somewhere in these localities; it cannot be in the polar sea, notwithstanding its excessive cold, because the upper strata there have less density. I have discussed this question with Sir John Murray. He thinks that the cold layer of this region is supplied from the top water being cooled during the winter somewhere close to Spitsbergen, or to the south of it, where no water of less density interferes with the upper layers descending to the bottom, when it is properly cooled by the winter cold. I perfectly coincide with the opinion of the distinguished oceanographer, and I am of opinion that cold water must settle down the slope of the bottom close to Spitsbergen.

There is no voyager in the polar regions who has not his own story of bear-shooting. I could not sacrifice time in that sport, but there is such an abundance of polar bears that one cannot avoid having a shot at them. Fresh traces of the white bear are seen on almost every other ice-floe. Generally the track goes from one end of the floe to the other, and it looks as if the bear on his way goes straight, whether on water or a floe of ice. The bear usually makes a hole in the snow, and then lies down in it, so that you cannot see him from a short distance. When a ship passes he jumps out at once from his hole, and were it not for this one would pass him by unnoticed.

The moment we entered the ice in June, we saw two bears, but we were very busy at that time with the study of the ice, so that we let them go their own way. When we came next into the ice, in August, we saw some bears almost every day. One bear was upon the floe when we approached. Our sportsman wounded him, but the bear escaped to the other end of the floe, and swam over the lane. By that time the *Yermak* approached the place where the bear was, and it was shot dead by a bullet from the forecastle of the ship. We stayed a quarter of an hour to get him on board. On another occasion three

MORENAS ON THE ICEBERG.

bears approached the ship at four o'clock in the morning; afterwards they proved to be a she-bear with her cub, and a he-bear. The watchman roused the sportsman, who at once pursued the bears. The cub was wounded first, in the leg, and it was most pathetic to see the mother-bear help her baby to get over the ridges. Another bullet killed the cub. The mother-bear, imagining that it was the he-bear that had killed the baby, rushed violently upon the he-bear, and ripped up his skin for more than a foot in length. This gave to our sportsman the chance to approach and finish with both bears.

The most interesting part of the experiment is the behaviour of the ship herself in the ice; the question whether or not the steel ice-breaker can break polar ice and stand its pressure. Experiments in the Baltic have shown that a great deal of power is required to propel the ship through the ice. Ice-ridges in deep water, in the Baltic, never attain any considerable height, but the ice is difficult to pass through; and it happens that the ice-field, which is no higher than one or two feet, requires more power than the *Yermak* can supply. In these cases we were obliged to move the ship astern, and charge at full speed, gaining sometimes less than the half-length of the ship at a charge. The fact is, that the Baltic ice, being composed of pieces no more than 2 to 3 feet thick, gives a very great skin-resistance to the ship. This was so to such an extent that other ships following the *Yermak* in the canal opened by her, on some occasions could scarcely proceed with full speed.

It is quite another proceeding, breaking the polar ice. In some places of the Baltic the ice-field is uninterrupted from one shore to another. In the arctic seas the ice is broken. Floes of ice might be several miles or several fathoms in length. Between ice-floes are the lanes, which are very irregular. Sometimes ice-floes are pressed against each other, and sometimes not. When the ice is not pressed, the progress of the ship is very easy. Floes of ice even a mile long move away and give passage to the ship. The sharp projecting angles of the floes break very easily, and sometimes it is preferable to shorten the way by cutting a floe right through. Thick polar ice looks very heavy and strong, and when walking on it, one cannot imagine that such a heavy thing could be broken. But the fact is that even ice 14 feet thick cracks when charged at by the ship, provided there is room to remove broken parts.

The lower part of the polar floe has constantly, more or less, the same temperature, while the temperature of the surface varies with the temperature of the air, which sometimes produces the cracks, and sometimes prepares the ice for cracking. The moment the ship charges the ice, it cracks at the place at which it might crack in half an hour itself with another change of temperature of a degree or so, or with the beginning of pressure. The big floe cracks more easily than the small floe, which sometimes is pushed by the ship, and goes in front until it manages somehow to pass on one side of the ship or the other.

Fields of hummocky ice are liable to crack even more than fields of plain ice. In charging that ice, the ship's bow rises to 9 feet; then the field cracks, the ship falls down, and goes ahead, moving aside the *débris* of the ice-field. It is a most exciting scene to see some of the big pieces of ice falling down into the water, and the others coming to the surface from a great depth, every detached piece trying to find a new position, while the ship itself, being always pushed ahead by her machinery, gradually advances, maybe rises again, and gives another crack to the field ice. We took some cinematograph pictures, which show how much the ship lifts herself up in the ice, and that gives us means of calculating what weight is applied to crack the floe of ice. If the ice is in the period of pressure, progress is not so easy; on one occasion it took me four hours to make 2 miles, while usually the ship went, by zigzags, with a speed of 3½ knots, making good 2½ knots an hour.

There is a great difference in ice-breaking in the Baltic sea and the polar regions. Hummocks in the Baltic sea are never high above the level, but sometimes they are very deep. According to our measurement they go down to as much as 20 feet. On one occasion we measured

YERMAK IN HEAVY ICE.

27 feet down and 6 feet up, the total being 33 feet. Such hummocks are composed of pieces 1 to 3 feet thick. Many hummocks are formed at the time when ice is moved by the swell; the result of this is that every piece of ice finds its best position, and the whole hummock is very compact. When the ship charges into it it does not always form long cracks, but breaks under the ship, producing no heavy effect upon her skin. When the ship passes half of its length in such a floe, she touches so many fragments of ice that they stop the progress of the ship by the friction and the pressure upon the skin of the fore part of the ship. When the ship stops, there is no other way than to go back and charge again. This time, before the bow of the ship touches the solid ice it has

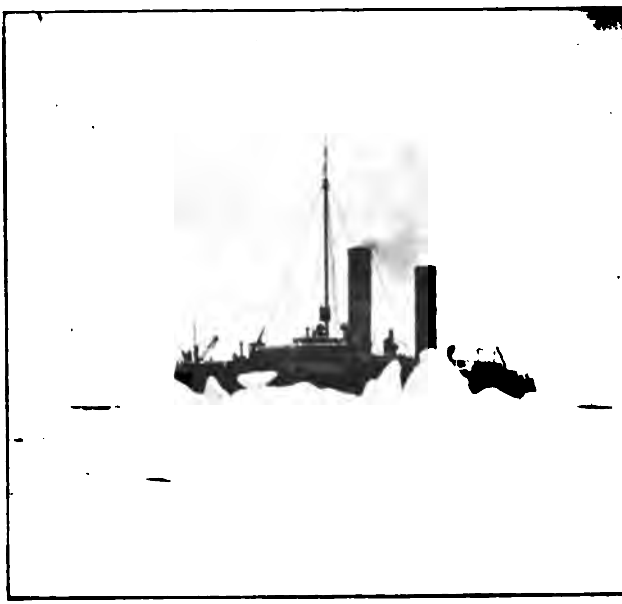
to run through 100 feet or so of broken ice; that diminishes very much the speed of the ship, which on a second charge may make a very little headway. It happens sometimes that after the ship stops going ahead it won't go back, and it takes half an hour, until by reversing the engines ahead and astern one can get the ship out of this disagreeable standstill position. From time to time it happens that one has to get the use of an ice-anchor to move the ship astern. Nothing like this happens in the polar ice, which breaks into big pieces, and consequently there is not so much skin-resistance. The moment you stop your engines the ship goes back herself, and there will be no fragments left which could stop her progress when she charges the second time. For this reason the second charge will be almost as efficient as the first, and we never wanted an ice-cage to move the ship in the polar region.

Fresh-water ice in the Baltic is stronger than the salt-water ice in the arctic sea, but, owing to the dimensions of the pieces of the ice, the ship never receives such tremendous local blows in the Baltic sea as in the polar region. The general conclusion is that in the Baltic the force of the engine is required, while in the arctic the strength of the construction is the main thing to pay attention to.

It is most interesting to decide the question whether my idea of exploring the polar regions by means of ice-breakers is sound or not; whether in future explorers of the arctic should stick to their sledges and dogs, or trust themselves to the drifting ships of Dr. Nansen, or embark upon the strong ice-breakers. It looks as if the voyage on the ice-breaker is the most expensive of the three, but it saves time, which, if properly calculated, is always money. If we come to the conclusion that the ice-breaker is to be used for the exploration of the arctic, then comes the question, what sort of ice-breaker is good for that purpose? Shall we repeat the *Yermak*, or shall we give to the new ice-breaker another feature, basing ourselves upon the lesson given us by the experiments of the *Yermak* in the polar ice? Surely the *Yermak* is not the last work of science in that direction. The forward propeller was very much praised in America, and proved to be useful in the Baltic. But when we first entered the ice in June last, I felt at once that the fore propeller had to be removed, which was done on my returning to Newcastle. No forward propeller could stand the charges of the ice-breaker into the polar ice, and if it does so it stops the progress of the ship. Of course the *Yermak* is meant for double service; for the Baltic the forward propeller is useful, and for the arctic it is objectionable. We have either to sacrifice one or the other, but if a special ice-breaker has to be built for the arctic, it ought to be without forward propeller.

With regard to the strength of the ship, it is not a question of the weight of material, it is a question of knowledge and experience, and I believe that Messrs. Armstrong, Whitworth & Co. have learnt very much since our last trial in the polar ice. One cannot make a mistake in building a ship too strong. The *Yermak* had to be improved in that respect after the first trial, and we have to do something more now. Had it not been for this, I would not have returned without penetrating farther on, in order to study that unknown region a little more.

The angle of the stem, 70° from the vertical line, proved to be a good one; 20° for the sides of the ship is also not bad, but it should run a bit higher than on board the *Yermak*, because the ship receives with her sides tremendous blows; 25° would be still more profitable. With such a shape of ship one would expect that the ship would roll heavily at sea. I did not dare to give to the *Yermak* any bilge keel, but I think it would do no harm to the ice-breaking qualities if the



YERMAK CHARGING THE ICE.

ship was supplied with two short bilge keels on the last third of the length of the ship; it would improve, somehow, her rolling quality; also a big rolling chamber would be useful.

The proportion of the *Yermak* is 1 to $4\frac{1}{4}$; it is such because the ship has to enter the port of St. Petersburg. For the polar ice-breaker finer lines would be better, but finer lines increase the weight of the ship. I believe 1 to 5 would be a good proportion.

The size of the ship depends very much on the power required, and the quantity of coal-supply. The bigger the ship, the more powerful will be the engines, and the greater the supply of coals. During our work in the arctic, we seldom used our full power; the ship progressed fairly well with the engines working slow. However, sometimes it happened, during the pressure of the ice, that full power was required. In such a case a ship with weak engines has to wait, but it should not be more than a few hours. The progress of the ice-breaker with smaller engines will not be so quick; anyhow, it will be progress. I may say, the less power you have, the more patience you want, in going through the polar ices. The *Fram* had 200 horse-power; it was not enough for a good ice-breaker, but I believe 2500 horse-power will be sufficient for fairly good progress through the ice.

The distance that one can go through the ice will depend upon the quantity of fuel, and as liquid fuel is more efficient than coal, it should be accepted for the polar ice-breaker. That fuel is easily put into any compartment of the ship, so that, on entering the ice, one can have as much of that fuel as the ice-belt and the shape of the vessel allows. Liquid fuel has another advantage, particularly applicable to ice-breaking, where the speed of the engine is changed so often. With the liquid fuel you stop burning instantaneously, while with the coal, you burn it unnecessarily every time you unexpectedly reduce your full speed to a dead slow. Liquid fuel is easily pumped from one part of the ship to the other, and can be used for trimming and heeling purposes.

All these deductions are preliminary. I have to think over them, and maybe more detailed study of the material we collected will force me to make a slight modification of what I have stated in this paper. But there will be no modification in my idea that the exploration of the arctic and antarctic ought to be done with the help of the polar ice-breakers.

ON THE CONFIGURATION OF THE EARTH'S SURFACE, WITH SPECIAL REFERENCE TO THE BRITISH ISLANDS.

By the Right Hon. Sir JOHN LUBBOCK, Bart., M.P., F.R.S., D.C.L., LL.D.

THE Geographical Society did me the honour of inserting in the *Journal* for December, 1895, a memorandum in which I amplified a suggestion, originally made in 1887, that the tendency of peninsulas to point to the south might be explained by the preponderance of water in the southern hemisphere, which M. Adhemar has suggested may be due to the alteration of the centre of gravity of the Earth caused by the great southern cupola of ice; and endeavoured to meet an objection made to me privately by my friend Mr. Francis Galton, by pointing out that if mountain chains are mainly the result of compression due to the contraction of the Earth, we must expect that there will be two series of folds, one at a right angle to the other.

Prof. Lapworth,* in a lecture on "The Face of the Earth," had already called attention to such intersecting folds, as also have Mr. Bertrand and Prof. Bonney; † Darwin also long ago ‡ called attention to the fact that volcanoes had to be arranged "on one line, or on a set of short parallel lines, intersecting at nearly right angles." But none of them offered any explanation of the fact that they cross one another at right angles.

Dr. Gregory, in a very interesting paper on "The Plan of the Earth and its Causes," § objects to the suggestions in my paper on two main grounds. In the first place, he says we should expect from it "that the main geographical structure lines in the northern and southern hemispheres would be symmetrical." That was also my own idea at first, and, in fact, it prevented me for some years from making the suggestion contained in my memorandum. Dr. Gregory must, however, have overlooked the fact that one object of my paper was precisely to show why they would not be symmetrical, and I will not therefore go over the same ground again.

Dr. Gregory's second and "still more serious objection" is, that "The primitive lines of these systems often coincide with features of modern development, and are inconsistent with the old-established geographical arrangements. For instance, Prof. Darwin quotes the trend of the western coast of Europe from Spain to Norway as in accordance with his scheme. Prinz makes the primitive line here run exactly at right angles to Darwin's line; and geological evidence favours Prinz. The coast-line from Spain to Norway is almost certainly of modern date, while the lines of wrinkling, both Hercynian and Alpine, run transversely to the direction which they ought to have followed if due to tidal strain."

And he adds "that the double folds are all true causes seems probable. What is doubtful is whether any extensive trace of their influence can be discerned in the present distribution of land and water. A map of the world in early Cambrian times might show the influence of these pre-geological incidents, but their geographical effects seem to have been obliterated by the changes of geological times."

I will not here discuss the torsion lines due to the Moon's action, which have been suggested by Prof. G. H. Darwin,‖ and which he considers would raise wrinkles on the surface running in a direction perpendicular to the axis of greatest pressure, *i.e.* north and south at the equator, with a trend in the north to the north-east, and the south to the south-west.

* *Geog. Jour.*, 1894.

† *Bull. Soc. Geol. France*, 1892.

‡ 'Geol. Obs.' (1851), p. 126.

§ *Geog. Jour.*, 1899.

‖ 'On Problems connected with the Tides of a Viscous Spheroid.'

As regards Dr. Gregory's suggestion,* however, that the geographical effects of "pre-geological" or early geological incidents could be "obliterated by the changes of geological times," I may remark that folds once started would establish lines of weakness, and thus tend, as Mr. Bertrand has shown,† to repeat themselves again and again, though not, of course, to the exclusion of others.

It is probable, then, that as soon as the contraction due to the cooling of the Earth began to throw the surface into wrinkles, these would take a north-eastern or south-western direction. How prevalent such lines are, a glance at the map will show. I need only mention the west coast of Europe, and North Africa from North Cape to Cape Blanco, the eastern coast of Asia from Kamskatka to Siam, and the eastern coast of North America from Greenland to Florida. But I have shown, or attempted to show, that ridges in any direction due to such a cause would be accompanied by others approximately at right angles to them. Such are the west coast of North America from north of British Columbia to Panama, the coast of Labrador, the western coast of Greenland, the western coast of Great Britain, the Red Sea, etc. There are no other lines of direction comparable with these in importance.

We cannot expect these lines to be straight or the directions to be mathematically true. Various circumstances would give rise to considerable deviations. Moreover, as the evidence shows, the lines have a tendency to bifurcate and reunite.

Dr. Gregory says that "Prof. Lapworth lays stress on 'the great Rocky Mountain-Andes fold, . . . the longest and most continuous crust-fold of the present day.' The agreement was important so long as the Rocky mountains and the Andes were regarded as a single mountain system, connected into a continuous line by a mountain axis running north and south across Central America. But that axial mountain chain in Central America is a myth. Central America is traversed by a series of ridges which run east and west, and not north and south. The watershed, it is true, runs along the Pacific border, but that is due to a movement later than the mountain ridges, which are thus truncated. The continuation of the Andes is in the mountains of Venezuela, not in North America or the Sierra Nevada."

But may not the Andes be continued both in the Rocky mountains and in the Alps of Venezuela? Very instructive experiments, as showing the manner in which the contraction of the Earth would throw up ridges, have been made by Sir I. Hall, Favre, Cadell, and others. In all these cases, however, so far as I am aware, the pressure was in one direction only, whereas in nature there would be compression in two directions at right angles to one another. I have already suggested

* *Phil. Trans.*, 1879, p. 529.

† *Bull. Soc. Geol. France*, 1892.

this in my book on the 'Beauties of Nature' (1892), but for the sake of clearness may perhaps repeat it here.

"If the elevation of a chain of mountains be due to the causes suggested in p. 214 (*i.e.* the contraction of the Earth through cooling, and consequent folding of the surface), it is evident—though, so far as I am aware, stress has not hitherto been laid upon this—that the compression and consequent folding of the strata would not be in the direction AB only, but also at right angles to it, in the direction AC, though the amount of folding might be greater in one direction than in the other. Thus in the case of Switzerland, while the main folds run south-west by north-east, there would be others at right angles to the main axis. The complex structure of the Swiss mountains may be partly due to the co-existence of these two directions of pressure at right angles to one another. The presence of a fold so originating would often divert the river to a course more or less nearly at right angles to its original direction." *

Nature has provided for us an admirable illustration in the case of the Jura. It will be seen there that the folds do not take the form of absolutely straight and parallel lines, but of elongated ellipses or lenses often bifurcating and then reuniting. The main folds run south-west and north-east, with cross-lines, as, for instance, the depression from Pontarlier by Jougne to Vallorbe; that by Delle, Porrentruy, St. Ursanne, and Biel; that by Basle, Liestal, and Olten, etc., all of which have been adopted by rivers and railway companies.

Now let us apply these considerations to a special part of the globe, and it is natural to select our own country.

I will begin with Scotland. The most remarkable geographical feature of North Britain is surely the Great Glen—that remarkable valley which, commencing in the south-west with the Firth of Lorn and continued through Loch Linnhe, Loch Eil, Loch Lochy, Loch Ness, and the Firth of Inverness, almost divides Scotland in two. It is, moreover, only one of many. Beginning with the north-west, we have the outer coast of the Hebrides, the Minch, Sleat sound, the eastern coast of Sutherland and Caithness, the line of Loch Awe, Loch Lydoch, Loch Ericht and the Spey, Loch Fyne and Loch Tay, the Solway Firth, etc.

The cross-lines, or those running from north-west to south-east, if shorter, are also numerous. In Sutherlandshire Loch Shin and Loch More, and coming southwards the two Loch Brooms, Loch Ewe and Loch Maree, the Sound of Harris and Loch Snizort, Loch Hourn, the Sound of Mull, the North Channel, Loch Ryan, and Luce bay, Wigtown bay, etc.

The predominant effect of these two lines on the geography of Scotland has not hitherto, I think, received the attention it deserves.

* 'Beauties of Nature,' p. 295.

In England and Wales we have, for the north-east and south-west lines, the Menai straits and north coast of Carnarvon, the north coast of Cardigan and Pembroke, the line of the Bristol Channel from Gloucester to Cape Cornwall, and some of the principal hill ranges, the Cheviots, the Cotteswolds, the Chilterns, etc. While for the transverse lines I might mention the Weaver and lower Mersey, the lower Dee, the Clwyd, further south the upper Severn, the Wye, the western Colne, and several other Thames tributaries, Southampton Water, etc.

Many of the great faults which cross the country for miles, as, for instance, the two great faults which cross the south of Scotland from sea to sea, also follow one or other of these two main lines of disturbance. I might also refer to the general strike of the Secondary strata from the Bristol Channel to the Wash.

I submit, then, that, so far from its being doubtful whether any extensive trace of these double folds can be discerned in the present distribution of land and water, the effect is still clearly shown on the Earth's surface, and that in the British Islands we have a most instructive illustration.

There is, however, of course, nothing in this which conflicts with Mr. Green and Dr. Gregory's very interesting and ingenious suggestions as to the tetrahedral form of the Earth.

A RECORD OF EXPLORATION IN NORTH-EAST AFRICA.*

THE appearance of a detailed narrative, by Lieuts. Vannutelli and Citerni, of the late Captain Bòttego's second great journey in East Africa, supplies a welcome addition to our knowledge of one of the most interesting regions of the whole continent. The expedition which it describes was, apart from the lamented death of the leader, one of the most successful and fruitful in geographical results that have been accomplished within recent times; and although more than two years have elapsed since the return of the survivors, the interest of the record has suffered no diminution in the interval.

The main objective of the journey was, as is well known, the solution of the much-debated question of the termination of the river Omo, whose headstreams, flowing southwards from the Abyssinian highlands, have been for many years known to travellers from that direction. Not only was this problem satisfactorily solved, but other points of interest connected with the lakes and rivers of this part of Africa were for the first time brought to light. After a brief introduction, in which the history

* 'Seconda Spedizione Bòttego. L'Omo.' By L. Vannutelli and C. Citerni. Milan: Hoepli. 1899.

of the Omo problem is concisely told,* the authors, the sole survivors of the four Europeans who set out from Brava in 1895, give a connected narrative of the course of the expedition down to the arrival at Zeila nearly two years later. The early stages of the route—from Brava to Logh on the Juba, and thence west up the valley of the Daua—led through country not entirely unknown, and must be passed over here, though the narrative contains valuable matter relating to the geography of the country, and the varied tribes which inhabit it. Entirely new ground was first entered in the neighbourhood of the lake Abbaya of Prince Ruspoli and Dr. Donaldson Smith. Here the travellers were in a region of mountains and lakes, meriting the title of an African Switzerland, of whose beauty and fertility they are never tired of discoursing. Keeping to the east of the Sagan, the feeder of Lake Stefanie, and thus leaving Lake Chamo (Abbaya) for the time unvisited, though seen from a distance, they soon reached a still larger basin girt with high mountains, its surface broken by numerous islands, which, like the shores, were clothed with luxuriant vegetation. Elephants and other game were frequently seen. The islands were inhabited by a tribe of skilled canoe-men, with whom, after some fighting, friendship was at last established. During the circumnavigation of the lake, it was found to be separated from Lake Chamo by a strip of ground only a couple of miles wide, and generally low. The larger lake (Pagade, or Margherita) is drained into the smaller by the river Walo. Lieut. Vannutelli, who explored a part of the eastern side of Lake Chamo, was of opinion that the stream on this side entered the lake, instead of issuing from it, as Dr. Donaldson Smith thought; but the latter view is accepted in the maps which accompany the work.

In order to reach the Omo near the lowest known point on its course, it was now necessary to strike west across a mountainous region in which constant rain was experienced. The natives showed themselves suspicious, by reason of the alarm spread abroad by the doings of Abyssinian raiding-parties, with whom the Italians were supposed to have some connection. After constant ascents and descents, during which a massive peak named Guge, nearly 14,000 feet high, was passed, streams flowing to the Omo—or "Uma," as the object of search began here to be known to the natives—were reached.† A new danger arose from the presence of an Abyssinian force on the Omo, just ahead of the expedition, but the wild mountains on either hand made it necessary to

* Mr. James MacQueen, whose views on the question are referred to in the introduction, is erroneously spoken of as an American. Although he resided for a time in the West Indies, Mr. MacQueen was by birth a Scotchman, and the greater part of his career was connected with this country.

† The name "Shambara," heard of by Borelli as that of the lake which received the Omo, was found in use here and along the Omo to designate an uninhabited tract of country.

keep straight on. Arrived at length in the narrow, thickly wooded valley of the Omo, the travellers turned at once towards its mouth, and succeeded in eluding their dangerous neighbours. Leaving the river for a time, they had to fight their way through the mountains, inhabited, for the first time, by tribes of negroid character. Again reaching the Omo on its exit from the mountains, the expedition followed down its eastern bank—round the great northerly curve, which seems to have led Dr. Donaldson Smith to mistake a tributary for the main stream—until at last the sight of Lake Rudolf told the travellers that their chief task was accomplished.

Although the chapters which tell of the march through the Alpine regions of East Africa are perhaps the most interesting part of the book, the subsequent portion, dealing with the exploration of the headstreams of the Sobat and the ascent to the Abyssinian plateau, is of scarcely less importance. The main narrative is followed by extracts from a journal kept by Dr. Sacchi on his fatal attempt to reach the coast from Lake Rudolf, with a map of his itinerary through the Boran country east of Lake Stefanie. The results of the surveys carried out during the whole march are shown on five large-scale sectional maps, based on 132 observations for latitude and 63 for longitude, which are fully discussed by Prof. Millosevich in an appendix. Other appendices give the scientific results of the expedition in other directions, which, valuable as they are, would have been still more complete had it not been for the loss of a part of the notes during the attack on the party near the Abyssinian frontier. The sections dealing with meteorology and geology, the latter illustrated by a special map based on the collections of Dr. Sacchi, are of particular value. The whole of the Alpine region of Lake Margherita and the Omo falls within the area of recent volcanic rocks, while in the Juba valley older volcanic rocks with calcareous and cretaceous strata of Mesozoic age are largely developed.

DISTRIBUTION OF AGRICULTURAL PRODUCTS AND LIVE STOCK OUTSIDE THE TROPICS.*

By A. J. HERBERTSON, D.Sc.

THE botanist who studies the distribution of plants usually eliminates all consideration of the plants cultivated by man, as vitiating his inquiry. The present work is an elaborate study, based on statistics, of the distribution of cultivated plants, and is the first complete work of its kind.

* 'Die Landbauzonen der aussertropischen Länder.' Auf Grund der statistischen Quellenwerke dargestellt von Th. H. Engelbrecht. In three volumes: vol. i. Text, pp. xi., 279; vol. ii., Statistics, pp. x., 383; vol. iii., Atlas, pp. viii., 79 maps. Berlin. 1899. Dietrich Reimer (Ernst Vohsen).

Originally inspired by the increase of American cereals in European markets twenty years ago, and planned as a study of the crops in the two continents, the work has been extended to include all the crops and live stock of the great cereal-producing regions of the World outside the tropics. The statistics are, in the first place, those for 1882 for most European countries, but they are compared with both earlier and more recent statistics in most countries, so that the second volume, which includes the statistical tables, is a most valuable source of accurate information as to the area growing cereals and the number of live stock, not merely in comparatively recent years, but also in the past.

The fault we find with the statistics is that for most countries single years have been taken. In the case of Argentina, for instance, the fluctuations from year to year in the wheat-producing area are so great that a comparison of one pair of years would lead to apparently diametrically opposite conclusions from that of another pair of years. In a work of this magnitude the mean values should have been calculated for a series of years. This would no doubt have involved much labour, but it would have given a greater and more lasting value to the elaborate maps which form the third part of the work.

The author has not shirked labour, for he has expressed the statistics in relative as well as in absolute figures. He has chosen what seems to us very unfortunate standards of comparison—in the case of agricultural products, the area sown with cereals (*Halmgetreide*, the northern cereals, excluding the *Hackgetreide*, the tropical cereals, such as maize and rice); in the case of live stock, the number of cattle. The former are useful in showing the relative importance of any particular crop compared with the total cereal crop in any region, but they give no indication of the relative importance of the particular crop in different regions, which is by far the most important consideration for geographical purposes. It is greatly to be regretted that the author should have considered the plan of the statistics to the common denominator of the total area of each region only to dismiss it. This is by far the most satisfactory method of treatment for cartographic purposes, except in cases where the data and the scale of the maps permit the delimitation of uncultivated lands, when the arable area can be used as the common denominator in the case of agricultural products, and the results of the calculations shown over only the arable region, and not over the whole political region of which it forms part.

The author's method leads to emphasizing the less of two important considerations, the one which can be most easily appreciated by a comparison of a series of maps. His maps show that in 1882, with hardly an exception, more than half the cereal-producing land of Scotland, Wales, and Ireland was cultivated for oats, and that in Suffolk less than 10 per cent. of this land was so utilized. This is useful if we have a map showing that in, say, Ross and Cromarty 2 per cent., and in Suffolk

37 per cent., of the total area produced cereals, as happened on the average from 1891 to 1895. He gives no such map. He does not even give the statistics that would have permitted the calculation of data from which such a map could be constructed, although it would have been easy to add a row of areas, at least in most countries dealt with. One has to obtain such statistics from other sources to discover that the same proportions of the surface of Ross and Cromarty and of Suffolk are sown with oats, namely 1·7 per cent., for in the former county 64·7, and in the latter only 5·2, per cent. of land growing cereals yielded oats. The author would say that the map based on proportion of total area growing oats would indicate that oats were more important in Suffolk than Ross and Cromarty, and would conceal the fact that they were by far the most important cereal in the latter county. Surely a comparison of wheat, barley, and oat maps would at once indicate this fact. The method of first eliminating, both in statistical tables and on the map, the uncultivated area would overcome this difficulty, and permit both the facts of the northern county having few crops and those chiefly oats, to be illustrated on one map. As it is, we have no means of appreciating from the atlas the intensity of cultivation of any particular crop in different regions. This would have been possible, had Mr. Engelbrecht calculated and depicted for each region the proportion of its cereal-producing land to the whole, and the number of cattle per unit area, by comparing such maps with those showing the relative proportion of one cereal crop to all, and of other live stock to cattle. It would be, however, much more difficult to obtain all the different interpretations of the facts from such a series of maps than from the other series, where everything was expressed in terms of the total area.

Although we think the relative tables and the maps would have been more useful if treated differently, yet the great excellence of all parts of this monumental work must not be overlooked. The tables are full of invaluable figures, the text of important observations, and the maps reveal many interesting features of distribution. Some of the maps, showing the distribution of two different crops, *e.g.* wheat and sugar in Australia, those with lines showing regions where wheat predominates over rye in Europe, are most instructive. Innumerable relationships are discussed in the text between climate and crops, and between one crop and other plants, and some of these are illustrated in the atlas.

On numerous maps selected isotherms are drawn, and in many cases these run close to the boundary of cultivation. For instance, hardly any maize is grown in Europe where the mean temperature is under 19° C. in June, in Australia where under 18° C. in January, but in North America maize is grown in all of the United States, in many of which the mean temperature in June is lower than this. In the case of Australia, especially, some rainfall lines would have proved valuable addition, *e.g.* that of 15 inches per annum, outside of which little wheat can be grown; and 30 inches, which approximately forms the western limit of maize in the east; and 40 inches, which bounds the region of more intensive maize cultivation. The increase of goats, mules, and asses in the drier areas is graphically shown on the maps, and would have been made clearer by a series of isohyets.

On many of the maps the distribution of a number of forest trees is indicated and correlated with that of the cultivated plants. This we consider a most valuable feature of the work. For instance, noting that the northern limits of the cultivation of oats almost coincides with that of the breaking buckthorn (*Rhamnus frangula*, L.) in European Asia, that its southern limit is almost coincident with the southern limits of the bird cherry (*Prunus padus*, L.), we may assume that the region between the natural limits of the growth of these trees in Siberia is a possible area for oat culture, and beyond that it would probably fail.

From a geographical point of view, the study of plant associations is more important than the study of the distribution of an individual species, and has great economic possibilities, so much so that in recent years special surveys of natural biological conditions have been started in several of the American states for the benefit of the farmer. This plan of comparing the distribution of cultivated plants with that of natural plants may be looked on as a special and most valuable application of the method. In this way it becomes possible to say, from the study of the natural flora, what the chances of success in cultivating special economic plants will be.

Two other valuable features of this great work must be noted: (1) There is a discussion of changes in the intensity of cultivation in the past few decades, of which the diminution of wheat in our own country and the increase of wheat in the more recently settled lands of the globe is the most striking example; but the retreat of the polar limits of wheat, the vine, and cotton with the increase of transport facilities is quite as interesting, if less known. (2) The first map and part of the introductory text deals with the different extra-tropical cultivation belts, which Mr. Engelbrecht divides into (*a*) arctic, (*b*) arctic and antarctic barley belts, (*c*) the oat belts, (*d*) the steppes of Central Asia and Southern Russia, (*e*) the maize belts, (*f*) the sub-tropical barley belt, (*g*) the sub-tropical cotton belt, and (*h*) the sub-tropical sugar-cane belt.

LIEUT. KOZLOFF'S EXPEDITION TO CENTRAL ASIA.

At a meeting of the Russian Geographical Society on November 22, an account was given of the expedition which the Society sent out last spring to continue the exploration of Central Asia. It was entrusted to Lieut. P. Kozloff, the well-known explorer, who has made several expeditions under Prjevalski and General Pevtsoff, and later on in company with Roborovsky. He was accompanied by M. Koznakoff, and a naturalist, M. Ladyghin. According to the information just received from Kobdo, the work of the expedition was as follows.

On June 23 the expedition was at the Altai Stanitsa, where the last preparations for the long journey into the deserts were completed. The expedition left this place on the 26th, the caravan consisting of 18 men, 54 camels, and 14 horses, and began its explorations in a very imperfectly known region of the Great Altai. Following the banks of the river Bukhtarma, they gradually ascended to the limits of perpetual snow and glaciers, and reached an undulating plateau, which was covered with grass that had already assumed its autumn tints. There was very little animal-life, though water was in abundance, the plateau being dotted with a great number of small lakes. The whole was of a gloomy aspect. Taking advantage of a day's halt, they explored, in a boat made of linen and cork which they had brought with them, one of these lakes—Khaluzyn-nor.

At the western end of the Ulan-daba pass, which is on the frontier of Russia, the expedition divided into two parties. The larger one, under Lieut. Kozloff, crossed the range, and on its eastern slope entered the basin of the river Kobdo, which is under the influence of the dry climate of Mongolia, and widely differs from that of the Bukhtarma. The river Kobdo was reached on August 15. It is 350 feet wide, and is very rapid. The valley is covered with woods. Here and there one sees small lakes and marshes, which are peopled with birds. The whole length of the river Kobdo is about 340 miles. It takes its origin in the glaciers of the Southern Altai, and flows afterwards on the high plains where it enters the lake Kara-usu. The caravan crossed the river by means of small rafts, and, leaving the valley, entered a rugged mountainous region intersected by deep valleys containing rapid torrents. After a four days' march the travellers approached the snow-clad mountains of Gurban-tsasatu, which are held in high respect by the Mongols. Some Mongols were found staying at this place, and guides were taken from among them. After several days' rapid march, without halts, the expedition saw at last, on August 24, from the top of a hill, the wide valley Buyuntu, with the little town of Kobdo.

The other party of the expedition, consisting of Koznakoff, Ladyghin, and a few men, lightly equipped, moved south from the Kobdo highway. Going through the valleys of the rivers Tsagan-gol and Kobdo, as far as the lakes at the sources of the latter, they crossed the water-parting between Kobdo and the Saksai, then the headwaters of the Buyuntu, and, finally passing by Lake Dain-nor, they reached the town of Kobdo. The route lay through a wild mountain region along a small footpath, which wound along the stony slopes of the valleys. The head valley of the river Tsagan-gol is not wider than 2 or 3 miles, and has, broadly speaking, a direction towards the east. The river itself, the muddy water of which rapidly runs between low banks, has a width of about 140 feet. The valley is inhabited by nomad Uryankhai Kalmuks. Further east the valley appears still more desert, the surrounding mountains are treeless, the ground is occasionally covered with salt, and both the vegetation and the animal-life became poorer and poorer as the party approached the place where the Tsagan-gol joins the Kobdo river. Further on they ascended the river Kobdo, which flows rapidly between wooded and hilly banks. Here, in contrast with the Tsagan-gol valley, the slopes of the hills are covered with trees, and there is plenty of rich meadows and pastures.

Continuing their journey up the Kobdo river, in a south-western direction, the party came to the spot where the river forms two small lakes, on the banks of which there are several Kirghiz villages. The lower Kobdo lake has an irregular elongated form, stretching 10 miles from east to west, with a width of about 5¼ miles. There are in it fifteen islands, of which some are from 2 to 2½ miles long. Taking advantage of the boat which they brought with them, the explorers made a series of soundings of the lake, and visited the slands. The upper lake is connected with the lower by a rapid watercourse, 420 feet wide. The upper lake proved much larger than it was supposed to be; its length is about 16½ miles, and its width 4 miles; its depth attains 18 fathoms. From these lakes the party travelled to Lake Dain-nor, and found on the way numbers of graves with ancient tombstones. The circumference of this last lake is 13 miles, and it is 4 miles wide. The pass Ak-korum is not very high, but difficult, on account of the great quantity of water which covers the stony ground and makes it slippery. Further on the party went along the valley of the river Saksai, which they found similar in nature to the Tsagan-gol; then they reached the Buyuntu, which flows first in a stony bed amidst thickets of bushes, and further on in a narrow and low gorge. Here and there small terraces, covered with trees, chiefly willows and ash, were seen along the banks. The population consists of Olot-Kalmuks. The gorge was followed for about 50 miles, when the valley suddenly widened, attaining a width of about 7 miles; the mountains on both its sides became very low, and a grand view opened upon a high snow-clad range, which runs parallel to the gorge to the right of it. A little further on this second party saw Kobdo, which they reached on August 28, having covered 378 miles in twenty days. At Kobdo the expedition stayed for nine days, buying provisions for its further six months' journey; and then, on September 6, they started towards the east-south-east, along the northern foot of the Gobi Altai.

THE MONTHLY RECORD.

EUROPE.

Oxford Degree for Physical Geography.—Some years ago the University of Oxford instituted the degree of Bachelor of Science to be awarded for original research. It has just been conferred on Mr. H. N. Dickson, of New College, University Lecturer on Physical Geography, whose research took the form of a comprehensive study of the temperature and salinity of the surface water of the North Atlantic, with special reference to seasonal variations and the influence exercised on the climate of Western Europe. The result is to throw much light on the changes in the circulation of the ocean according to the season, and on the interaction of sea-surface temperature and climate. The examiners were Sir John Murray and Prof. Odling.

The Birmingham Water-supply from Wales.—An interesting account of the Birmingham water-supply scheme, now in course of execution, appears in the fifteenth volume of the *Proceedings of the Royal Institution of Great Britain*, being a paper read last year before the Institution by Mr. James Mansergh. The drainage area, over which control was obtained from Parliament, lies in the western corner of Radnorshire, with parts of neighbouring counties, including the basins of the Elan and Claerwen, western feeders of the upper Wye, the distance to Birmingham by the route chosen being 80 miles, as compared with 100 miles from Thirlmere to Manchester, and 66 from Vyrnwy to Liverpool. The projected Welsh scheme for London involves an aqueduct of 170 miles. The area of supply is 45,562 acres, while from the record of rainfall kept by the lord of the manor from 1871 onwards, the mean annual fall of a long series of years is taken as 68 inches, and that of three consecutive dry years as 55 inches. From this it is calculated that, allowing for evaporation and loss by overflow, a supply of seventy-five million gallons daily will be obtained, in addition to twenty-seven millions, the amount fixed as "compensation supply" for the river below the lowest dam. As the discharge at this spot has been estimated at only four and a half million gallons during very dry weather, the benefit to the river is evident, apart from the additional service done by obviating disastrous floods. The geological features of the area favour the operations for reservoir construction. At a point called Caban Coch, a little below the junction of the Elan and Claerwen, bands of hard grits and conglomerates cause a contraction of the valley, and point out the best spot for the construction of the lowest dam. This will be 122 feet high, and will impound the water for a distance of 4 miles up the Elan valley, and 2½ miles up that of the Claerwen. Spots have been chosen for the erection of five more dams higher up the valleys, two in that of the Elan, and three in that of the Claerwen, the positions being determined by the fact that they afford the greatest impounding capacity with the least amount of structural work. An interesting and unusual feature is the provision of a "submerged" dam within the lowest reservoir, so as to provide the necessary head of water (770 feet above ordnance datum) for the Birmingham supply in times of drought, while leaving that contained in the rest of the reservoir, at a lower level, available for the "compensation" supply to the river. At such times the former supply will be derived from the upper reservoirs, a drought of 180 days being thus provided for. The drainage area above Caban Coch is twice that dealt with in the case of Vyrnwy, and four times that of Thirlmere. In time of high flood, the discharge may amount to 700,000 cubic feet a minute, and the surplus water will pour over the whole 600 feet of the dam, with a depth of about 3 feet at the crest. Almost the whole collecting area consists of mountain pasture or moorland; but in the lower parts of the valleys a few small farmsteads will be submerged, as well as the church and old manor-house of Nant-gwillt and Cwm Elan House, once the residence of Shelley.

Anthropogeography of Corsica.—An instructive study, by Prof. Ratzel, of the effect produced by the physical geography of Corsica on the course of its history, appears in the *Annales de Géographie* for July 15 last. The writer begins by examining the influence exercised by the position of the island with respect to neighbouring lands, and to the enclosed basin of the Tyrrhenian sea, the historical importance of which has always been greater than that of the more open sea to the west of Corsica. By its more northerly position, Corsica was further removed than Sardinia from the influence of pre-Roman civilization, and was long placed at a disadvantage from the prior attention directed to the latter. Naturally, the island is most nearly connected with the Tuscan coast of Italy, being further removed from France, and still further from Spain. Its relations, however, with the nearest part of the Italian coast (Pisa) lasted for a comparatively short period (1098–1348), being followed by Genoese domination, while the rivalry between Genoa and

France finally brought about its connection with the latter. The shifting of political ascendency thus followed a regular course from E.S.E. (Rome) to N.N.W. (Marseilles and France). Although an island, Corsica was too small and too near other land-areas to maintain an independent existence, but its insularity has been sufficient to impress a decided character of their own on the life and thought of the inhabitants. As regards the physical structure of the island, the dominating fact is its division, broadly speaking, between the granitic area of the west and south and the schistose area of the north-east. The line of division is marked by an important depression, parallel with the principal lines of elevation, which was covered by the sea during the Tertiary epoch. The main water-parting of the island, nearer the west coast in the north, and the east in the south, plays a very different *rôle* in the granitic and schistose areas, presenting greater facilities for communication across it in the latter. The character of the surface in the two regions is also very different, the north-eastern section being composed of undulating heights running generally north and south, while the granitic area is a land of mountains rising abruptly from the sea in parallel ridges, forming long and narrow valleys, and gulfs cutting deeply into the coast-line. Socially it is the land of shepherds and "signori," whilst historically it lies off the track of great events. In the extreme north and south are minor areas, distinct in many ways from the rest of the island. The region of the north-east, though in area only a fourth part of the island, forms in history practically the whole of Corsica. In it one of the most important positions is occupied by Corte, the radiating centre of the principal lines of traffic, and the point of contact between the mountains and the coast-lands; and it contains as well a whole series of sites of historical importance. This region has a striking counterpart in the south-west of Sardinia, in which the co-ordination of geographical features, and the resulting historical phenomena, are strictly analogous. The concluding section of Prof. Ratzel's paper deals with the contrasts offered by the east and west coasts, and the reasons which make the latter, with its many indentations, an exception to the rule that a broken coast-line favours the development of a country.

ASIA.

New Surveyor-General of India.—The Indian Survey Notes for September, 1899, contain the announcement of the retirement from the post of Surveyor-General of Major-General C. Strahan, R.E., and of the appointment in his place of Lieut.-Colonel St. George C. Gore, previously Superintendent of Trigonometrical Surveys. General Strahan was the last officer in the active service of the Indian Government of the corps of engineers raised under the East India Company, the distinguished record of which is thus brought to a close by his retirement. He had served in the Survey Department for thirty-six years, during the last four and a half of which he had been at its head. An important part of his work had been connected with the topographical surveys of the Native States of Bundelkhand, Central India, etc., where the present system of plane-table surveying may be said to have been elaborated and brought to perfection. To this work he had devoted himself for no less than twenty years. The place of Colonel Gore as Superintendent of Trigonometrical Surveys is taken by Major S. G. Burrard, R.E., one of the officers entrusted a few years ago with the re-determination of the longitude of Madras. Another announcement is that of the death of Hira Singh, a native surveyor of the Department, who did much good work on and beyond the north-west frontier while attached to various military and other expeditions, including that of the Afghan Boundary Commission.

Rhinoceros Remains from Eastern Mongolia.—We have received from M. Obrucheff, the well-known Russian traveller, the copy of a pamphlet on the discovery of the remains of rhinoceros in Eastern Mongolia during his journey of 1892–94. The identity of the remains, which consist principally of a lower jaw with fragments of teeth, has only recently been established by Prof. Suess, whose report forms the first part of the brochure. They are of interest as establishing the fact that the sedimentary formation in which they occurred is a fresh-water deposit of at most Middle Tertiary age, and thus shedding valuable light on the geological history of Eastern Central Asia. M. Obrucheff gives a description of the geological features of the neighbourhood of the Khuldyin Gobi plateau, on the edge of which he discovered the remains. The plateau lies near the salt lake Iren-dabassun-nor, on the caravan route from Urga to Kalgan. Its border is much broken into isolated fragments, where the geological formation is easily determined. The upper layer is a whitish fine-grained conglomerate, beneath which is a whitish marl with intermixture of clay, etc., while the lowest layer is a brownish-red marl. The rhinoceros remains were found in the middle layer. From the general lie of the country, M. Obrucheff concludes that the strata of the Khuldyin Gobi, which occupy the lowest part of the whole region, form the oldest member of the extensive Gobi deposits of Eastern Mongolia. These being now proved, as above stated, to be of fresh-water origin, it is found that the ancient Inner Asiatic sea or series of lakes consisted from the beginning of fresh water, and existed during the latter half of the Tertiary period. These conclusions agree with those of Prof. Lóczy, the geologist of the Széchenyi expedition, though M. Obrucheff had before doubted the fresh-water character of the ancient sea, having taken the remains now described for those of a large fish.

The Geological Structure of the Malay Archipelago.—A concise summary of our present knowledge of the geology of the Malay archipelago, with especial reference to the main lines of tectonic structure, is given in the *Journal* of the Tokyo College of Science (vol. xi. part 2), by Prof. B. Koto. The basis of the description is Prof. Suess' chapter on the archipelago in 'Das Antlitz der Erde,' but Prof. Koto has extended and modified his account from the most recent researches. Beginning with the great Malayan arc, which extends from Burma to the vicinity of Timor and forms the outer portion of the archipelago, the writer traces in turn its various component parts, especially the great volcanic belt running through Sumatra, Java, etc. The outermost member he considers to run from Cheduba off the Arakan coast, through the Andamans and Nicobars to the line of islands which fringe the south-west coast of Sumatra, the volcanic belt being represented in the north by Narcondam and Barren island. In the east this seems to terminate in the island of Pantar, north-west of Timor, being separated by the latter and other islands near it (all remarkably free from volcanoes) from the volcanic arc of Banda, which may thus be regarded as independent of the great Malayan arc. Prof. Koto is inclined to cut short the Banda arc, which begins with Roma in the south-west, at the Banda group, believing that Wawani on Amboina cannot be established as an *active* volcano. On the final decision of this question it depends whether or not a connection exists between the volcanic chains of Banda and the Moluccas. Outside the Banda arc runs a parallel chain of islands from Kisser northwards—the shattered relic of an old mountain range, while a third external zone has also been indicated. This threefold arc, of which the inner zone is of young volcanic origin, has a striking counterpart in the lesser Antilles, and still more in the Riu-kiu islands. Within the great Malayan curve lie the three K-shaped islands of Borneo, Celebes, and Gilolo, the external resemblance of which is, however, only superficial. To the south their relation with the outer curve is not clear, but their geologic lines converge unmistakably in the Philippine group, presenting a striking instance of "virgation." In the south-west Borneo possibly falls on the tectonic line which runs from the Malay peninsula through Banka and Billiton, while in its centre tectonic lines running from east to west have lately been discovered, and neo-volcanic rocks have unexpectedly been found to exist. The north-eastern peninsula of Celebes lies on the volcanic belt which, beginning in the Gulf of Tomini, runs north through Sangi, and in Mindanao joins the chain of the Moluccas to form the great volcanic belt of the Philippines. This is not considered by Prof. Koto to run the whole length of Luzon, but, after traversing its south-east section, to cross the sea to the extreme north-east corner. The other tectonic lines of the group are somewhat complicated. The map accompanying the paper is an excellent specimen of Japanese lithography.

AFRICA.

The Egyptian Problem.*—Although Mr. Silva White's recent work is written with avowed political motives, its aim being the advocacy of a British protectorate over Egypt, the political questions involved are so far bound up with geographical considerations that the book contains much matter of interest to geographers, as well as to the wider circles in which a subject so nearly affecting the future of the British Empire cannot fail to arouse attention. From first to last the author follows a continuous line of argument, in which he attempts to make each step the logical sequence from what has preceded it, the starting-point of the whole being the geographical description of the Nile valley. Mr. White has a striking and original way of presenting his facts, and his volume is decidedly suggestive, while, apart from its more definite object, it is of value as presenting a clear view of recent Egyptian history, its administrative system, and the progress it has made under British control. In the discussion of the physical factors, Mr. White's central idea is the organic unity of the Nile valley and the consequent need that it should be under one political control.† He is, perhaps, inclined to lay too much stress on the isolation of the Nile valley from the rest of the continent, and to overlook the differences which exist between its component parts, which, but for the connection supplied by the river itself, could hardly have been brought into close relation on purely natural grounds. After dealing with Egypt proper, the author gives an interesting chapter on the Sudan, the section dealing with the "title-deeds of the Nile valley" being useful as bringing together the various international agreements on which the Anglo-Egyptian rights depend. Mr. White urges the importance of fixing a definitive frontier with Abyssinia, the absence of which is the one weak point in our settlement of pending questions. He regards the Lybian desert as placed within the Egyptian sphere by the recent agreement with France, but it is to be observed that Article III. of the Declaration merely conceded the French claims up to a certain line in this direction, without saying anything of the status of the country beyond it, which most naturally forms the *Hinterland* of Tripoli.‡ Again, the dissatisfaction felt in Italy was not so much due, as Mr. White supposes, to the idea that Tripoli became a French sphere, as

* 'The Expansion of Egypt under Anglo-Egyptian Condominium.' By Arthur Silva White. London: Methuen. 1899.

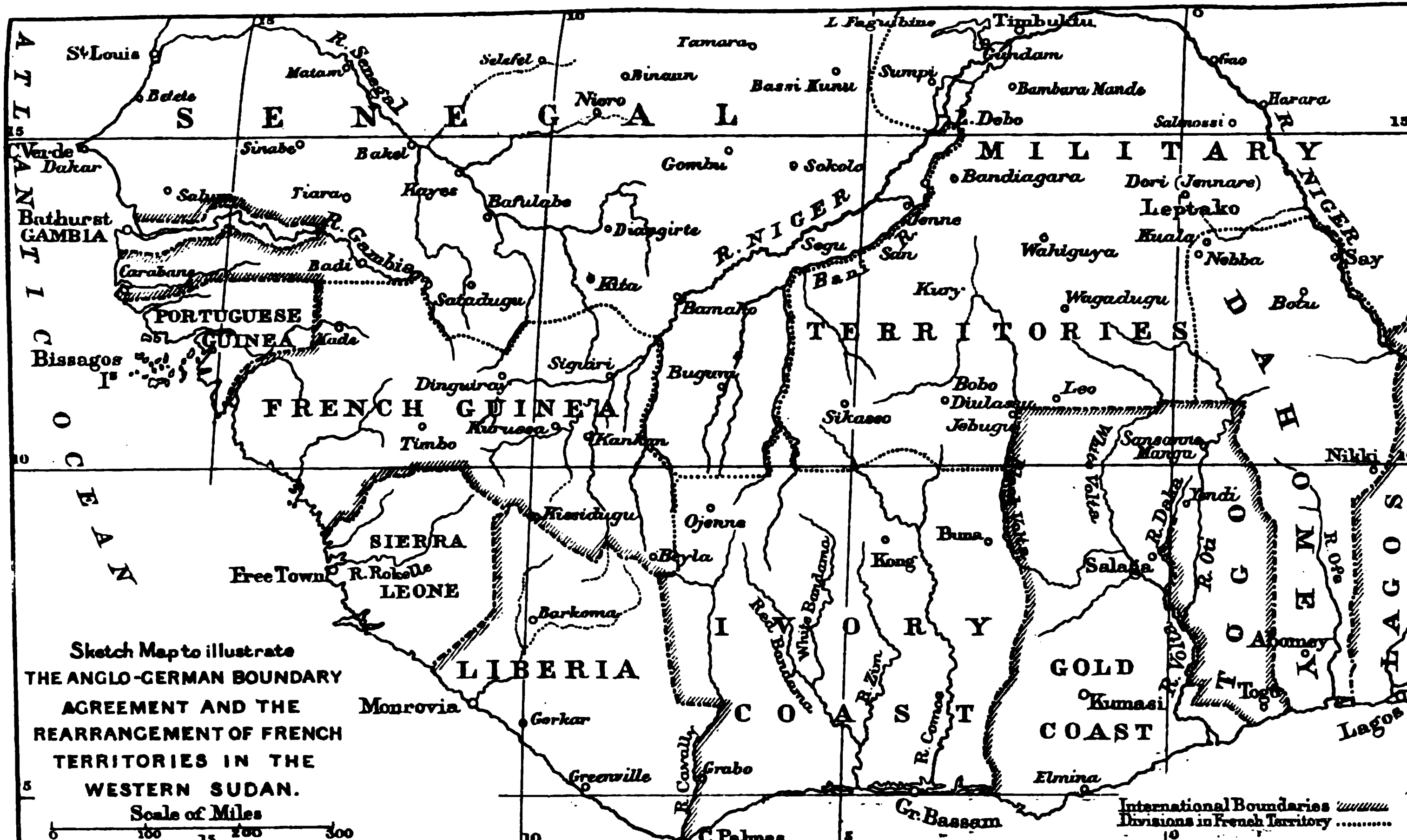
† Mr. White makes a curious slip in stating that the Nile basin would contain the area of a hundred British isles. For a hundred, ten should of course be read.

‡ The trade route from Bengazi to Wadai renders this otherwise valueless tract of some importance to the possessor of Tripoli.

that Tibesti, naturally another part of Tripoli's *Hinterland*, was assigned to France. The work contains some useful maps, by Bartholomew, of the Nile basin. In that showing political data, the whole British and Egyptian territory from Alexandria to Mombasa is divided into four areas, according to the four grades of British domination spoken of in the text. The reason for the severance from the Sudan by the parallel passing through Fashoda, of the Bahr-el-Ghazal, etc., as a "British sphere of influence," is not evident, as this is in accordance neither with the terms of the Anglo-Egyptian agreement of January, 1899, nor with the fact that Egyptian stations have already been re-established south of that line. The map showing zones of vegetation is misleading in one or two points. Thus Uganda, with its abundant vegetation, is shown of the same tint as the arid plains of Somaliland, while the coast lands of British East Africa are supposed to be covered with dense forests comparable to those of the Congo basin.

Reorganization of French West Africa.—By a decree of the French Colonial Minister, dated October 17, 1899, the French possessions in West Africa have been placed under a new organization, which considerably modifies the distribution of territory between the various provinces. The reason given is the difficulty which has been experienced in controlling the operations in the far interior—on the Middle Niger—from so distant a centre as Kayes, the capital of Senegal. The Middle Niger region, including the greater part of the area within the bend of the river, is therefore placed under a separate military administration, while the western portion of the old Sudan province is united with that of Senegal to form a single administrative division, which reaches eastward to Lake Debu. French Guinea, the Ivory Coast, and Dahome remain, broadly speaking, within the same limits as formerly, the Ivory Coast extending roughly to 10° N., and Dahome a little north of the latitude of Say. The approximate boundaries of the new divisions are shown on the opposite map, which also illustrates the territorial arrangements between Great Britain and Germany in the same region. They are taken from a map published in the *Bulletin du Comité de l'Afrique Française*, and reproduced in the *Politique Coloniale* for November 14.

Baron von Grünau's Visit to Siwa.—During the winter of 1898–99 a visit to the Siwa oasis was made by Baron von Grünau, who gives a short account of his journey in the *Zeitschrift* of the Berlin Geographical Society (1899, No. 3). Between the Natron lakes and Moghara the German traveller seems to have taken a route not often followed across the plateau, by which the length of the journey was reduced by a day. The ground here entailed a succession of ascents and descents over a rocky surface, but the differences in elevation were but slight. Baron von Grünau made a compass survey of the route, and was able to correct some slight errors in the maps. He also carried out a regular series of meteorological observations, as well as determinations of the temperature of the water of wells. In Siwa he took measurements of some of the ruins, but does not seem to have added much to the information collected by Mr. Silva White. He seems to have been incorrectly informed that Mr. White did not visit Aghormi, of which a photograph is given in that traveller's book. Possibly, however, the particular ruins which he claims to have discovered were not seen by Mr. White. The temperature of the famous "fountain of the sun," near the temple of Jupiter Ammon, was repeatedly taken, at various hours of the day, and the same result (31° C. or 87·8° Fahr.) obtained in each case. The popular idea that it is cooler at midday and warmer in the evening, is thus due only to the divergence of the temperature from that of the outer air. Baron von Grünau met with a friendly reception from the sheiks, even from the representative of the Senussi, but any



Sketch Map to illustrate
THE ANGLO-GERMAN BOUNDARY AGREEMENT AND THE REARRANGEMENT OF FRENCH TERRITORIES IN THE WESTERN SUDAN.

attempt to proceed to Jarabub would have been strenuously opposed. He accomplished the return march in eighteen days without serious mishaps, but considers the journey to Siwa the most difficult of the nine caravan journeys he has hitherto undertaken.

Major Gibbons' Zambezi Expedition.—Writing to us from Lialui on August 31, 1899, Major Gibbons sketches the results of the explorations of himself and his colleagues since March, in which month his last letter was despatched (*Journal*, vol. xiv. p. 93). In accordance with the plans previously announced, the field first chosen for exploration was that to the west of the upper Zambezi, on the upper courses of the Okavango, Kwando and other streams of the western Zambezi basin. Captain Quicke, after reaching, from Lialui, the confluence of the Kubangui and Kwando, followed the latter to its source, and then struck north-east to the Lungwebungu, which, where first seen, was a strong deep stream about 200 yards wide. Its valley, like that of other streams of the region, is bounded by undulations of white sand, which diminish in height in the direction of the Zambezi. The lower part of the Kwando was explored by Captain Hamilton, who found it a much smaller stream than either the Kubangui or the Kwito, both of which are, or could easily be made, navigable for stern-wheelers. The Kwito, according to Major Gibbons' survey, has a very different course to that hitherto shown on our maps, on which it is placed some 25 miles too far east. After crossing 19° E. in about 15° 5′ S., it makes a wide curve to the west, again crossing 19°, and finally passing east of that line only in about 16° 65′ south.* It joins the Okavango in 20° 27′ E. and 17° 58′ 30″ S., beyond which point the latter river crosses and recrosses 18° south, and then, flowing a little south of east, enters a wide swamp-plain without any of the windings shown on many maps.† Major Gibbons, like Mr. Reid (see below), speaks of a channel connecting the Okavango with the Kwando (Linyanti). It is known as the Mag'wekwana. Following its course from near the Kwando, he was struck with the magnitude of its bed, which inclined him to the idea that it had once formed the main channel of the Okavango, which would then have belonged to the Zambezi system. The channel, however, subsequently became less definite, and he found that it merely forms an overflow from the Okavango during two months of the year, becoming waterless in the dry season. After its bed had become dry, Major Gibbons still found water in pans well above its level, though these in turn are dry in July. Within the bend of the Kwito above described, a large number of tributaries of the Kwando take their rise, very little water flowing to the Kwito from this side. The ground falls considerably towards the Kwando both from the vicinity of the Kwito and of the Lungwebungu, enclosing a generally level triangular plain which extends to the Zambezi, and may be called the great Zambezi plain. On the east of the Zambezi the ground again rises rapidly. Major Gibbons' plans for further exploration were as follows: Captain Hamilton was to descend the Kafukwe, joining his surveys with those of Major Gibbons in 1895–96. Captain Quicke was to ascend the upper Kafukwe and meet his chief at the Kabompo source, afterwards proceeding west along the watershed *en route* for Loanda. Major Gibbons himself hoped to ascend the Zambezi to its source, then proceeding east along the Kafukwe-Congo watershed, and

* The Kwito was crossed by Capello and Ivens in about 15° 45′ S., its longitude being supposed by them to be then about 19° 35′ E. They showed its course without any decided bend to the west, though they were correctly informed as to its navigability down to the Okavango.

† As to the lower course of the Okavango, Major Gibbons agrees with Dr. Passage (*Journal*, vol. xiv. p. 311).

making his way to Tanganyika. Thence he will, if possible, make for the Nile and Khartum. His proceedings have been somewhat hampered by the impossibility of obtaining supplies from the lower river, owing to the unfortunate death of Mr. Muller and the retirement through ill health of Mr. Weller.

Survey of the Linyanti River by Mr. Percy Reid.—Mr. Percy Reid, whose explorations in the Barotse country in 1895–96 are well known to our readers, writes to us from Kazungula, under date September 17, announcing his return to that place from a trip round the marshes of the Linyanti river (Chobe of Livingstone), as far as Maini's, placed in our maps in about 23° E. Mr. Reid had been able to make a fair number of astronomical observations, and had fixed the position of Maini's and of the Sunta river (the arm which diverges to the south) by occultations. He hoped also to fix the position of Kazungula (opposite the mouth of the Linyanti) in the same way. An interesting discovery is that of the waterway connecting the Okavango marshes with those of the Chobe, which has long been reported to exist, though the fact has been doubted.* Mr. Reid has paid much attention to the mysterious subject of the rise of the Linyanti at the height of the dry season, to which attention was first, we believe, called by Mr. Selous (*Proc. R.G.S.*, N.S., vol. iii. p. 171), and we may hope that his observations will throw light on the problem. Mr. Reid says that the river rises *twice* in the year. Mr. Selous found the flood-water at its highest in September, while Dr. Bradshaw (*ibid.*, p. 212), who seems to have been in the country at all times of the year, says that the rise commenced in January, and was at its full height in March, falling till January again. It would almost seem as if the *régime* of the floods varied from year to year, and this is in some measure borne out by Mr. Selous' statement that between 1874 and 1879 the overflow seemed to be growing less year by year. Mr. Arnot, who crossed the headstreams of the river in 1884, accounted for its rise in the dry season by the porous nature of the ground near its sources, which was said to absorb the rainfall until the close of the wet season (*Proceedings*, N.S., vol. xi. p. 69).

Fluctuations in the Level of Tanganyika.—The *Mouvement Géographique* for October 22 last (No. 43, 1899) prints an extract from a letter from Père Daull, missionary at Karema, relative to recent changes in the level of Lake Tanganyika. Since 1879, the writer says, the lake has fallen at least 26 feet (8 metres), there being now more than a kilometre of cultivated land between the shore-line and the low hills near Karema, which the water reached a few years ago. This does not mean, he says, that the lake is in course of disappearance, but merely that it has retreated within its natural bed, its former high level being due to the blocking of the outlet. It now remains stationary. Père Daull also gives some particulars respecting the present state of Ujiji, or rather of the chief centre of that district. Arab influence has entirely declined, most of the traders having left for the coast. A Greek trader now occupies the house of the former English mission. The Germans, under whose rule there is complete security for Europeans, are introducing the rupee as the official medium of exchange.

Surveys by Captain Ashburnham in Buddu and Ankoli.—Captain Ashburnham, who before starting for Uganda took some lessons in surveying under the Society's instructor, writes to Mr. Coles from Buddu, giving an account of his surveys in that country, with sketch-maps. The chief geographical result has been the first correct delineation of Lake Kachera, which, though long known to

* Dr. Aurel Schulz found that a considerable stream, which he concluded to be a branch of the Okavango, entered the Linyanti from the west. His idea was confirmed by native accounts.

exist, has hitherto been incorrectly shown on the maps. The lake seems to have been first visited by Lieut. Hobart (*Journal*, vol. xii. p. 189), who, however, saw a part of it only, and considered this to be distinct from the lake previously shown on the maps from native accounts. Captain Ashburnham has traced its shores without losing sight of it for more than an hour at a time, and has found that there is only one lake, split up into a number of narrow arms. The greatest length of the lake—about 25 miles according to Captain Ashburnham's sketch—is from west to east, but there is a long narrow arm running north for about 12 miles to the neighbourhood of Kabula (on Lugard's route of 1891-92). The Ruezi river enters the lake at the west end, while the Kivale, known lower down as the Bukora, flows out at the east, entering the Victoria Nyanza a little north of the mouth of the Kagera, with which river it has no connection, though erroneously shown as a tributary on some maps.* The name Kachera is known to all the neighbouring tribes, though each separate inlet (of which there are nearly a dozen) seems to have its own local name. A depression among the hills to the south-west, forming the continuation of one of the arms of the lake, constitutes the boundary between Koki and Ankoli, and another natural trough, continuing the line of the northern arm, separates the latter from Buddu. Neither the Ruezi nor the Bukora are navigable, though the Bukora is deep even in the dry weather, but, like a great part of the lake, is choked with papyrus. There are no crocodiles in either, though they swarm in the Kagera. The district of Sango, south of the Bukora mouth, is densely cultivated, but a forest of large timber stretches to the south and south-west of this. Captain Ashburnham's observations for latitude confirm Lieut. Hobart's statement that the German operations have overstepped the boundary into the British sphere. He has had a good deal of trouble with the rebels, but thinks that their power is now broken.

AMERICA.

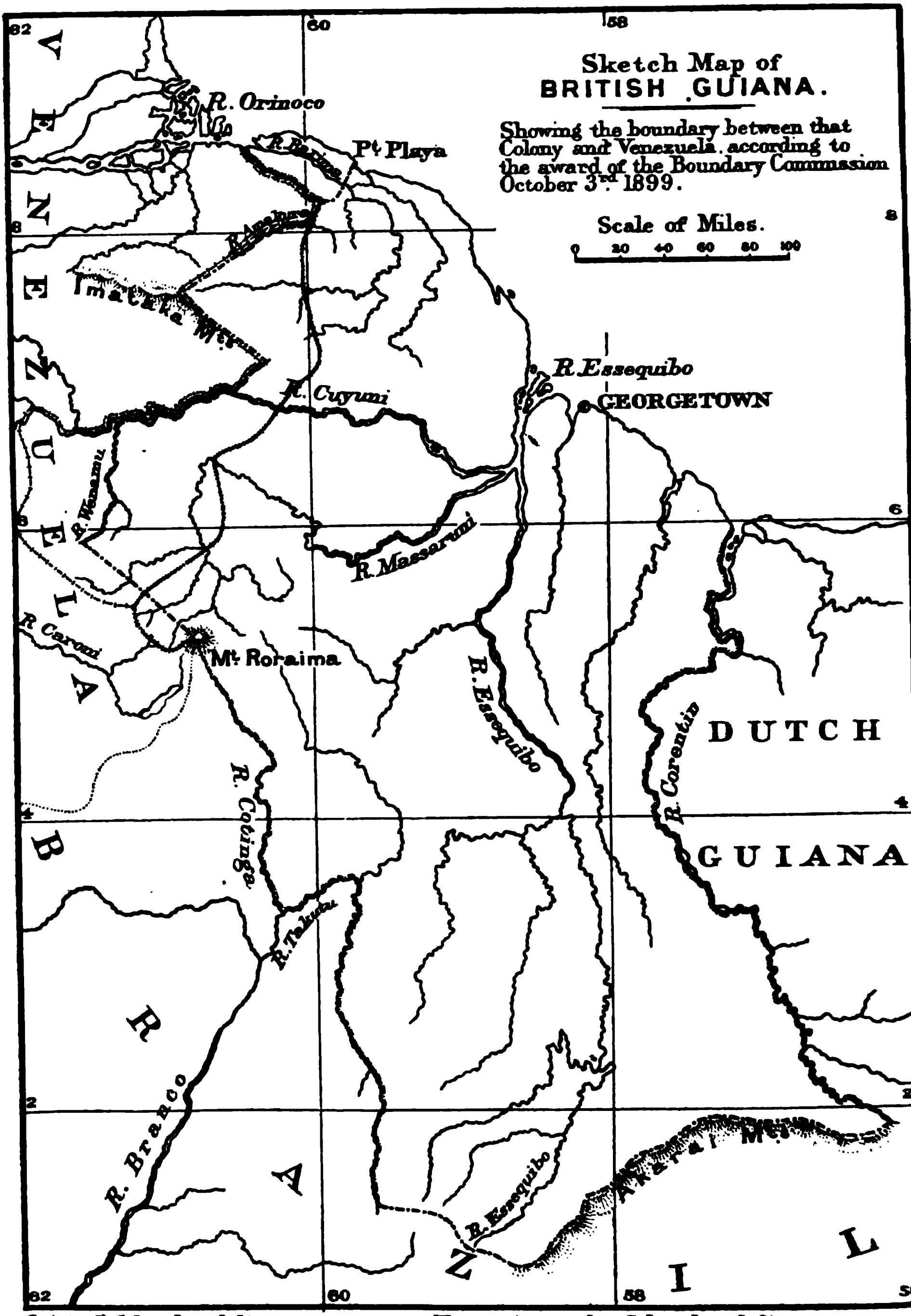
Forest and Prairie in Nebraska.—A short paper on recent changes in the extent of forest-land on the Nebraska plains appears in *Science* for November 24 last, having been read by Mr. C. E. Bessey at the last meeting of the American Association for the Advancement of Science. Two years before, the same author had shown reason for believing that the pines of Western Nebraska are advancing eastward where destruction by fire or cattle is prevented, and where cutting does not proceed too rapidly. He now brings forward evidence from Eastern Nebraska, which, he says, is still more conclusive that tree areas are there advancing with a good deal of rapidity. He has found that, in travelling up-stream and passing out to the side branches, the trees are invariably smaller and younger, it being a very rare occurrence to find large trees near the upper end of a forest belt. This alone would hardly be conclusive, but it is supported by the statements of old settlers, who invariably tell of an advance of trees up the valleys, sometimes a mile or more, while the width of the timber belts on the streams has also greatly increased. The keeping out of fire seems the general cause of the spread of the trees.

The Harriman Expedition to Alaska.—An account of the expedition to Alaska last summer, organized by Mr. E. H. Harriman, is given by Mr. Henry Gannett, of the U.S. Geological Survey, in the *Bulletin* of the American Geographical Society, vol. xxxi., No. 4, 1899. This expedition was planned for the

* The Ruezi ("Rwizi"), the lake, and the Kivali ("Kiware") were shown in correct relation in Stanley's map of 1878, though the latter river was made to join the Kagera. The name of the lake was not then known, but was correctly given in Mr. Ravenstein's map illustrating Captain Lugard's journeys.

purpose of a scientific study of the little-known coast of Alaska, and some important contributions were made to geography, geology, zoology, botany, and other departments of science. As no extended stops were made, it was only possible to make limited surveys in localities of particular interest and to measure heights of mountains. Many glaciers were surveyed and their fronts located. The party left Seattle in the steamer *Geo. W. Elder* on May 31, and proceeded north-westward, touching at Metlakatla, on Annette island, Skagway, and Glacier bay, where several days were devoted to mapping and studying the glaciers. At Sitka several days were given to biological work. Some important work was done at Yakutat bay in mapping the glaciers which discharge here and in the neighbouring Russell Fiord, including the Hubbard, probably the largest discharging glacier in North America, the Dalton, Hidden, and Nunatak. Prince William sound, which is little known, was next visited, and several days were devoted to its exploration. The coast was found incorrectly mapped in many places, especially on the north and west sides of the sound. A fiord, 15 miles in length, and containing five discharging glaciers, was found, which does not appear on any map, while elsewhere scores of glaciers were discovered which were not on record. The fiord was named Harriman fiord, and was mapped, with the glaciers tributary to it. Port Wells, of which Harriman fiord is an arm, was also mapped. A glacier, named by the expedition Columbia, which discharges into a bay of the same name, was also mapped. From Prince William sound the ship proceeded to the north shore of Shelik of strait, thence to Uyak bay, on the north shore of Kadiak island. On the way to Unalaska a party of naturalists was left on Popof, one of the Shumagin islands, others being left at Unalaska. Proceeding northward, a brief stay was made at Bogoslof, two young volcanic islands in the southern part of Bering sea, and at St. Paul, the northernmost of the Pribilof islands, the party afterwards arriving at Plover bay, in North-Eastern Siberia. Port Clarence, Alaska, was the most northern point reached. Starting southward, the ship touched at St. Lawrence, Hall, and St. Matthew islands, in Bering Sea, which were found thronged with sea-birds. During this two months' exploration, the fronts of twenty-three glaciers were located, and most of these glaciers were mapped. The heights of many mountains, including the volcanic cones on the Alaska peninsula and the Aleutian islands, were measured. A prominent fact connected with the coast region of Southern Alaska is that its features are almost wholly the product of glacial action. There is sufficient evidence to show that the glaciers have in past times greatly receded, and that on the whole they are, with few exceptions, still receding.

Settlement of the British Guiana Boundary Question.—By the award of the arbitrators, given in Paris on October 3, the disputed question of the boundary between British Guiana and Venezuela, which has engaged the attention of statesmen during the greater part of the century, and reached an acute stage some four years ago, has at last received its solution. The history of the question has been fully set forth in the *Journal* in past years, and need not be again touched upon. The result of the award is, broadly speaking, the adoption of the boundary laid down by Sir Robert Schomburgk as marking the extent of country that might justly be claimed by Great Britain on the basis of historical considerations. In two localities only does the new line differ from Schomburgk's. The latter started from the mouth of the Amakuru, thus including within British territory all the land to the north and east of that river; whereas the line now fixed gives to Venezuela the triangular section of territory included between the lower course of the river and the sea—a concession more than once offered by this country in consideration of the importance attached by our neighbour to the complete possession of the territory on both sides of the Orinoco. The second deviation from the Schomburgk



Original Schomburgk line .... Extension of the Schomburgk line ._._._.
Boundary settlement, Oct. 3. 1899. ._._._.

line occurs to the south of the Kuyuni, a tributary of the latter—the Wenamu—being chosen as the boundary instead of the upper course of the Kuyuni itself. The intervening district is inhabited chiefly by Indian tribes, but it includes the British Yuruan post, which formed the subject of special difficulties between the two governments a few years ago. It was claimed on behalf of Great Britain that a Dutch post existed here in former times. That a Dutch fort existed in the seventeenth century near the mouth of the Barima, in the territory now made over to Venezuela, seems not to admit of doubt. Here, too, British stations have existed during recent years, and some agricultural settlements have been made, which are now transferred to Venezuela. All the gold-fields, however, in the disputed area, with the exception of that on the Yuruari beyond the Schomburgk line, remain within the territory of the colony. The accompanying map shows the new boundary in detail. It starts from the coast at Point Playa, and runs thence to the junction of the Barima with the Mururuma; then up the latter to its source, and across to the junction of the Haiowa with the Amakuru; up the latter to its source, and south-west along the spur of the Imataka range to a point opposite the source of the Barima, where it turns south-east, following the main Imataka range to the source of the Akaribisi; down the latter to the Kuyuni, and along the northern bank of this river to the mouth of the Wenamu; then up the Wenamu to its westernmost source, and thence direct to the summit of Mount Roraima. Beyond this point the line is subject to an arrangement with Brazil, but is provisionally fixed by the lines of the Kotinga and Takutu rivers and the Akarai mountains. It is matter for congratulation that a question which has so long affected the prosperity of British Guiana is at last satisfactorily settled, and it may be hoped that the development of the colony will now proceed without hindrance. It should be mentioned that the award provides for freedom of navigation and equality of treatment to the goods of both nations on the Barima and Amakuru rivers.

AUSTRALASIA AND OCEANIC ISLANDS.

The Dutch Discoveries of Australia.*—Prof. J. E. Heeres, whose valuable work on Tasman's life and voyages was noticed in the *Journal* early in the present year, has rendered another service to historical geography by editing a complete series of documents bearing on the Dutch voyages to Australia from 1606 to 1765. Prof. Heeres laments the general ignorance which prevails on the subject of these voyages, an ignorance due largely to the rarity of a working acquaintance with the Dutch language on the part of foreign students, though even in Holland the story of early discovery is insufficiently known. Mr. Major's collection of documents bearing on the subject is, though far from complete, useful so far as it goes, and it is therefore unnecessary, Prof. Heeres thinks, to reprint at length those given by him. But the Hague archives contain a large amount of hitherto unpublished matter, which is now given to the world both in Dutch and English, thus supplying students for the first time with all the available information respecting the first authenticated voyages to the fifth great land-area of the world. The *data* respecting some of the discoveries are very meagre, though in certain cases the fortunate existence of charts embodying the results of the voyages supplies satisfactory evidence that they were made. Many of these charts are reproduced by Prof. Heeres, the most interesting being perhaps those of Hessel Gerritsz of 1618 (subsequently

* 'The Part borne by the Dutch in the Discovery of Australia, 1606–1765.' By J. E. Heeres, LL.D. Published by the Royal Dutch Geographical Society in commemoration of the twenty-fifth anniversary of its foundation. London: Luzac & Co. Leiden: Brill. 1899. [In Dutch and English.]

revised) and 1627, which record the discovery of Eendrachtsland and other parts of Western Australia. The first use, apparently, of the name Eendrachtsland to designate the land discovered by Dirk Hartogszoon in the *Eendracht* in 1616 is to be found in a marginal note, added by an official of the East India Company to a letter reporting the result of the voyage of the *Mauritius* in 1618. A large map by Isaac De Graaf is valuable as a general record of the discoveries of the Dutch in the seventeenth century, and also as showing the results of De Vlamingh's voyage in 1696–97. Among the documents perhaps the most valuable are the journal kept by Jan Carstensz on his voyage of 1623 to the gulf of Carpentaria with the Pera and Arnhem, and the various papers relating to the voyage of Pool and Pieterszoon in 1636. Other documents deal with less-known voyages, *e.g.* that of Jan Van der Wall to the north-west coast in 1678, for which the only authority seems to be a chart showing the results of the survey. While allowing that the Dutch discoveries in the west were the result of accident, Prof. Heeres points out that those in the north were the outcome of a systematic endeavour on the part of the Dutch officials to extend the sphere of their operations.

Report by the Surveyor-General of New Zealand for 1898–99.—The recently issued report of the New Zealand Department of Lands and Survey contains an unusual amount of interesting matter relating to the development of the resources of the colony as well as to the present position of its surveys. It is illustrated by a large number of maps and views of scenery, etc. With regard to the trigonometrical and topographical surveys, Mr. Percy Smith reports that the largest area under triangulation during the year lies in the centre of the north island, around the mountain groups of Ruapehu, Tongariro, Kaimanawa, etc., forming the connecting link between the triangulation of Aukland, Wellington, and Hawke's bay. The work has been carried out under the direction of Mr. J. H. Lowe, and the final results are looked forward to with considerable interest. Existing triangulation in Taranaki has been extended, and in Nelson a large area among the western mountains has been surveyed. The preliminary results seem to show that the west coast south of Cape Farewell is slightly out of position on the charts. The surveys in Marlborough, around the Kaikoura mountains, will furnish data respecting a district very imperfectly mapped at present. An appendix to the report (No. 11) gives the account of a journey of exploration made by Mr. W. Y. H. Hall in the mountainous region west of Lake Te Anau, with sketch-map. Mr. Hall, with a native companion, started from the head of the south fiord of the lake, and spent three days without tent or blanket exploring the valleys beyond. Near the head of the fiord a stream (named by Mr. Hall "Gorge Burn") runs in from the west, bounded on the south by mountains 5000 to 6000 feet high. Ascending its valley, Mr. Hall discovered a series of lakes, and, crossing a spur to the north, came upon another series (also drained towards Gorge Burn), the largest of which—about 3 miles long according to the map—lay right under the West Coast range. Mr. Hall's companion climbed Forden peak, whence he looked down to Bradshaw sound, an inlet off the west coast. An attempt to descend to the lakes of the Esk Burn valley to the north proved impossible, owing to the precipices which surround them, and the return to the Gorge Burn valley had likewise to be made down awkward precipices. Other appendices deal with forestry, with the sanctuaries for wild animals which have been established, and with the "Hermitage" and other works for the opening of the Mount Cook district to tourists, as well as to such subjects as the progress of settlement and road-making. The "Sanctuaries" alluded to include Little Barrier island, the avi-fauna of which embraces species nearly extinct on the mainland; the Paraparaumu reserve, devoted especially to the rearing of game-birds and deer; and Resolution island, on which and neighbouring islands Mr. Henry, the curator, succeeded in placing some additional species of birds during the year. Mr. Henry gives a sketch-map of the maze of islands in Dusky sound, south of Anchor island; he says that the "Sealer's cove" of our maps, on the south side of the latter, is the inlet called by Cook "Luncheon cove," although the latter name is now applied to a spot a mile further west. The report also includes a photograph and description of the rare bird *Notornis Mantelli*, of which the fourth specimen only was discovered near Lake Te Anau in 1898. This bird, which forms a distinct genus of *Rallidæ*, is the prototype of a well-known genus of swamp-hens. The last specimen, probably immature, stood 20 inches high.

The British Solomon Islands.—The report for 1898–99 of Mr. Woodford, Resident Commissioner for the British Solomon islands, has lately been issued by the Colonial Office (No. 275). Including the small groups added in 1897–98, the protectorate now extends (apart from the islands just ceded by Germany) for 900 miles from N.N.W. to S.S.E., but the new islands are at present of small importance as regards trade. The white residents in the protectorate now number fifty to sixty, and the prospects of trade seem to be good, owing to the introduction of sun- in place of smoke-drying of copra, and the commencement of diving operations for the large gold-tipped pearl-shell. Tobacco is the principal export, but the demand for Sydney-built boats among the natives is increasing. The area of land under cultivation by white residents (chiefly for coconuts) is steadily increasing, and favourable reports have been received from two experimental coffee plantations on the Guadalcanar. The report includes tables of rainfall observations, which give the total amount for 1898 at 147·39 inches, a fall having taken place on two hundred and forty days, the smallest number of rainy days in any one month (June) being fifteen. The account is also given of an interesting expedition made by Mr. Woodford, accompanied by Mr. Svensen, to the interior mountains of Guadalcanar, of which Mount Lammas, seen from the south coast, has been generally supposed to be the highest. The party landed on the shore of Wanderer bay, then proceeding eastward across the spur which terminates at Cape Hunter. Hence a view was obtained of a straight pebble beach strewn with the trunks of enormous trees, evidently brought down by the Ithina river in flood. This appears to be the largest river on the south coast, draining the whole district visited by Mr. Woodford. The volume of water must, after heavy rain, be enormous. Crossing this stream, the explorers struck into the bush after reaching the deserted village of Bolonda. An ascent to 1600 feet was followed by a descent to the Kolondoma, a tributary of the Ithima, running west through a rocky gorge. A steep rocky track led into the region of ferns and moss, and at 2700 feet quarters for the night were found in a native hut, whence a good view of the country was obtained. Immediately in front, but far below, was the gorge of the Teremalenga, another tributary of the Ithina, coming from Mount Popomanasiu by a fine fall of perhaps 400 feet. From Mount Legombi on the right a horseshoe of mountains closed the view as far as the north-east. On the third day, after a descent of 1100 feet to the rock-encumbered Teremalenga river, the ascent was resumed through a region of daily rain, where trees and ground were thickly covered with moss. On the fourth the party passed over the summit of Bulumarau to that of Popomanasiu (nearly 6000 feet). The latter falls 3000 feet to the valley of the Ithina, there being no saddle connecting it with the great Kavo range, which is undoubtedly the highest in the island. Provisions now running short, it was impossible to proceed farther, but the experience gained will be of use for any future attempt. Mr. Woodford made interesting notes on the botany of the country, the conditions between 4000 and 6000 feet being found much the same as on the mountains of New Guinea.

The South Sea Islands and European Enterprise.*—Count Pfeil's recent work on the German possessions in the Western Pacific deserves the careful attention of all who are interested in the future of European dealings with less civilized races. Although the book has something to say regarding the natural features of New Guinea and the neighbouring archipelagoes, its central idea is the discussion of the problems which affect the future prosperity and development of the German Pacific, with especial regard to the mutual relations of the white and coloured inhabitants; and the author's views are both practical and well-considered. After an introductory chapter, in which he sums up with judicious conciseness the most striking physical characteristics of the countries in question, with a sketch of their recent history, he turns to the consideration of the native tribes, which, in spite of the impossibility of extended travel during the period of his stay in the islands, he was able to study with some thoroughness from their concourse to the trading ports and labour-stations. He regards them throughout rather from a psychological than an ethnographical standpoint, deducing their mental and moral characteristics from a preliminary view of their manners and customs. Chapters I. to III. treat in unusual detail of these subjects, the life-history of a "Kanaka" from birth to death being vividly sketched. The fourth chapter deals with the nature of their habitat, and especially the volcanic agencies there exhibited, while the fifth takes up the possibilities of economic development. In this connection Count Pfeil wisely urges the great importance of obtaining by systematic effort a more thorough knowledge of the conditions of the country, pointing out how much the want of such knowledge may hinder progress. As regards the future relations of the whites with the natives, he dismisses as chimerical the idea that the two races might live together on equal terms, but, on the other hand, rejects the pessimistic views of those who hold that the natives must eventually succumb. The great reserve of the character of the natives and their slowness to adopt European ideas and methods are the great hindrances to their acceptance of the position of labourers under European control, while the rooted idea, so often prevalent, that the white man's stay is only temporary, tends in the same direction. It is among the more warlike tribes, which are also the most intelligent, that a future labour-supply will, in Count Pfeil's opinion, most probably be obtained; but hostile encounters can hardly be avoided before this event is reached. Meanwhile the immediate wants of the colonies might be supplied by the introduction of Chinese coolies. Plantation products must form the staple resource of the possession, and for these New Pomerania, where the greatest progress has already been made, seems the most promising portion. German New Guinea as a whole presents a less favourable picture. The last chapter contains some interesting experiences of travel, though the author has elsewhere carefully avoided introducing the personal element.

POLAR REGIONS.

Exploration in the Siberian Sea.—A sum of £5400 has been inscribed in the Budget of the Russian Ministry for the equipment next summer of an Arctic Hydrographic Expedition to the northern shores of Siberia, with the view of exploring in detail the northern route to the mouths of the Ob and the Yenisei.

GENERAL.

The Anglo-German Agreement.†—The latest international agreement with regard to the delimitation of colonial possessions settles in a satisfactory manner

* 'Studien und Beobachtungen aus der Südsee.' Von Joach'm Graf Pfeil. Brunswick: Vieweg. 1899.

† Map showing West African arrangement, p. 63.

the last important points outstanding between Germany and this country. It has been arrived at by mutual concessions, Great Britain waiving her undoubted rights in the Samoan archipelago in return for important renunciation of claims in other parts of the world by Germany. The Samoan islands of Savaii and Upolu are made over absolutely to Germany, who thus secures a much-desired position on the ocean routes from San Francisco and Vancouver to New Zealand and Australia, and from the western end of any future American inter-oceanic canal to her possessions in New Guinea and neighbouring seas. The third important island, Tutuila, is reserved for the United States. Great Britain obtains in exchange the relinquishment by Germany of all claims to a coaling-station in the Tonga group, important to Great Britain by reason of its nearness to Fiji, and the cession of the two islands of Choiseul and Isabel in the Solomon group, which, with Bougainville and Buka (still German), had fallen to Germany in the partition of the group in 1886. The British possessions in this part of the Pacific are thus rounded off in a more satisfactory way than formerly. In West Africa an important settlement has been arrived at with respect to the "Neutral Zone" established in 1888 in the region behind the Gold Coast. This, together with the area to the north between 10° and 11° N., is now divided between Great Britain and Germany in such a way that the former secures possession of the natural *Hinterland* of the Gold Coast in the Upper Volta basin, as far as the commencement of French territory. From the point on the Volta where the neutral zone began, the new boundary is to follow the Daka tributary of that stream to 9°, beyond which it is to run north in a line to be demarcated by a mixed commission, but which is to be so chosen that the territories of Mamprusi and Gambaga fall to Great Britain, and those of Yendi and Chakosi to Germany.* By this arrangement the two important trade centres of Salaga and Yendi, within the former neutral zone, fall, the first to Great Britain, the second to Germany. Gambaga, to which the latter had laid claim, though a treaty with the ruler had been made in 1894 by British agents, lies in the western portion of the contested territory north of the neutral zone, while Chakosi (Yakoshi) is the name of the district further east, which contains the town of Sansanne Mangu, where the Germans already have a station. Information respecting the region in question is principally to be found in the reports of German officers in the *Mitteilungen aus den Deutschen Schutzgebieten*, the results of journeys by British officers having, unfortunately, been rarely given to the world. Captain Lonsdale's journey to Salaga and Yendi in 1881—the first accomplished by a European—was, however, described in the Parliamentary Report on the Gold Coast for 1882. Lieut. von François' journeys to Yendi, Gambaga, etc., in 1888–89 are described in the first two volumes of the German publication above alluded to; and those of Captain Binger, our medallist, who traversed the Upper Volta region on his great journey across the Western Sudan (1887–89), in that traveller's book, 'Du Niger au Golfe de Guinée.' The best map of the region is that by P. Sprigade, on the scale of 1 : 1,000,000, given with the *Mitteilungen* for 1898 (part 4). Finally, it must be mentioned that the agreement includes the conditional abandonment by Germany of extra-territorial rights in Zanzibar. The map on p. 63 shows the new boundary in West Africa so far as it can be laid down previous to delimitation on the spot.

New System for the Transcription of Geographical Names.†—The latest contribution to the vexed question of geographical orthography is a memoir by

* With our present knowledge, the boundary cannot be correctly shown beyond 9° N.

† Méthode de Transcription Rationelle Générale des noms Géographiques. Par Christian Garnier. Paris: Leroux. 1899.

the late Christian Garnier, which recently gained the Volney prize of the French Institute, with special commendation. The author was a young French *savant*, whose attention was directed to the subject during the London meeting of the International Geographical Congress, and who took up the idea of supplying an improved general system of orthography with such enthusiasm, that early last year, in spite of failing health, he had completed the laborious linguistic and other studies necessary to the working out of a system based on thoroughly scientific principles. M. Garnier's memoir lays down with great clearness the *desiderata* for a really rational general system of transcription, and there is no doubt that, granting such a system to be itself desirable, his work marks an advance on previous attempts in the same direction, simplicity having been aimed at as well as comprehensiveness. The author shows the disadvantages of both strictly orthographic and phonetic methods, and his system is a combination of the two. After a chapter on general principles, he examines in turn the principal alphabets and languages of the world, with a view to gaining a clear idea of the sounds to be represented, and then proceeds to explain his system in detail. His alphabet consists (1) of fundamental letters—those of the complete Latin alphabet; (2) of signs indicating aspirations, clicks, and "tones," or vocal modulations of vowels; (3) of accents modifying the sounds of the fundamental letters; (4) of supplementary letters; (5) of graphic conventions. A few examples only of the use of the modifying signs can be given. On the analogy of the Croatian *c* the sign is used with *c*, *s*, and *z* to give the sounds of the English *ch*, *sh*, and the French *j*. The point below the letter denotes, according to established custom, cerebral consonants, while the comma in the same position nasalizes the *n*. The sign ·· modifies the sound of vowels (*ö* representing the French *eu*), and when used with *d* and *t*, gives the sound of the soft and hard *th* in English. Whatever advantages the method may possess, it is extremely doubtful whether any such universal system can prove serviceable in practice. Apart from the large number of symbols required, it must necessarily have the disadvantage, that even the fundamental letters agree in value with the established usage in no single country, while a confusion must always arise from the uncertainty whether the universal or particular method is employed in any given case. The adoption of a limited number of systems, suited to the usage of the principal languages of Europe, would involve no greater confusion than the existence of the languages themselves necessitates, and would even in certain cases facilitate correct pronunciation, by the means for comparison thus supplied.

OBITUARY.

Sir Rawson William Rawson, K.C.M.G., C.B.

By the death, on November 20, of Sir Rawson Rawson, at the advanced age of eighty-eight years, the Society has lost one of its oldest and most valued members. Sir Rawson joined its ranks as far back as 1838, there being now only some half-dozen survivors of the Fellows elected during the previous eight years of its existence. Among those who have held office on its Council, Sir Rawson's seniority was undisputed, as he had been first elected on that body in 1841, and from first to last served as Councillor no less than nineteen years, his final resignation taking place less than two years ago. During this time his experience and business-like capacity were freely placed at the disposal of the Society, of which he became Vice-President in 1896.

Sir Rawson Rawson entered public life in 1841 as private secretary to Mr. Gladstone on the appointment of the latter as Vice-President of the Board of Trade. During the greater part of his public career, however, he was connected in one way or another with colonial administration, being appointed Chief Secretary for Canada in 1842, and shortly afterwards Treasurer of Mauritius, which office he held for a considerable period. In 1854 he became Colonial Secretary at the Cape, and ten years later was promoted to be Governor of the Bahamas, whence he was transferred to the same post in the Windward islands in 1869. In 1875 he retired, being created K.C.M.G. in acknowledgment of his services. During the remainder of his life, Sir Rawson was well known as a zealous statistician, paying special attention to the trade of the British Empire, of which, among other writings, he published a useful synopsis in 1888. While governor of the Windward islands he had dealt, in a report published in 1874, with the rainfall of Barbadoes and its influence upon the sugar crops. After his return to this country, when the "scramble for Africa" began to attract general attention, he contributed to our *Proceedings* for 1884 a valuable summary of the claims of the several European nations on the coasts of that continent, supplementing the paper the following year with a more detailed discussion of European territorial claims on the Red sea coasts.

CORRESPONDENCE.

Longitude of Nkata Bay, Lake Nyasa.

December 17, 1899.

I THINK that the difficulty mentioned in this month's *Journal* (p. 667) as to the longitude of Nkata bay on Lake Nyasa can be explained. After we had determined the longitude, I sent our value to H.M. acting Consul-General at Zomba for his information. In the next copy of the *B.C.A. Gazette* he printed it, with the remark that the previously accepted longitude was 6 miles in error. I believe that Dr. Gill's statement is quite correct, and based on this. No doubt the best map available was used for the comparison. This was *before* the value of Lieuts. Rhoades and Phillips was published (or rather had reached Central Africa). Lieut. Rhoades's value does not depend on Blantyre, but, as I understand, is an independent chronometer value brought up from the coast. Such an accordance with the telegraphic value as actually occurred, is remarkable.

As regards the error in the longitude of Blantyre, that still remains unknown. We were unexpectedly prevented from determining this telegraphically. My own view is that, as the value of Blantyre is the mean of eighty-one absolute determinations, it should not be more than half a mile in error.

Perhaps the B.C.A. Survey Department might be moved to settle this in conjunction with Dr. Gill, H.M. astronomer at the Cape, when the war is over.

C. F. CLOSE,
Capt. R.E.

The Mansarowar and Rakastal Lakes.*

1st Batt. 3rd Gurkhas, Almora, N.W.P., October 12, 1899.

Mr. Walter Savage Landor, whose introductory letter I enclose, was very anxious that I should write to you to state that in August, 1895, when up

* This letter is addressed to the President.

travelling in Tibet with my father, General Channer, I practically crossed the ridge dividing the Mansarowar and Rakastal lakes. I was on the look-out for burrel at the time, so kept along the crest as much as possible. I saw no "ditch" connecting the two sheets of water. The connection I believe to be a tunnel. The pundits with whom I have talked over the matter deny any cutting between the lakes. Moorcroft, in 1842, I believe, crossed the ridge and saw no ditch. I hope this information may be of some use to help this disputed point.

G. KENDALL-CHANNER.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1899–1900.

Second Ordinary Meeting, November 27, 1899.—Sir CLEMENTS MARKHAM, K.C.B., President, in the Chair.

ELECTIONS.—*Henryk Arçtowski, Meteorologist to the Belgian Antarctic Expedition; Antonio Joaquim Basto, Jun.; Charles Clive Bigham; William Bleloch; Ernest Horsford Bingley; Alexander Claude Forster Boulton; W. A. Frank Balfour Browne; William T. H. Bradley; Lieut. Norman Edwin Oswell Philip Canning, R.N.R.; Thomas B. Clarke-Thornhill; Francis J. Collinson; Adolphus Coustol; Vice-Consul William Edward B. Copland Crawford; Pierre Bons D'Anty; Rev. Curtis Hoyt Dickins; R. Jeffrey Donohue; Major Edward Dorset Farmer-Bringhurst, F.R.C.S.; Captain John David Ferguson, D.S.O.; Randall John Fox; Major Charles James Fox; Captain H. C. Fraser* (1st *Life Guards*)*; Charles Alfred Gibbes; William Goodacre; Harold W. Gough, M.A., F.C.S.; Major Walter Wingate Gray* (*Berwick and Lothian Yeomanry*)*; Thomas Jones Gibb Duncanson, M.A., F.Z.S.; Shipton Green; Charles Kennerley Hall; Sholto Henry Hare; William Roland Hart; Richard Kilvington Hattersley; Arthur Frederick Herbert; Arthur Herbert Jocelyn Hill; J. Bernard Stoughton Holborn; George Jamieson, C.M.G.; Captain Gilbert Ward Johnson* (3rd *Punjab Cavalry*)*; Albert Kendall; Arthur Landsberg; George Ruthven Le Hunte, C.M.G.* (*Lieut.-Governor and Administrator of British New Guinea*)*; Sigmund Lipmann; Leonard A. Lyall; Captain Mill Malcolm* (*Argyll and Sutherland Highlanders*)*; Stewart Margetson; Frederick Thomas Middleton; Rev. Hugh Parry; C. V. A. Peel; Captain Francis Barrow Pearce* (*West Yorkshire Regt.*)*, Deputy Commissioner, B.C.A. Protectorate; T. T. Phelps; Lieut. Francis William Pirrie* (*Indian Staff Corps*)*; John St. Vincent Pletts; Percy Horace Gordon Powell-Cotton; Archdeacon Francis D. Pritt; G. W. Prothero; Dr. G. R. Radmore; Colin Spittal Reddie; William Redman; Bertram Edward Sargeaunt; Hermann Schürhoff, Consul for Spain; Ernest Henry Shackleton* (*Officer, R.M.S.* "*Tantallon Castle*")*; A. Hastings Stewart; Lord Alexander Thynne; Charles Todd, M.D., M.R.C.S.; Philip David Warren* (*Assistant Surveyor-General of Ceylon*)*; Lieut. William Alan Watts-Jones, R.E.; R. Valentine Webster; George Wilson; Captain A. W. S. Wingate* (*Indian Staff Corps*)*; Captain J. E. S. Woodman* (*West India Regiment*).

The President read extracts from the letters of Major Gibbons and Mr. Percy Reid, who have been exploring, independently, in Barotseland; and of Mr. Arthur H. Sharp, who, with Mr. E. S. Grogam, has been travelling for about three years from Beira to Lake Tanganyika, Lake Kivu, Lake Albert Edward, and Uganda.

The Paper read was :—

"Desert Sand Dunes." By Vaughan Cornish.

Third Ordinary Meeting, December 11, 1899.—Colonel Sir T. H. HOLDICH, R.E., K.C.I.E., C.B., Vice-President, in the Chair.

ELECTIONS.—*Edward Seymour Bell; Captain Ernest Leonard Cowie (West India Regiment); Rev. William Tudor Jones; Max Michaelson; Alfred Henry Spurrier, L.R.C.P.; Prof. Hans Steffen.*

HONORARY CORRESPONDING MEMBERS.

Captain Meliton Carbajal (President of the Peruvian Geographical Society); Prof. A. Bertrand (Professor of Topography and Engineering in the University of Santiago, Chile); Señor D. Samuel A. Quevedo (distinguished geographer and ethnologist of Buenos Aires.)

The Paper read was:—

"A Journey through Abyssinia to the Nile." By H. Weld Blundell.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By HUGH ROBERT MILL, D.Sc., *Librarian*, R.G.S.

THE following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.	Mag. = Magazine.
Abh. = Abhandlungen.	Mem. = Memoirs, Mémoires.
Ann. = Annals, Annales, Annalen.	Met. = Meteorological.
B. = Bulletin, Bollettino, Boletim.	P. = Proceedings.
Com. = Commerce.	R. = Royal.
C. Rd. = Comptes Rendus.	Rev. = Review, Revue.
Erdk. = Erdkunde.	S. = Society, Société, Selskab.
G. = Geography, Geographie, Geografia.	Sitzb. = Sitzungsbericht.
Ges. = Gesellschaft.	T. = Transactions.
I. = Institute, Institution.	V. = Verein.
Iz. = Izvestiya.	Verh. = Verhandlungen.
J. = Journal.	W. = Wissenschaft, and compounds.
k. u. k. = kaiserlich und königlich.	Z. = Zeitschrift.
M. = Mitteilungen.	Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Alps—Glaciers. *Jahrb. Schweizer Alpenclub* **34** (1899): 275–297. **Forel, Lugeon, Muret.**
Les variations périodiques des glaciers des Alpes. Par Dr. F.-A. Forel, Dr. M. Lugeon, E. Muret. Dix-neuvième rapport. 1898. *With Illustration.*

Austria-Hungary. **Baedeker.**
Austria, including Hungary, Transylvania, Dalmatia, and Bosnia. Handbook for Travellers, by Karl Baedeker. With 30 Maps and 36 Plans. Ninth edition, revised and augmented. Leipsic: Karl Baedeker; London: Dulau & Co., 1900 [1899]. Size 6½ × 4½, pp. xvi. and 480. *Price* 8*s*. *Presented by Messrs. Dulau & Co.*

Austria-Hungary. *J. Manchester G.S.* **15** (1899): 11–23. **Latham.**
Visit to the Tatra. By J. B. Latham. *With Illustrations.*

Böhmerwald—Lakes. **Wagner.**

Die Seen des Böhmerwaldes. Eine geologisch-geographische Studie, zugleich ein Beitrag zur Lösung des Karproblems. Von Dr. Paul Wagner.—Wissenschaftliche Veröffentlichungen des Vereins für Erdkunde zu Leipzig. Vierter Band. Beiträge zur Geographie des mittleren Deutschland. Herausgegeben . . . Von Friedrich Ratzel. Leipzig: Duncker & Humblot, 1899. Pp. 1-90. *Maps and Illustrations.*

Particulars of the mountains, lakes, and tarns of the boundary district between Bavaria and Bohemia, which were sounded by the author, together with a discussion on the origin of corries.

Eastern Mediterranean. **Overbergh.**

Dans le Levant, en Grèce et en Turquie. Par Cyr. Van Overbergh. Bruxelles: O. Schepens et C^ie^, 1899. Size 7½ × 5, pp. xvi. and 422. *Illustrations. Presented by the Publishers.*

The journal of a pleasure trip on board one of the tourist yachts to the ports of Greece and those of European and Asiatic Turkey in the Ægean sea.

Europe. **Allen.**

The European Tour. A Handbook for Americans and Colonists. By Grant Allen. London: Grant Richards, 1899. Size 8 × 5¼, pp. viii. and 294. *Price 6s. Presented by the Publisher.*

This book was written originally for Americans who wish to turn a single visit to Europe to the best account. It is now published in this country in the hope of being useful to colonial visitors as well. The sketch of the interesting tour through Europe is done in the late Mr. Allen's best style, and there is probably no one else who could give in so little space such a valuable indication of what is best worth seeing on the continent, always with the object of acquiring that education which travel alone can give.

United Kingdom—England. **Cuttriss.**

P. Yorkshire Geolog. and Polytechnic S. **13** (1899): 433–443.

Notes on the Caves of Yorkshire. Part ii. By S. W. Cuttriss. *With Plan and Plates. Also a separate copy presented by the Author.*

Describes the progress of speleological exploration in Yorkshire by the members of local scientific societies. The exploration of Gaping Ghyll and Rowten Pot is described in some detail.

United Kingdom—England. *Q.J. Geolog. S.* **55** (1899): 359–364. **Dakyns.**

The Limestone-knolls below Skipton and Grassington in Craven. By J. R. Dakyns.

United Kingdom—England. *Q.J. Geolog. S.* **55** (1899): 327–358. **Marr.**

On Limestone-knolls in the Craven District of Yorkshire and elsewhere. By J. E. Marr, F.R.S., etc. *With Illustrations.*

United Kingdom—Meteorology. **Brodie.**

Quarterly J. R. Meteorolog. S. **25** (1899): 181–202.

The Prolonged Deficiency of Rain in 1897 and 1898. By F. J. Brodie. *With Maps and Diagrams.*

United Kingdom—Scotland. **Penney.**

Handbook for Travellers in Scotland. Edited by Scott Moncrieff Penney, M.A. Seventh Edition. London: John Murray, 1898. Size 7 × 5, pp. xxxvi. and 480. *Maps and Plans. Price 9s. Presented by the Publisher.*

United Kingdom—Tide Tables. **Harris and Havergal.**

Tide Tables for the British and Irish Ports for the year 1900. Also the times and heights of high water at full and change for the principal places on the Globe. By Captain H. R. Harris and Commander A. Havergal. London: J. D. Potter. Size 10 × 6¼, pp. xl. and 262. *Price 2s. Presented by the Hydrographer, Admiralty.*

United Kingdom—Wales. **Baddeley and Ward.**

Thorough Guide Series. North Wales (Part ii.), Llangollen, Bala, Dolgelley, Barmouth, Oswestry, Shrewsbury, Welshpool, Llanidloes, Machynlleth, and Aberystwith Sections. By M. J. B. Baddeley, B.A., and C. S. Ward, M.A. Fifth Edition. London: Dulau & Co., 1899. Size 6½ × 4¼, pp. xvi. and 154. *Maps, Plans, and Panorama. Price 2s. 6d. Presented by the Publishers.*

United Kingdom—Wye Valley. **Buckman.**

The Valley of the Lower Wye. By S. S. Buckman, F.G.S. Reprinted from the *Proceedings of the Cotteswold Naturalists' Field Club;* vol. xiii. Part i., June, 1899. Size 10 × 6½, pp. 25–32. *Presented by the Author.*

Study of the evolution of a river-valley. The author points out that, on account of the more rapid erosion of the valley of the Usk and the proximity of the tributaries of that river to the Wye, the latter may possibly be ultimately diverted into the Usk.

ASIA.

Asia—Travels. *Nouv. Archives Miss. Sci.* 9 (1899): 55–101. **Chaffanjon.**

Rapport sur une mission scientifique dans l'Asie Centrale et la Sibérie. Par M. J. Chaffanjon. *With Map and Plan.*

Setting out in October, 1894, M. Chaffanjon visited Turkestan and Mongolia, proceeded to Vladivostok, and returned thence by sea. The work done comprised a route-survey from Tashkent to Urga *viâ* Kulja, and a new route in Eastern Mongolia from Urga to Blagoveschensk, as well as many astronomical determinations of positions. The archæological collections were extensive, including some from the ruins of Karakorum, and collections of zoological, botanical, and geological specimens were also made. The modes of life of the people were studied, and some folk-tales recorded.

British Asia. **Various Authors.**

India, Ceylon, Straits Settlements, British North Borneo, Hong-Kong. (The British Empire Series, vol. i.) With Two Maps. London: Paul & Co., 1899. Size 8½ × 6, pp. xxviii. and 536. *Price 6s. Presented by the Publishers.*

This volume is made up of lectures delivered at the South Place Institute, Finsbury, between 1895 and 1898. After an introduction by Sir Raymond West, there are twenty-three chapters by capable authorities. Mr. J. A. Baines gives "A general view of India and its people" and "Famines in India;" Bombay is treated by Lord Harris, Madras by Lord Wenlock, Sind by A. F. Baillie, Bengal by Romesh Dutt, the Punjab by Sir J. B. Lyall, the Central Provinces by Sir Charles Grant, Industries in India by Sir M. M. Bhownaggree. The lecture on Ceylon is by a former judge of the Ceylon Supreme Court, Mr. L. B. Clarence; that on Straits Settlements by a late Governor, Sir Andrew Clarke. The several chapters have been revised and brought to date by the authors, and statistical appendices and maps complete the volume.

Central Asia—Antiquities. **Hoernle.**

J. Asiatic S. Bengal 68 (Pt. i., extra No. 1, 1899): xxxii., 1–110.

A Collection of Antiquities from Central Asia. Part i. By A. R. Rudolf Hoernle. *With Map.*

China. *Export* 21 (1899): 425–427, 441–442, 458–459. ——

Die Franzosen und Engländer in Südchina.

China. **Colquhoun.**

China in Transformation. By Archibald R. Colquhoun. With Frontispiece, Maps, and Diagrams. London and New York: Harper & Bros., 1898. Size 9 × 6, pp. viii. and 398.

China—Shantung. *Ann. Hydrographie* 27 (1899): 481–483. ——

Aus den Reiseberichten Seiner Majestät Schiffe. *With Map and Illustrations.*

On the south-eastern promontory of Shantung, with chart and views.

India. *J. East India Assoc.* 30 (1899): 31–71. **Elliott.**

The recent Famine in India and the Reports of the Second Famine Commission. By Sir Charles Elliott, K.C.S.I., etc. *With Map.*

India. **Steevens.**

In India. By G. W. Steevens. London: W. Blackwood & Sons, 1899. Size 8 × 5½, pp. viii. and 366. *Map. Price 6s. Presented by the Publishers.*

Impressions of India, written with a vivid force which makes a series of remarkable word-pictures.

India and China—Railway. *Fortnightly Rev.* 66 (1899): 759–768. **Stuart.**

Direct Railway Communication between India and China. By James Stuart. *With Map.*

Mr. Stuart urges the importance of the railway route from Assam to the Yangtse proposed by Captain Blakiston in 1862, through a belt of territory in 27° N. which has not yet been explored by any white man.

India—Assam. ———

Report on the Administration of the Province of Assam for the year 1897–98. Shillong, 1899. Size 13½ × 8½, pp. xiv., 214, and ccxliv. *Map.*

India—Bombay, etc. *J.S. Arts.* 47 (1899): 731-739. **Birdwood.**

The Hill Forests of Western India.

India—Bombay Observations. ———

Magnetical and Meteorological Observations made at the Government Observatory, Bombay, 1897, under the direction of N. A. F. Moos. With an Appendix. Bombay, 1898. Size 14 × 10, pp. xviii., 18, 12, and 6.

India—Botanical Survey. ———

Report of the Director of the Botanical Survey of India for the year 1898–99. Size 13 × 8½, pp. 38.

Indo-China. **Pavie.**

Mission Pavie Indo-Chine, 1879-1895. Études Diverses. I. Recherches sur la Littérature du Cambodge, du Laos et du Siam. Par Auguste Pavie. Paris: E. Leroux, 1898. Size 11 × 9, pp. xlvi. and 370. *Map and Illustrations.*

A number of Indo-Chinese folk-tales with quaint native illustrations, many of them reproduced in colours.

Japan. **Chamberlain and Mason.**

A Handbook for Travellers in Japan, including the whole empire from Yezo to Formosa. By Basil Hall Chamberlain and W. B. Mason. Fifth Edition. London: John Murray, 1899. Size 7½ × 5, pp. x. and 578. *Maps and Plans. Price 20s. Presented by the Publisher.*

Japan. *J. College Sci. Imp. University Tōkyō* 11 (1899): 161–195. **Omori and Hirata.**

Earthquake Measurement at Miyako. By F. Omori, D.SC., and K. Hirata. *With Maps and Diagrams.*

Japan—Formosa. *Globus* 76 (1899): 217–222. **Schumacher.**

Eine Reise zu den Tschin-huan in Formosa. Von Rob. Schumacher. *With Illustrations.*

Korea. **Bret.**

Miss. Catholiques 31 (1899): 174, 189, 198, 213, 222, 236, 248, 260, 2?8, 286, 297, 309, 321, 333, 344, 354, 366, 382, 394, 402, 413, 425, 437, 451.

Dans la Corée Septentrionale. Par M. Bret. *With Maps and Illustrations.*

Malay Archipelago—Borneo. **Furness.**

Folk-Lore in Borneo: a Sketch. By William Henry Furness, 3d, M.D. Wallingford, Penn., 1899. Size 8½ × 6, pp. 30. *Illustrations. Presented by the Author.*

An interesting set of folk-tales and descriptions of customs collected by the author during a recent sojourn in Borneo. There are also some remarkably fine photographs of native Borneans.

Malay Archipelago—Borneo. **Keyser.**

Trade of Borneo and Sarawak for the year 1898. Foreign Office, Annual No. 2322, 1899. Size 10 × 6½, pp. 10. *Price 1d.*

Malay Archipelago—Java. **Schlegel.**

Geographical Notes. XII. Shay-Po, Djarâ. By G. Schlegel. Reprinted from the *Toung-Pao*, vol. x. No. 3. Leyden: E. J. Brill, 1899. Size 10 × 6½, pp. 62. *Plate. Presented by the Author.*

Malay Archipelago—Sumatra. **Volz.**

Tijds. K Ned. Aard. Genoots. Amsterdam 16 (1899): 415-485.

Zum Toba-See in Central-Sumatra. Von Dr. Wilhelm Volz. *With Map.*

A sketch of the history of exploration round the Toba lake in Sumatra, followed by a report of the author's journey in that region in 1898. He inquired specially into the existence and limitations of anthropophagy amongst the Battaks, and has much to say on the subject.

Malay States. **Swettenham.**

Report by the Resident-General of the Federated Malay States to His Excellency the High Commissioner (Sir Charles Bullen H. Mitchell, G.C.M.G.). Kuala Lumpur, 1899. Size 13½ × 8½, pp. 10.

Malay States—Negri Sembilan. **Birch.**
Negri Sembilan Administration Report, 1898. Seremban, 1899. Size 13½ × 8½, pp. 16 and xx.

Malay States—Pahang. **Clifford.**
Annual Report of the State of Pahang for the year 1898. By Hugh Clifford. Kuala Lumpur, 1899. Size 13½ × 8½, pp. 24.

Malay States—Perak. **Treacher.**
Perak Administration Report for the year 1898. By W. H. Treacher, C.M.G. Taiping. Size 13½ × 8½, pp. 64. *Illustration.*

Philippine Islands. **Algué.**
Observatorio de Manila. Las Nubes en el Archipiélago Filipino. Colaboración al Trabajo Internacional de Medición de Nubes [1° Junio 1896–31 de Julio 1897]. Por el P. José Algué, S.J. Manila, 1899. Size 12½ × 9, pp. xvi., 86, and 43.

On the clouds in the Philippine islands.

Philippine Islands. **Harford.**
Trade of the Philippine Islands for the year 1898. Foreign Office, Annual No. 2319, 1899. Size 10 × 6½, pp. 18. *Price* 1½*d.*

Persia. *Petermanns M.* 45 (1899): 215–217. **Sarre.**
Reise von Ardebil nach Zendschan im nordwestlichen Persien. Von Dr. Fr. Sarre. *With Map.*

Russia—Caucasus. **Lojka and Déchy.**
Lichenes in Caucaso et in peninsula Taurica ab. H. Lojka et M. a Déchy Collecti. Enumeravit E. A. Wainio præfationemque scripsit M. a Déchy. (Ex. *Természetrajzi Füzetek*, xxii., 1899.) Size 10½ × 7, pp. 269–343. *Presented by M. de Déchy.*

Russia—Siberia. *Globus* 76 (1899): 166–172. **Stenin.**
Jochelsons Forschungen unter den Jukagiren am Jassatschnaja und Korkodon. Von P. v. Stenin. *With Illustrations.*

Siam. *J. East India Assoc.* 30 (1899): 7–22. **Barrett.**
Siam and its Neighbours. By the Hon. John Barrett.

Turkey—Asia Minor. *Deutsche Rundschau G.* 21 (1899): 354–361. **Friedrich.**
Geographisch-Statistisches vom Wilajet Smyrna. Von Dr. Ernst Friedrich. *With Map, Plan, and Illustrations.*

Turkey—Babylonia. **Hilprecht.**
B. Free Museum Sci. and Art University of Pennsylvania 2 (1899): 87-91.
The Recent Excavations of the University at Nippur. By Prof. H. V. Hilprecht. *With Plates.*

Turkey—Baghdad and Bussorah. **Loch and Wratislaw.**
Trade of Baghdad and Bussorah for the year 1898. Foreign Office, Annual No. 2316, 1899. Size 10 × 6½, pp. 10. *Price* 1*d.*

AFRICA.

Africa—Partition. *Wesleyan Miss. Notices* (1899): 145–147. **Halligey.**
The Transformation of Africa. By Rev. J. T. F. Halligey. *With Map.*

British Africa. **Various Authors.**
British Africa. (The British Empire Series, vol. ii.) With Four Maps. London: Paul & Co., 1899. Size 8½ × 6, pp. xiv. and 414. *Price* 6*s.* *Presented by the Publishers.*

A collection of lectures delivered at the South Place Institute, Finsbury, supplemented by other writings by various authors, with an introduction by Dr. J. Scott Keltie. The parts of Africa dealt with are the Cape of Good Hope, Rhodesia, Bechuanaland, the Transvaal, Natal, British Central Africa, Zanzibar, British East Africa, including Uganda, Egypt, and the West African Colonies. There is also a chapter on Mauritius.

Cape Colony. ———
Statistical Register of the Colony of the Cape of Good Hope for the Year 1898, with Supplement for March Quarter, 1899. Cape Town, 1899. Size 13 × 8½, pp. xvi. and 361. *Diagram.*

Central Africa. *Mouvement G.* 16 (1899): 553–555. ———
Le plateau du Tanganika et le "Graben" du lac Rikwa.

Comoro Islands—Mayotte. *M.G. Ges. Wien* 42 (1899): 263–285. **Couarde.**
Eine Skizze über Mayotte. Von G. Couarde, K. u. K. Fregatten-Capitän.

Notes based on a visit by an Austro-Hungarian training ship in 1899.

Egypt. **Penfield.**
Present-day Egypt. By Frederic Courtland Penfield. London: Macmillan & Co., 1899. Size 8½ × 6, pp. xiv. and 372. *Map and Illustrations. Price* 10*s. Presented by the Publishers.*

Mr. Penfield was United States Diplomatic Agent and Consul-General to Egypt in 1893–97; his book, intended for the reader who wishes a general account of Egypt at the present day, is consequently one of some authority. It contains a description of Cairo, and Alexandria, a brief history of the Suez Canal, chapters on the various public works, on several important matters of administration, on the position of Great Britain in Egypt, and on wintering in Egypt for health's sake. The illustrations are partly from drawings by Paul Philippoteaux and R. Talbot Kelly, and partly from photographs.

Egyptian Sudan. *P.R.S.* 65 (1899): 333–349. **Budge.**
On the Orientation of the Pyramids and Temples in the Sûdân. By E. A. Wallis Budge, M.A.

French Sahara. *B.S.G. Com. Bordeaux* 22 (1899): 403–413. **Bénard.**
Le chemin de fer transsaharien au Congrès de géographie d'Alger. Par M. Charles Bénard. *With Map.*

French Sahara. *Nouv. Archives Miss. Sci.* 9 (1899): 513–519. **Périn.**
Rapport sur la mission Foureau-Lamy. Par M. G. Périn.

Preliminary plan of the expedition from Algeria to Lake Chad through the Tuareg country.

German East Africa. *Petermanns M.* 45 (1899): 166–167. **Meyer.**
Aus Th. Meyers Bericht über seine Reise zur Anlage neuer Stationen im Njika und Bundali-Land im November 1898. *With Map.*

German East Africa. **Widenmann.**
Die Kilimandscharo-Bevölkerung. Anthropologisches und Ethnographisches, aus dem Dschaggalande. Von Dr. A. Widenmann.—Dr. A. Petermanns Mitteilungen. Ergänzungsheft Nr. 129. Gotha: Justus Perthes, 1899. Size 11 × 7½, pp. x. and 104. *Illustrations.*

A careful and fully illustrated anthropological description of the Jaggas.

Marocco. **Doutté.**
Les Djebala du Maroc d'après les travaux de M. Auguste Mouliéras. Par Edmond Doutté. Oran: L. Fongue, 1899. Size 10 × 6½, pp. 42. *Presented by the Author.*

Marocco. **Maclean.**
Trade of Dar-al-Baida and District for the years 1897 and 1898. Foreign Office, Annual No. 2323, 1899. Size 10 × 6½, pp. 40. *Price* 2½*d.*

Mauritius. *Tour du Monde* 5 (1899): 445–456. **Verschuur.**
L'Ile Maurice. Par M. G. Verschuur. *With Illustrations.*

Niger Basin. *Mouvement G.* 16 (1899): 163–165, 169–171. ———
Le bassin du Niger.

Niger. **Guy.**
Renseignements Colon., Comité l'Afrique Française (1899): 1–13, 17–30, 33–48.
Les résultats géographiques et économiques des explorations du Niger. Par M. Camille Guy. *With Maps.*

Northern Africa. **Bernard.**
Revue Bibliographique des Travaux sur la Géographie de l'Afrique Septentrionale. Par Augustin Bernard. Extrait du 'Bulletin de la Société de Géographie d'Alger.' Alger, 1899. Size 9½ × 6½, pp. 28. *Presented by the Author.*

Notes on the bibliography of Northern Africa.

Portuguese East Africa—Chinde. **Hillier.**
Trade of Chinde for the year 1898. Foreign Office, Annual No. 2328, 1899. Size 10 × 6½, pp. 10. *Price* 1*d.*

Réunion. *Tour du Monde* 5 (1899): 457-468. **Verschuur.**
L'Ile de la Réunion. Par M. G. Verschuur. *With Illustrations.*

Sahara. *Rev. Scientifique* 12 (1899): 161-172. **Duponchel.**
La colonisation africaine et les chemins de fer transsahariens. Par M. A. Duponchel.

Sahara. *B. Comité l'Afrique Française* 9 (1899): 113-115. **Leroy-Beaulieu.**
Le tracé du Transsaharien. Par M. Paul Leroy-Beaulieu.

Sahara. *Petermanns M.* 45 (1899): 174-175. **Supan.**
Ueberschwemmung in der Sahara. Von Prof. Dr. A. Supan.

Sierra Leone. ——
Report by Her Majesty's Commissioner and Correspondence on the Subject of the Insurrection in the Sierra Leone Protectorate, 1898. Part i.—Report and Correspondence. London: Eyre & Spottiswoode, 1899. Size 13½ × 8½, pp. 176. *Price* 1*s.* 5½*d.*

Sierra Leone. ——
Sierra Leone. Report by Her Majesty's Commissioner and Correspondence on the Subject of the Insurrection in the Sierra Leone Protectorate, 1898. Part ii.—Evidence and Documents. London: Eyre & Spottiswoode, 1899. Size 13½ × 8½, pp. x. and 682. *Price* 5*s.* 6*d.*

Somaliland. **Vannutelli and Citerni.**
Seconda Spedizione Bòttego. L'Omo. Viaggio d'esplorazione nell' Africa Orientale narrato da L. Vannutelli e C. Citerni. Sotto gli auspici della Società Geografica Italiana. Milano: U. Hoepli, 1899. Size 10½ × 7, pp. xvi. and 650. *Portrait, Maps, and Illustrations. Presented by the Publisher.*

Sudan Boundaries. *Questions Dipl. et Colon.* 6 (1899): 385-392. **Lanessan.**
La Convention Franco-Anglaise du 21 Mars 1899. Par J. L. de Lanessan. *With Map.*

Transvaal. ——
South African Republic. Correspondence relating to the Status of the South African Republic. London: Eyre & Spottiswoode, 1899. Size 13½ × 8½, pp. 34. *Price* 3½*d.*

Transvaal. ——
South African Republic. Further Correspondence relating to Proposed Political Reforms in the South African Republic. London: Eyre & Spottiswoode, 1899. Size 13½ × 8½, pp. x. and 74. *Price* 8½*d.*

Transvaal. ——
South African Republic. Further Correspondence relating to Proposed Political Reforms in the South African Republic. London: Eyre & Spottiswoode, 1899. Size 13½ × 8½, pp. vi. and 76. *Price* 8*d.*

Transvaal. ——
Further Correspondence relating to Political Affairs in the South African Republic. London: Eyre & Spottiswoode, 1899. Size 13½ × 8½, pp. viii. and 66. *Price* 7½*d.*

Welwitsch's African Plants. **Hiern and Rendle.**
Catalogue of the African Plants collected by Dr. Friedrich Welwitsch in 1853-61. Dicotyledons. Part iii.—*Dipsaceæ* to *Scrophulariaceæ*. By William Philip Hiern, M.A., F.L.S. Vol. ii., Part i. Monocotyledons and Gymnosperms. By Alfred Barton Rendle, M.A., etc. London: Longmans & Co., 1898-99. Size 9 × 5½, pp. (part iii.) 511-784, (vol. ii. part i.) 260. *Presented by the British Museum.*

West Africa. **Darwin.**
British Expansion in West Africa. By Major L. Darwin. From the *National Review*, August, 1899, pp. 968-979. Size 10 × 6½.

West African Boundaries. ——
Treaty Series, No. 15, 1899. Convention between the United Kingdom and France for the Delimitation of their respective Possessions to the West of the Niger, and of their respective Possessions and Spheres of Influence to the East of that river. Signed at Paris, June 14, 1898. Together with a Declaration completing the same. Signed at London, March 21, 1899. London: Eyre & Spottiswoode, 1899. Size 9½ × 6½, pp. 20. *Maps. Price* 10½*d.*

NORTH AMERICA.

Alaska. **Hitchcock.**

Two Women in the Klondike. The Story of a Journey to the Gold-Fields of Alaska. By Mary E. Hitchcock. New York and London: G. P. Putnam's Sons, 1899. Size 9 × 6, pp. xiv. and 486. *Map and Illustrations. Price* 12*s.* 6*d. Presented by the Publishers.*

This is a detailed record of the incidents of a voyage up the Yukon, undertaken in 1898 by two wealthy American ladies, with graphic notes of their picknicking at Dawson for the short autumn, and their return journey just at the onset of winter up the Yukon and the lakes to the White pass and home by Skagway. There are some excellent photographs and a good map.

Canada. *P. Canadian I.* 2 (1899): 61–73. **Penck.**

Observations made on a Tour in Canada. By Albert Penck.

On the trip across Canada, made on the occasion of the British Association Meeting in 1897.

Canada—British Columbia. *P. Canadian I.* 2 (1899): 57–60. **Penck.**

The Illecillewaet Glacier in the Selkirks. By Albert Penck.

Canada—Historical. *Deutsche G. Blätter* 22 (1899): 170–201. **Nederkorn.**

Die Entdeckungs-, Besiedlungs- und Entwicklungsgeschichte Canadas und seiner Grenzgebiete. Von Dr. W. Nederkorn.

Mexico. *Nouv. Archives Miss. Sci.* 9 (1899): 571–630. **Diguet.**

Rapport de Mission. Par M. Léon Diguet. (La Sierra du Nayarit et ses indigènes.) *With Maps and Plates.*

Mexico—Lower California. *Nouv. Archives Miss. Sci.* 9 (1899): 1–53. **Diguet.**

Rapport sur une mission Scientifique dans la Basse Californie. Par M. Léon Diguet. *With Plates.*

A full geographical and ethnographical description of Lower California.

North America. **Newberry.**

Monographs of the United States Geological Survey. Vol. xxxv. The Later Extinct Floras of North America. By John Strong Newberry. A posthumous work, edited by Arthur Hollick. Washington, 1898. Size 12 × 9½, pp. xviii. and 152. *Plates. Presented by the U.S. Geological Survey.*

United States—Coast and Geodetic Survey. ———

Report of the Superintendent of the U.S. Coast and Geodetic Survey, showing the progress of the work during the fiscal year ending with June, 1897. Washington, 1898. Size 12 × 9½, pp. xxii. and 774. *Maps and Illustrations. Presented by the Survey.*

CENTRAL AND SOUTH AMERICA.

Argentine—Aconcagua. **Fitz Gerald.**

The Highest Andes: a Record of the First Ascent of Aconcagua and Tupungato in Argentina, and the Exploration of the Surrounding Valleys. By E. A. Fitz Gerald. With Chapters by Stuart Vines, M.A., and Contributions by Prof. Bonney, D.SC., G. C. Crick, R. J. Pocock, G. A. Boulanger, F.R.S., J. H. Burkill, Philip Gosse. London: Methuen & Co., 1899. Size 10 × 6½, pp. xvi. and 390. *Maps and Illustrations. Price* 30*s. Two copies, one presented by the Author, the other by the Publishers.*

This volume gives a finely illustrated description of Mr. Fitzgerald's important expedition to Aconcagua, the geographical details of which were published in the *Journal* for November, 1898. The illustrations include panoramas from great elevations. Appendices deal at considerable length with the scientific collections and observations made by different members of the expeditions, and there is an index to the whole work.

Argentine—Buenos Aires. *P.I. Civil Engineers* 138 (1899): 170–243. **Dobson.**

Buenos Ayres Harbour Works. By J. M. Dobson. *With Plans.*

Brazil. **Coudreau.**

Henri Coudreau. Voyage au Yamunda, 21 Janvier 1899—27 Juin 1899. Paris: A. Lahure, 1899. Size 11½ × 9, pp. 164. *Maps and Illustrations.*

In this journey M. Coudreau ascended the Yamunda tributary, on the left bank of the Amazon, to 0° 33′ S. in lat. 59° 24′ W. of Greenwich, thus entering an entirely unexplored region. The description is illustrated by photographs, and accompanied by a map on the scale of 1 : 100,000; but not provided with a scale of lengths, latitudes, longitudes, statement as to projection, nor any means of showing how the six sheets of which it is composed fit together.

Haiti. *Petermanns M.* 45 (1899): 153–155; 201–204. **Tippenhauer.**
Beiträge zur Geologie Haïtis. Von L. Gentil Tippenhauer. *With Map.*

Jamaica. **Hemming.**
Jamaica. Annual Report for 1897–8. Colonial Reports, Annual No. 261, 1899. Size 10 × 6½, pp. 56. *Price* 3*d.*

Jamaica. *J.I. Jamaica* 2 (1899): 502–509. **Nicholas.**
The Economic Geology of Jamaica. By F. C. Nicholas.

Peru. *B.S.G. Lima* 8 (1898): 193–237. ———
Informe que la Sociedad Geográfica de Lima presenta al Supremo Gobierno, sobre demarcación. Por departamentos, del territorio de la República.

Peru. *B.S.G. Lima* 8 (1898): 171–179. **Hilfiker.**
Informe sobre la zona mineral de Ananea-Poto. Por el ingeniero Adolfo Hilfiker. *With Map.*

Peru. *B.S.G. Lima* 8 (1898): 278–320. **Ráez.**
Tayacaja; Monografia de esta provincia del departamento de Huancavelica. Por Nemesio A. Ráez.

Peru. *B.S.G. Lima* 8 (1899): 241–277. **Raimondi.**
Itinerario de los viajes de Raimondi en el Perú; Cuzco, Quispicanchi, Lucré, Pisac, etc., hasta Marcapata (1865).

Peru. **Tizón y Bueno.**
Breve estudio geografico-estadistico del Departamento de La Libertad. Por Ricardo Tizón y Bueno. Lima, 1899. Size 7½ × 5½, pp. 54.

Peru—Callao. *B.S.G. Lima* 8 (1898): 350–355. **Remy.**
Climatología del puerto del Callao en 1898. Por Federico Remy.

Rio de la Plata. **Martinez.**
Etnografia del rio de la Plata. Discurso pronunciado . . . por Benigno T. Martinez. 1899. Size 7½ × 5½, pp. 26. *Presented by the Author.*

Venezuela. **Haggard.**
Trade of Venezuela for the year 1898. Foreign Office, Annual No. 2315, 1899. Size 10 × 6½, pp. 34. *Price* 2½*d.*

Venezuela Boundary. ———
Venezuela. Nos. 1, 2, and 3 (1899). Boundary between British Guiana and Venezuela. London: Eyre & Spottiswoode, 1899. Size 13½ × 8½, pp. (No. 1) 164; (No. 2) 142; (No. 3) 56. *Price* (No. 1) 1*s.* 4*d.*; (No. 2) 1*s.* 2*d.*; (No. 3) 6*d.*

The text of the British case as presented to the Court of Arbitration in Paris.

West Indies. ———
West Indian Bulletin. The Journal of the Imperial Agricultural Department for the West Indies, vol. i. No. 1. London: Dulau & Co. [1899]. Size 10 × 6½, pp. 142. *Presented by the Commissioner of the Imperial Department of Agriculture for the West Indies.*

AUSTRALASIA AND PACIFIC ISLANDS.

Australia—Flora. *Natural Sci.* 15 (1899): 198–212, 274–286. **Moore.**
Suggestions upon the Origin of the Australian Flora. By Spencer Moore, B.SC.

Caroline Islands. **Christian.**
The Caroline Islands. Travel in the Sea of the Little Lands. By F. W. Christian. London: Methuen & Co., 1899. Size 9 × 6, pp. xiv. and 412. *Map, Plans, and Illustrations. Price* 12*s.* 6*d. Presented by the Publishers.*

This records a long residence in the Caroline islands, including travels through the group, and dwells especially on the island of Ponapé, though the author has much to say also about Yap, and about many of the smaller islands which lie between. The appendices contain much precise information of an original kind on the anthropology and archæology of the group, so that when the new owners of the islands undertake the minute surveys and investigations they are sure to institute, they will find a great deal of the work done for them by Mr. Christian. A general summary of the results of these studies will be found in the *Journal* for February, 1899, vol. xiii. p. 105.

Hawaii. **Brigham.**

Hawaiian Feather Work. By William T. Brigham.—Memoirs of the Bernice Pauahi Bishop Museum of Polynesian Ethnology and Natural History (vol. i. No. 1). Honolulu, 1899. Size 12½ × 10, pp. 82. *Illustrations. Presented by the Bernice Pauahi Bishop Museum, Honolulu.*

New Guinea. **Krieger.**

New Guinea, von Dr. Maximilian Krieger, mit Beiträgen von Professor Dr. A. Freiherrn von Danckelman, Professor Dr. F. von Luschan, Kustos Paul Matschie und Professor Dr. Otto Warburg mit Unterstützung der Kolonial-Abteilung des Auswärtigen Amtes, der Neu-Guinea-Kompagnie und der Deutschen Kolonial-Gesellschaft.—Bibliothek der Länderkunde, herausgegeben von Prof. Dr. Alfred Kirchhoff und Dr. Rudolf Fitzner. Fünfter und sechster Band. Berlin: A. Schall, 1899. Size 10½ × 7, pp. xii. and 536. *Maps and Illustrations. Presented by the Publisher.*

An important work dealing with all parts of the great island of New Guinea, first in its general aspects, and then with particular regard to each of the three possessions, which are treated in considerable detail.

New Zealand. **Smith.**

Report of the Department of Lands and Survey, New Zealand, for the year 1898–99. By S. P. Smith, Surveyor-General. Wellington, 1899. Size 13½ × 8½, pp. iv., xxiv., and 276. *Maps and Illustrations. Presented by the Department of Lands and Survey, New Zealand.*

New Zealand—Flora. **Kirk.**

The Students' Flora of New Zealand and the Outlying Islands. By Thomas Kirk. Wellington, [1899]. Size 10 × 7½, pp. vi. and 408. *Presented by the New Zealand Government.*

The death of the compiler of this list of New Zealand plants deprives the work of a chapter on the geographical distribution of plants in New Zealand, which he had planned as an introduction.

Queensland. *P.I. Civil Engineers* **136** (1899): 268–281. **Williams.**

Floods in the Brisbane River; and a System of Predicting their Heights and Times. By C. J. R. Williams. *With Map and Diagrams.*

South Australia—Meteorology. **Todd.**

Meteorological Observations made at the Adelaide Observatory and other places in South Australia and the Northern Territory during the Year 1896, under the direction of Charles Todd, K.C.M.G. Adelaide, 1899. Size 13½ × 8½, pp. xiv., 96, and 82. *Maps. Presented by the Adelaide Observatory.*

Victoria. **Bride.**

Public Library, Museums, and National Gallery of Victoria. Letters from Victorian Pioneers: being a series of papers on the Early Occupation of the Colony, the Aborigines, etc. Edited . . . by Thomas Francis Bride, LL.D. Melbourne: R. S. Brain, 1899. Size 9 × 6, pp. xiv. and 326. *Map. Presented by the Public Library of Victoria.*

The fifty-eight letters now published for the first time were collected from early settlers by Governor La Trobe in 1853, when he had the intention of writing a history of Victoria. Each letter gives the recollections of one of the pioneer settlers concerning events in which he had taken part not more than seventeen years in any case before the time at which he wrote. The letters are full of information as to the aborigines.

AUSTRALASIA AND OCEANIC ISLANDS.

Solomon Islands. *Ann. Hydrographie* **27** (1899): 529–535. ——

Aus den Reiseberichten Seiner Majestät Schiffe. *With Maps and Illustration.*

A cruise round Bougainville island.

Western Australia. *Mission Field* **44** (1899): 403–408. **Burton.**

On a Bicycle in Australian Wilds. By the Rev. Alfred. *With Illustrations.*

A bicycle ride from Norseman to Eucla in Western Australia. It is mentioned incidentally that the ordinary means of communication with Eucla is by a steamer, which calls there once in three months.

Western Australia. *Ann. Hydrographie* 27 (1899): 540–542. **Tiedemann.**
Der Hafen von Bunbury. Nach Bericht von Kapt. H. Tiedemann. *With Map.*
On Bunbury harbour.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Date-line. **Smith.**
Where a day is lost or gained. By Benjamin E. Smith. From the *Century Magazine*, September, 1899, pp. 742–745. *Map.*
On the line of change of date in the Pacific ocean.

Latitude Changes. **Sande Bakhuyzen.**
P. Section Sci., K.A. Wetens. Amsterdam 1 (1899): 42–55.
On the Motion of the Pole of the Earth according to the observations of the years 1890–1896. By Dr. E. F. van de Sande Bakhuyzen.
The publication of an English edition of the Proceedings of the Scientific Section of the Royal Academy of Amsterdam will be welcomed by all men of science who are ignorant of the Dutch language. This memoir summarizes the recent observations ou the shifting of the pole.

Latitude Changes. **Sande Bakhuyzen.**
P. Section Sci., K.A. Wetens. Amsterdam 1 (1899): 201–213.
Some remarks upon the 14-monthly motion of the Pole of the Earth and upon the length of its period. By Dr. E. F. van de Sande Bakhuyzer.

atitude Determination. *C.Rd.* 129 (1899): 270–272. **Ebert and Perchot.**
Sur les méthodes de M. Lœwy pour la détermination des latitudes. Note de MM. W. Ebert et J. Perchot.

ap-reading. *P.R. Artillery I.* 26 (1899): 339–340. **Prinsep.**
A Portable Map Reader for Field Service. By Major D. G. Prinsep.
Description of a ruler marked with scales for use in artillery work in the field.

an Density of Earth. **Rein.**
Bestimmung der mittleren Dichte der Erde. Von Prof. Rein. (Separat-Abdruck us den Sitzungsberichten der Niederrhein. Gesellschaft für Natur- u. Heilkunde onn, 1898.) Size 8½ × 5½, pp. 4. *Presented by the Author.*
The final corrected results of Richarz, Kriga, Menzel, and König gives 5·505 as the n density of the Earth.

tical Almanac. ——
ie American Ephemeris and Nautical Almanac for the year 1902. First Edition. ashington: Bureau of Equipment, 1899. Size 11 × 7½, pp. 588. *Diagram.*

gational Instruments. *Rev. Maritime* 142 (1899): 590–594. **Molfino.**
vigation; les Nomogrammes du Professeur E. Molfino.
a mechanical method of calculating latitudes.

tric Calculations. *Riv. G. Italiana* 6 (1899): 521–528. **Marinelli.**
ra un nuovo procedimento orometrico osservazioni di Olinto Marinelli.

Rosenbach.
B. Free Museum Sc. and Art. Univ. of Pennsylvania 2 (1899): 73–86.
Rittenhouse Orrery by Abraham S. Wolf Rosenbach. *Illustration.*
es regarding a remarkable planetarium in the Philadelphia museum constructed by David Rittenhouse.

a Determinations. *Ann. Hydrographie* 27 (1899): 505–512. **Fulst.**
Berechnung des Schiffsortes aus zwei Gestirnshöhen nach der Höhenmethode. Dr. O. Fulst.

leridian. *A travers le Monde, Tour du Monde* 5 (1899): 285–286. **Combes.**
iestion du Méridien unique. Par M. Paul Combes. *With Map.*

and Sunset. **Logan.**
II. U.S. Hydrographic Office. Sunrise and Sunset Tables showing the Mean Time of the Sun's visible rising and setting for each degree of latitude n 60° North and 60° South, and for each degree of the Sun's Declination. igton, 1896. Size 11½ × 9½, pp. 24. *Presented by the U.S. Hydrographic*

Time. *Riv. G. Italiana* 6 (1899): 529–541. **Rajna and Quarenghi.**
Una discussione sul' unificazione del calendario: il meridiano iniziale per le longitudini e l'ora universale. By Michele Rajna e Cesare Tondini de Quarenghi.

Time and Angles. *Rev. Scientifique* 12 (1899): 691–693. **Rey-Pailhade.**
Etat de la Question de la Décimalisation du Temps et de L'Angle. Par M. J. de Rey-Pailhade.

Time and Longitude. *Riv. G. Italiana* 6 (1899): 457–480. **Rajna.**
Una discussione su l'unificazione del calendario: il Meridiano Iniziale per le Longitudini e l'ora Universale. By Michele Rajna.

Time Standards. *Rev. Scientifique* 12 (1899): 526–530. **Quarenghi.**
Le méridien de l'heure universelle et la Russie. Par M. C. Tondini di Quarenghi.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Atmospheric Circulation. *Ann. Hydrographie* 27 (1899): 563–566. **Köppen.**
Ueber den Rücktransport der Luft nach niedrigen Breiten in den gemässigten Zonen. Von Prof. Dr. W. Köppen.

On the return currents of air towards low latitudes in the temperate zones.

Atmospheric Circulation. *Meteorolog. Z.* 16 (1899): 337–353, 397–411. **Polis.**
Die Strömungen der Luft in den barometrischen Minima und Maxima. Ein Beitrag zur Theorie der Cyklonen und Anticyklonen. Von Dr. P. Polis.

On the circulation of air in cyclones and anticyclones.

Geology. **Lapparent.**
Traité de Géologie. Par A. De Lapparent. Quatrième édition. Phénomènes Actuels. Page 1 à 592. Géologie proprement dite. Page 593 à 1240. [2 Parts.] Paris: Masson et C^ie^, 1900 [1899]. Size 10 × 6½. *Maps and Illustrations. Presented by the Author.*

A new and entirely recast edition of Prof. de Lapparent's well-known text-book of geology.

Geology. **Chamberlin.**
The Ulterior Basis of Time Divisions and the Classification of Geologic History. By T. C. Chamberlin. Reprinted from the *Journal of Geology*, vol. vi. No. 5, July–August, 1898. Chicago, 1898. Size 9½ × 7, pp. 449–526. *Presented by the Author.*

Geology. **Chamberlin.**
A Systematic Source of Evolution of Provincial Faunas and The Influence of Great Epochs of Limestone Formation upon the Constitution of the Atmosphere. Reprinted from *Journal of Geology*, vol. vi. No. 6, September–October, 1898. Chicago, 1898. Size 9½ × 7, pp. 597–621.

Geology—Age of Earth. *Scottish G. Mag.* 15 (1899): 561–578. **Geikie.**
Address to the Geological Section of the British Association, 1899. By Sir Archibald Geikie.

A discussion of the geological evidence bearing on the probable age of the stratified rocks formed since the first consolidation of the Earth's crust.

Geomorphology. **Beneat.**
Submarine Gullies, River Outlets, and Fresh-Water Escapes beneath the Sea-Level. By Henry Beneat. From the *Geographical Journal* for October, 1899. Size 10 × 6½, pp. 20. *Diagrams.*

Geomorphology. *J. of T. Victoria I. London* 31 (1899): 269–297. **Hull.**
On the Sub-Oceanic Terraces and River Valleys off the Coast of Western Europe. By Prof. Edward Hull. *With Maps and Sections.*

Geophysics. *Globus* 76 (1899): 174–176. ———
Die Ansichten über das Erdinnere. *With Illustration.*

A notice of Woldrich's study of the interior of the Earth published in the *Transactions* of the Prague Academy of Sciences, accompanied by a coloured diagram showing an ideal section of the Earth on the hypothesis that within the solid lithosphere lies a pyrosphere of intensely high temperature, and successively in a plastic, fluid, and finally at the centre gaseous state.

Glacial Period. *J. Geology* 7 (1899): 545–584. **Chamberlin.**
An Attempt to frame a Working Hypothesis of the Cause of Glacial Periods on an Atmospheric Basis. By T. C. Chamberlin.

Glacial Period. *J. of T. Victoria I. London* 31 (1899): 141–167. **Hull.**
Another Possible Cause of the Glacial Epoch. By Prof. E. Hull, LL.D., F.R.S., etc. *With Map.*

Prof. Hull brings forward evidence which inclines him to believe that the Glacial period was brought about by changes in the Earth's crust sufficient to deflect the warm currents from the northern seas.

Land Forms. *Ann. G.* 8 (1899): 289–303, 385–404. **Davis.**
La Pénéplaine. Par M. W. M. Davis.

Meteorology. *Rev. Scientifique* 12 (1899): 553–560. **Souleyre.**
La distribution des Pluies à la Surface de la Terre. Par M. A. Souleyre.

An attempt to explain the distribution of rainfall on the Earth's surface.

Meteorology. *Symons's Monthly Meteorolog. Mag.* 34 (1899): 129–135. ———
Meteorological Extremes.—II. Temperature.

The maximum annual range of the world is 217°·8 Fahr., formed by a maximum recorded at Wargla of 127°·4 on July 17, 1879, and a minimum of −90°·4 at Verkhoyansk on January 15, 1885.

Meteorology. ———
Die Orkane des Nordatlantischen Ozeans in der letzten Woche des Januar und den ersten Wochen des Februar 1899. Herausgegeben von der Direktion der Seewarte. Beiheft I. zu den "Annalen der Hydrographie und Maritimen Meteorologie," Heft vii. (Juli), 1899. Berlin: E. S. Mittler & Son. Size 10½ × 7½, pp. 34. *Charts.*

An account, with synoptic chart, of the remarkable series of cyclones which swept across the North Atlantic in January and February, 1899.

Meteorology. *P. American A. Arts and Sci.* 34 (1899): 599–618. **Clayton.**
Investigations on Periodicity in the Weather. By H. Helm Clayton. *With Diagrams.*

Meteorology. *J. School G.* 3 (1899): 241–250. **Ward.**
Equipment of a Meteorological Laboratory. By Robert De C. Ward.

Lists of instruments and books suitable for practical instruction in meteorology for schools.

Meteorology—Isotherms. **Meinardus.**
Die Entwickelung der Karten der Jahres—Isothermen, von Alexander von Humboldt bis auf Heinrich Wilhelm Dove. Von Wilhelm Meinardus. Sonderabdruck aus der Humboldt-Centenar-Schrift der Gesellschaft für Erdkunde zu Berlin, 1899. Size 11 × 7½, pp. 32. *Maps. Presented by the Author.*

Meteorology—Rainfall. **Herbertson.**
The Monthly Rainfall over the Land-Surface of the Globe. Inaugural-Dissertation zur erlangung der philosophischen Doktorwürde vorgelegt der Hohen philosophischen Facultät der Albert-Ludwigs-Universität zu Freiburg im Breisgau. Von Andrew John Herbertson. 1899. Size 10 × 6½, pp. 60. *Maps.*

Ocean Currents. *J. and P.R.S. New South Wales* 32 (1898): 120–131. **Hepworth.**
Current Observations on the Canadian Australian Route. By Captain M. W. Campbell Hepworth. *With Charts.*

Observations on the Pacific ocean on the route from Vancouver to Sydney, N.S.W., resulting from sixty-two passages.

Ocean Currents. *J. and P.R.S. New South Wales* 32 (1898): 230–240. **Russell.**
Current Papers, No. 3. By H. C. Russell, B.A., etc.

Oceanography. **Murray.**
Oceanography. By Sir John Murray, K.C.B., etc. From the *Geographical Journal* for October, 1899. Size 10 × 6½, pp. 16. *Chart. Also, without chart, from the British Association Report for* 1899.

Oceanography. *Ann. Hydrographie* 27 (1899): 327–335. **Schott.**
Von der deutschen Tiefsee-Expedition. Dritter Bericht des Ozeanographen der Expedition Dr. Gerhard Schott.

Physiography. *Rev. Scientifique* 12 (1899): 289-295, 364-369, 424-429. **Klossovsky.**
La vie Physique de notre Planète. Par M. A. Klossovsky. *Also a separate copy, Odessa,* 1899. *Presented by the Author.*

By the physical life of the planet M. Klossovsky means the interacting agencies which produce the circulation of air and water, the movements of the crust, and the development of the land.

Phytogeography. **Engler.**
Die Entwickelung der Pflanzen-Geographie in den letzten hundert Jahren und weitere Aufgaben derselben. Von A. Engler. In *Wissenschaftliche Beiträge zum Gedächtniss . . . Alexander von Humboldt.* Berlin: W. H. Kühl, 1899. Pp. 1-247.

Seismology. *Atti R.A. Lincei, Rendiconti* 8 (1899): 35-45. **Riccò.**
Riassunto della sismografia del terremoto del 16 nov. 1894. Parte ii. Oggetti lanciati a distanza, velocità di propagazione, profondità dell' ipocentro, repliche, confronto col terremoto del 1783. Nota del A. Riccò.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Anthropogeography. **Tomé.**
Geografia del presente e dell' avvenire ossia etnografia e geografia politica del mondo civile giusta i principii della etnicarchia. Studii e proposte di Giuseppe Tomé. 3 vols. Torino e Roma: E. Loescher, and Porto Maurizio, 1880, 1893, 1898. Size $9\frac{1}{2} \times 6\frac{1}{2}$, pp. (vol. i.) 112; (vol. ii.) 168; (vol. iii.) 454. *Presented by the Author.*

The first volume is a work in two parts: the first on theoretical ethnography in relation to geography; the second, practical applications of the theory to the actual cases of the different nations of the world, explaining their present political conditions and forecasting their future. The two later volumes fill up in greater detail the general scheme of the first volume.

Commercial Geography. **Rozenraad.**
The Commercial Struggle of the Nations. By C. Rozenraad. Speech delivered at the Institute of Bankers, February 2, 1898. London: Smith & Ebbs, 1898. Size $11 \times 7\frac{1}{2}$, pp. 40. *Presented by the Author.*

History of Geography. **Keane.**
The Evolution of Geography. A sketch of the Rise and Progress of Geographical Knowledge from the earliest times to the first Circumnavigation of the Globe. By John Keane. London: E. Stanford, 1899. Size $8\frac{1}{2} \times 6$, pp. xvi. and 160. *Maps, Portraits, and Illustrations. Price 6s. Presented by the Publisher.*

The aim of this book is to trace the development of geographical ideas and knowledge from their infancy. The knowledge of the early Egyptians, Hebrews, and Greeks is disposed of in a chapter of about thirty pages. Other short chapters summarize the advances in the early Christian ages, under the Crusading impulse, and a chapter each is given to Columbus and Magellan. There the history stops. Two general chapters deal with early maps and with instruments. It affords a summary of the growth of geographical knowledge suited for those for whom the works of Tozer and Vivien St. Martin, not to speak of Bunbury, are too long.

Historical—Strabo's Theories. *Riv. G. Italiana* 6 (1899): 542-553. **Cossu.**
Il concetto di Geografia presso Strabone. Nota del Dott. A. Cossu.

BIOGRAPHY.

Botella y de Hornos. *Deutsche Rundschau G.* 21 (1899): 517-520. **Levy.**
D. Federico de Botella y de Hornos. *With Portrait.*

The subject of this memoir, a distinguished Spanish geologist, has done much to advance our knowledge of the physical geography of the Iberian peninsula.

Bòttego. *Deutsche Rundschau G.* 22 (1899): 87-88. ——
Vittoria Bòttego. *With Portrait.*

Bowen. *Deutsche Rundschau G.* 21 (1899): 571. ——
Sir George Bowen. *With Portrait.*

Chun. *Deutsche Rundschau G.* 22 (1899): 37-39. **Wolkehauser.**
Prof. Dr. Karl Chun. *With Portrait.*

Prof. Chun was the leader of the German deep-sea expedition in the *Valdivia.*

French Travellers. *B.S.G. Lyon* 16 (1899): 5-17. **Chambeyron.**
Lyon voyageur et géographe. Par E. Chambeyron.

On travellers born in Lyons.

Hartl. *Deutsche Rundschau G.* 22 (1899): 86-87. ———
Heinrich Hartl. *With Portrait.*

Colonel Hartl was appointed Professor of Geodesy in the University of Vienna in 1899.

Huth. *Deutsche Rundschau G.* 21 (1899): 373-375. ———
Dr. Georg Huth. *With Portrait.*

Dr. Huth is a prominent linguistic scholar who has paid special attention to the ethnology of Eastern Asia.

Jordan. *Deutsche Rundschau G.* 21 (1899): 520-522. ———
Prof. Dr. W. Jordan. *With Portrait.*

Prof. Jordan of Hannover—born 1842, died April 17, 1899—was a geodesist, and took part in Rohlf's exploration of the Libyan desert in 1873-74.

Marcou. *P. American A. Arts and Sci.* 34 (1899): 651-656. **Hyatt.**
Jules Marcou. By Alpheus Hyatt.

Mizon. *Deutsche Rundschau G.* 21 (1899): 471-473. ———
Louis Mizon. *With Portrait.*

M. Mizon, born in 1853 in Paris, died in 1899 at Jibuti, after having had a career as an African explorer and colonial official.

Müller. *Deutsche Rundschau G.* 21 (1899): 375-377. ———
Dr. Karl Müller. *With Portrait.*

Dr. Müller's work lay in the departments of botanical distribution and popular exposition. He was born in 1818, and died on February 9, 1899.

Pauliny. *Deutsche Rundschau G.* 22 (1899): 39-41. ———
J. J. Pauliny. *With Portrait.*

An able cartographer and instructor in the Austrian Geodetic Institute, who, amongst various other extra duties, spent several years on leave in giving cartographical instructions to the Egyptian and Japanese surveys. He was born in 1827, and died June 11, 1899.

Pickering. *Deutsche Rundschau G.* 21 (1899): 468-471. ———
Edward Charles Pickering. *With Portrait.*

E. C. Pickering was born in 1846 in Boston, and became director of the Harvard observatory in 1876.

Salm. *Deutsche Rundschau G.* 21 (1899): 568-570. ———
Fürstbischof Franz X. Altgraf Salm. *With Portrait.*

The Prince-Bishop Salm of Gurk, in Carinthia, was one of the pioneers of Austrian alpine study. He was born in 1748 or 1749, in 1799 he made the first ascent of the Gross-Glockner, and died in 1822.

Winsor. *P. American A. Arts and Sci.* 34 (1899): 641-645. **Lowell.**
Justin Winsor. By A. Lawrence Lowell.

An interesting record of the work of the late Justin Winsor as a librarian and bibliographer.

GENERAL.

Arabic Language. **Thimm.**
Arabic Self-Taught. (Syrian.) With English Phonetic Pronunciation, containing Vocabularies—Elementary Grammar, Idiomatic Phrases and Dialogues—Travel Talk—English and Arabic Dictionary. By C. A. Thimm. Edited by A. Hassam and Prof. G. Hagopian. Third Edition. (Revised and corrected.) London: E. Marlborough & Co., 1899. Size $7\frac{1}{2} \times 5$, pp. 96. *Price* 2*s*. 6*d*. *Presented by the Publishers.*

Bibliography—Subject Index. ———
Minutes of Proceedings of the Institution of Civil Engineers. Subject-Index, vols. cxix. to cxxxviii., Sessions 1894-95 to 1898-99. Size $8\frac{1}{2} \times 5\frac{1}{2}$, pp. 88. *Presented by the Institution of Civil Engineers.*

British Empire. **Woodward.**

A Short History of the Expansion of the British Empire, 1500–1870. By William Harrison Woodward. Cambridge: the University Press, 1899. Size 7½ × 5, pp. x. and 326. *Maps. Presented by the Cambridge University Press.*

A very compact and logically arranged history of the acquisition and growth towards a complete system of government, of the various possessions which were under the British flag before 1870.

Educational—Methods. **Reynolds.**

The Teaching of Geography in Switzerland and North Italy, being the Report presented to the Court of the University of Wales on a Visit to Switzerland and North Italy in 1898, as Gilchrist Travelling Student. By Joan Berenice Reynolds, B.A. London: C. J. Clay & Sons, 1899. Size 7½ × 5, pp. xii. and 112. *Presented by the Publishers.*

Describes the methods of teaching geography in elementary and higher classes in different parts of Switzerland and in a few towns in the south of Italy.

French Colonies. **Gaffarel.**

Les Colonies Françaises. Par Paul Gaffarel. Sixième édition. Paris: F. Alcan, 1899. Size 9 × 6, pp. 564. *Price 5 fr.*

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(E. Stanford, Agent.)

Gallia. **Grundy.**

Murray's Handy Classical Maps: Gallia. Scale 1 : 2,500,000 or 39·7 stat. miles to an inch. Edited by G. B. Grundy, M.A., of Brasenose College, Oxford. London: John Murray, 1899. *Price* 1*s. With Index. Presented by the Publisher.*

This is the first issue of a series of handy classical maps in course of publication by Mr. Murray. It is orographically coloured in three tints, showing elevations from sea-level to 600 feet, from 600 feet to 3000 feet, and elevations above 3000 feet; the boundaries of countries and provinces being shown by red lines. Two insets are given, one of Gallia at the time of Cæsar, and the other of Insula Batavorum. The map, which is furnished with an index, has been edited by Mr. G. B. Grundy, M.A., and produced by Bartholomew in his usual clear style. As the maps of this series can be purchased separately, they will be most useful to students or persons attending lectures.

ASIA.

China. **Chevalier.**

Atlas du Haut Yang-Tse de I-Tchang Fou à P'ing-Chan Hien par le R. P. S. Chevalier, S.J. 1[er] Fascicule de I-Tchang Fou à Tchong-King Fou. Observatoire de Zi-Ka-Wei. Shanghai, 1899.

This is the first issue of an Atlas of the Upper Yang-tse; it contains thirty-nine sheets, and includes the river between Ichang and Chung-King. Soundings are in metres at the time when the water is lowest, and the lettering is given in Chinese, French, and English. When completed the atlas will contain a survey of the source of the Yang-tse from I-chang to Ping-shan. The atlas is accompanied by explanatory letterpress.

AFRICA.

Transvaal. **Mackenzie.**

New Relief Map of the Transvaal. Scale 1 : 1,000,000 or 15·8 stat. miles to an inch. By E. A. Mackenzie. The Universal Publishing Co., Ltd., London, 1899. *Presented by the Publishers.*

West Africa. **Diderrich.**

Carte de la Région du Mayumbe du Congo au Chiloango, dressée par l'Ingénieur N. Diderrich, Directeur Général de la Société des Chemins de Fer Vicinaux du Mayumbe. Scale 1 : 125,000 or 2 stat. miles to an inch. Librairie Falk Fils, Bruxelles, 1899. 4 sheets.

This map has apparently been published to show existing and proposed lines of railway in the Mayumbe district of French Congo. It has been drawn on a large scale to show the results of preliminary surveys, and contains but little other information.

POLAR REGIONS.

South Polar Regions. **Lecointe.**

Expédition Antarctique Belge. Commandée par le Capitaine A. de Gerlache. Croquis provisoire du Détroit de la Belgica, dressé par le Lieutenant de Vaisseau G. Lecointe, Commandant en second de l'expédition. Scale 1 : 400,000 or 6·3 stat. miles to an inch. Société Royale Belge de Géographie, 1899.

GENERAL.

French Colonial Atlas. **Mager.**

Nouvel Atlas Colonial, par Henri Mager, Membre du Conseil supérieur des Colonies (1892–97), Conseiller du Commerce extérieur. Vingtième mille. Paris: Ernest Flammarion, Éditeur. *Price* 1·5 *fr. Presented by the Author.*

World. **Meyer.**

Meyer's Hand-atlas. Zweite, neubearbeitete und vermehrte Auflage mit 112 Kartenblättern, 9 Textbeilagen und Register aller auf den Karten verzeichneten

Namen. Parts 31 and 32 (in one), 33 and 34 (in one), and 35 and 36 (in one). Leipzig und Wien. Verlag des Bibliographischen Instituts, 1899. *Price 60 pf. each issue.*

World. **Vivien de Saint Martin and Schrader.**

Atlas Universel de Géographie. Ouvrage commencé par M. Vivien de Saint Martin et continué par Fr. Schrader. Paris: Librarie Hachette et Cie. Sheet: Italie Septentrionale. *Price 2 fr.*

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, September and October, 1899. *Presented by the Hydrographic Department, Admiralty.*

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982		Truk or Hogolu islands:—Plan added, Oraluk or Bordelaise lagoon.

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442 Guantanamo harbour. 98 Approaches to ports Casilda and Masio.	New sheet. Plans on the south coast of Cuba . . . 98
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1376 Anchorages in the Galápagos islands.	New sheet. Anchorages in the Galápagos islands . . 1376

Charts that have received Important Corrections.

No. 1951, England, west coast:—Liverpool bay. 1447, Ireland, east coast:—Dublin bay and river Liffey. 1039, Norway:—Christiania harbour. 2308, Norway, west coast:—Approaches to Trondhjem, eastern sheet. 2275, White sea:—Gulf of Onega. 2842B, Baltic sea. 2296, Gulf of Bothnia. 2302, Gulf of Bothnia:—Tome point to Tauvö. 2227, Gulf of Finland:—Revel roadstead. 2372, Gulf of Riga:—Libau to Lyserört. 2694, France, west coast:—Channels between Ile d'Ouessant and the mainland. 480, Corsica:—Lava bay to Cape Morsetta. 2600, West Indies:—San Domingo to Dominica. 130, West Indies:—Anguilla to Puerto Rico. 85, Magellan strait:—English narrows and adjacent anchorages. 1374, Chile:—Cape San Antonio to Tucapel point. 1286, Chile:—Tucapel point to point Lora. 647, Chile:—Coronel, Lota, and Colcura bays. 1922, British Columbia:—Fraser river and Burrard inlet. 714, British Columbia:—Oyster and Telegraph harbours. 1923A, British Columbia:—Cape Caution to port Simpson. 1235, Persian Gulf:—Mouth of the Euphrates. 1293, Celebes:—Approach to Makassar. 1739, China, south coast, Canton river:—Whampoa channel to Canton. 3026, China:—Macao to Pedro Blanco. 1199, China, east coast:—Kue shan islands to the Yang tse kiang. 1271, Bays and anchorages on the east coast of Korea. 358, Japan:—Western coasts of Kiusiu and Nipon. 2657, Japan:—Gulf of Tokyo. 1674, Australia, east coast:—Brisbane river. 980, Caroline islands.

(*J. D. Potter, Agent.*)

Scotland. **Hydrographic Office.**

Tidal Streams round the Coast of Scotland. Hydrographic Office, London. 1899. 12 charts. *Price 5s. Presented by the Hydrographic Office.*

The twelve charts which this atlas contains show the direction and rate in knots of the tidal streams round the coasts of Scotland for every hour of the tide at Dover. They have been compiled from observations made during the various Admiralty surveys from 1836 to 1899, and from observations made at the lightships of the Northern Lights Commissioners.

The compilation of these charts has been carried out by Commander Courtland H. Simpson, R.N.

United States Charts. **U.S. Hydrographic Office.**

Pilot Charts of the North Atlantic and North Pacific Oceans for November, 1899. Published at the Hydrographic Office, Washington, D.C. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Central Asia. **Rickmers.**

Twenty Photographs of Russian Turkestan, Bokhara, etc., by W. R. Rickmers, Esq. *Presented by W. R. Rickmers, Esq.*

These photographs were taken by Mr. W. R. Rickmers in Russian Turkestan and Bokhara. The following is a list of their titles :—

(1) Looking east from the top of Hazrat-Ishan ; (2) Yakh-Su valley, looking up from mouth of Safet-Daria ; (3) Hissar ; (4) Conglomerate ; (5) Looking south from the interior of the double barrier ; (6) Hazrat-Ishan, from a point on the west ridge ; (7) In the Beg's garden, Baljnan ; (8) Right bank of the Safet-Daria just above its mouth ; (9) Left bank of the Safet-Daria opposite the Russian colony (barrier V.) ; (10) The Russian colony (November) ; (11) Baljnan ; (12) Conglomerate scenery ; (13) General view of conglomerate ranges ; (14) A side valley of the Yakh-Su ; (15) Hazrat-Ishan and the Safet-Daria valley ; (16) A bridge, Karatagh ; (17) Gallows ; (18) A court-yard ; (19) A gorge, Dandushka ; (20) Village near Munninabad.

China. **Watson.**

Forty Photographs of the Upper Yang-tse Kiang. By Lieut. H. D. R. Watson, R.N., of H.M.S. *Woodcock.* 1899. *Presented by Lieut. H. D. R. Watson, R.N.*

This interesting series of views was taken by Lieut. H. D. R. Watson, R.N., and, as their titles will show, represent river scenery of the Yang-tse above Ichang :—

(1) Win rapid ; (2, 3) Ta Tong rapid ; (4) Kong Sing rapid ; (5–7) River opposite town of Kwei Chau, province of Hupeh ; (8–10) Yeh rapid ; (11) The Tao Tai of Chung King landing at Kwei Fu, province of Su Chuan ; (12–13) Nin Kon rapid ; (14) Looking up river just above Nin Kon rapid ; (15) Wushan gorge ; (16) Pagoda of Patung, province of Hupeh ; (17) Wushan gorge ; (18) Town of Kwei Fu, province of Su Chuan ; (19) Feng Hsiang gorge, upper end ; (20–23) Miao Chi Tre rapid ; (24–27) Hsin Tung rapid, or new rapid of Yun Yang Hsien ; (28, 29) New rapid ; (30, 31) River and river-bed in May, 1899, 4 miles above Yun Yang Hsien ; (32–36) Hsin rapid ; (37–40) Nin Kon rapid.

South America. **Wallace.**

Forty-nine Photographs taken during a Journey from Salta (Argentine Republic) to La Paz (Bolivia), by L. A. Wallace, Esq. *Presented by L. A. Wallace, Esq.*

The journey which these photographs illustrate was undertaken by Mr. L. A. Wallace in 1893. The series consist of forty-nine photographs, of which the following are the titles :—

(1, 2) Looking up stream (Rio Grande) near Senequillas, about 70 miles north of Jujuy, Argentine Republic ; (3, 4) Humahuaca ; (5, 6) On road in river a few miles north of Humahuaca ; (7) Summit above Ojo de Aquas ; (8) At the Posta Cangrejillos ; (9) Mojo church ; (10) Mojo in distance ; (11) In village of Naserino ; (12, 13) On road in river above Naserino ; (14) General view of Tupiza, Bolivia ; (15) Cuesta de Almona ; (16, 17) Cultivating fields at Totora, a little beyond Almona ; (18, 19) Town of Cotagaita, Bolivia ; (20, 21) Indians near Cotagaita ; (22, 23) Arrival of mules at the Posta of Lagunillas, Bolivia ; (24, 25) The Posta at Tolapalca, Bolivia ; (26) Posta at Anacato ; (27–29) Indians dancing in Posta of Challapata, south end of Lake Aullagas (Poopoo), Bolivia, 12,500 feet ; (30) Plaza in Challapata ; (31) Posta in Challapata ; (32, 33) Posta Machamarca, between Lake Aullagas and Oruru, Bolivia ; (34–42), Taken on river Ubiquera, between Salta and Cerro Nevado, Argentine Republic ; (43–49) Taken in the streets of La Paz.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

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A JOURNEY THROUGH ABYSSINIA TO THE NILE.*

By HERBERT WELD BLUNDELL.

The establishment of a British Legation to the court of King Menelik, one of the important results of the English mission under Sir Rennell Rodd in 1897, gave me the opportunity of first visiting Addis Abbeba last year (1898) in the spring, when I obtained permission to accompany Captain J. L. Harrington on his journey to take up his appointment as diplomatic representative at the capital. Our route was that taken by the English mission from Zeila *viâ* Harar, well and fully described by Count Gleichen in his 'English Mission to King Menelik.' The delicate position our envoy was placed in made it impossible for me to suggest a journey I had long contemplated through the southern zone of Abyssinia to the Sudan. The journey, however, not only gave me an interesting experience of Abyssinian life and court and military ceremony, but ample opportunity of making inquiries and arrangements for future travels.

In spite of its want of a good harbour and any natural advantages, Zeila still monopolizes, through sheer good management, the confidence of traders and assures the security of the caravans. On the other hand, Jibuti, only 25 miles to the north, with the finest harbour in that part of the coast, does one-tenth of the trade, with the help of (or, according to their compatriots, in spite of) just twenty-six times as many *fonctionaires*. This elaborate administration has operated in such a way that merchants and camel-owners are most averse to coming into the

* Read at the Royal Geographical Society, December 11, 1899. The map will be published in the next number, along with the Appendix to the paper.

town. In the last few years the road has been enlivened by raids and massacres on a large scale, while a regular war has been going on between the tribes on each side of the route, the Black Isa and the Danakils, who both combine to threaten the French settlers. The railway in slow course of construction is a constant source of irritation to the other local tribes, who are mostly camel-owners; this year it culminated in a regular attack on the workmen, resulting in the murder of a European and fourteen navvies and a threatened assault on the town itself. The railway has only reached its twentieth kilometer or so, but if completed will entirely destroy the trade of Zeila.

The road from Zeila to Harar is about 180 miles, as compared to 220 from Berbera, and will always command the traffic until a railway

TRIAL BETWEEN TWO SOLDIERS: ONE ACCUSES THE OTHER OF COWARDICE IN BATTLE.

is built connecting it with one of the good harbours, Berbera or Jibuti, and according as the former or latter is the first in the field, the trade will be absorbed by the English or the French.

On arrival at Harar, we found Ras Makunen, Governor of Harar, was away on an expedition in the very direction I afterwards travelled, in the Beni Shongul country, so that to my regret I had not the pleasure of seeing this general, who is almost universally regarded as the coming man of Abyssinia. We therefore pushed on to Addis Abbeba, arriving there in sixteen days (about 260 miles), on April 19.

The first appearance of the representative of the British Empire in Addis Abbeba was not impressive. We pushed on ahead of the caravan, and arrived like a flock of half-drowned hens wading through such a sea of mud, as a continuous sheet of water (a sample of what are flippantly called the "light rains") could transform an extraordinarily rich and thirsty soil. We were obliged to beg for a couple of days' grace for the prosaic business of drying clothes and luggage, and furnishing the large round empty hut assigned to us, an operation performed by dividing up the space and extemporizing packing-cases into divans and cupboards. The third day the king sent word that he would receive the envoy in state at his palace. The reception took place about nine o'clock, but at early dawn our compound was surrounded by a variegated mob of men armed with samples of all the guns ancient and modern, dressed in flowing shammas ornamented by a broad red stripe. Among them appeared officers with brocaded shields overlaid with gold

MONEY-CHANGERS, BLOCKS OF SALT BEING CURRENCY, FIVE TO A DOLLAR.

and silver on their arms, and mounted on fat mules gorgeous with brass and silver trappings. Interspersed were the men of distinguished service—lion-killers with a fringe of the animal's mane round their heads like a blonde wig of a bald-headed comedian; elephant-killers with chains hanging from their ears; and warriors with feathers and bangles awarded for various feats of prowess.

As we proceeded out of our gates a rough but picturesque order was formed. Ourselves (Mr. Harrington, myself, and the interpreter) rode in the centre, attended by a large escort and the special bodyguard of the king, with muskets in red cloth covers, preceded by a band of very doleful one-note trumpeters. Finally came Mr. Ilg Conseiller d'État, raised to the high rank of Betwadded ("favourite"), who has signalized himself by his useful services to the country of his adoption, by coaching the king in all matters European, and acting as intermediary between him and foreigners. On each side the escort marched in single file, with a space of 50 yards in breadth between the parallel lines. The reception took place in a large whitewashed hall, situated on a commanding hill, and fenced by a high split bamboo Zeriba, whitewashed walls, floor strewed with rugs, and the roof of gaily coloured matted bamboo supported by wooden pillars. The officers and ministers, in full panoply of state, grouped themselves according to rank, the lines converging towards an alcove, under which, huddled between two high cushions on a throne like a richly hung four-post bed, sat the king. His majesty, though very dark in complexion, with not very regular features, has charming manners and a particularly pleasant voice, while his face is quite redeemed from the effect of the type, by a most intelligent mobile expression and an amiable smile that makes his features almost handsome. The audience was very short. The credentials were delivered and accepted with friendly expressions of the

RETURN OF ELEPHANT-HUNTING EXPEDITION.

usual sort, the (Italian) cannon boomed a salute, and the ceremony that opened a new chapter in the history of the respective nations was over.

After the opening formalities, which had led very speedily, by the good-will of the king and the tact of our representatives, to relations that promised to be of a very friendly nature in the future, it was decided to return to England before the rains (it was now May 16) were imminent. I returned with Captain Harrington, having obtained permission to make another visit and to travel in the country. Before November, 1898, my expedition was organized, and the party, consisting of Lord Lovat, Dr. Koettlitz (late of the Jackson-Harmsworth Expedition), and Mr. Harwood (naturalist), and myself had collected at Berbera by December 7. Within seven hours of landing the baggage, our caravan of camels and horses was moving out of the town to the first camp.

Somaliland—now almost as well known as Scotland as a country of sport—does not call for any description. As our route lay through the country reserved for the Aden garrison, we were obliged to possess our fouls in patience till we arrived at Harjesa—a patience that was sorely tried when a leopard entered the camp at night and killed a sheep in a zeriba in the middle of our Sudanese, and a hyæna purloined our mutton, hung a foot or two over some of our men. We took a *détour* from Harjesa to the north-west along the watershed, in order to pass through Jefa Medr and the Maran prairie, where much game was reported. We were disappointed in lion, but we got some good herds of oryx, awwal (Semmering's gazelle), and hartebeest.

The Maran prairie breaks up on its western border suddenly into mountain ranges round Harar just as the Colorado plains seem to open to let through them the great Pike's peak range of the Rockies. The first ascent is over the thickly wooded Mardo pass, leading from the summit into a fine valley flanked by bold basalt masses, that look with their perfectly horizontal courses like the breeched remains of some huge ruined rampart. Conspicuous among them is the conical pyramid of Gara Mulato to the south, and the lofty battlement of Kondora, over 10,000 feet high, to the north. The caravan route descends into a fertile valley, and emerges between their bulwarks to the last saddle, called Fyambiro, whence it winds along the spurs of Kondora to the hill on which Harar gathers the caravan roads from each point of the compass.

It would be hard to imagine a more beautiful situation for a great city than that of Harar. It stands 5400 feet above the sea, with every condition that makes for wealth and prosperity—fertility of soil, industrious agricultural population, and central position, and what is so rare in the catalogue of advantages of an African town—with an extraordinarily healthy and invigorating climate. Held by the Egyptians from 1874 to 1885, it was abandoned by us in their name, and an agreement entered into with the French by which both nations agreed to refrain from laying hands on it. No sooner had the last British soldier disappeared over the horizon than the Emir Abdullahi tore down the British flag with every insult, and declared his independence. A few months after, the Abyssinians descended upon it, utterly destroying the army of the Emir at Chelunko (three days' march on the Addis Abbeba road), and took possession of the town. Harar, in fact, is a bone dropped by England while she was growling at France, and picked from under their noses by Abyssinia.

The invasion of the Abyssinians, and a subsequent visitation of cholera, rinderpest, and famine, have practically decimated the population of Gallas throughout the whole of this region as far as the Hawash. These catastrophes, however terrible they were from every human point of view, has had the effect of restoring a country teeming with villages and closely cultivated to almost its primeval beauty of fertile valleys and wooded ridges, sleepy hollows only half cultivated by a stricken remnant of the population—tangled tropical forest and grassy slopes succeeding one another in an endless panorama of beautiful parks.

We arrived at Addis Abbeba on January 19, and found the king was still on campaign against the rebel Ras Mangasha in the north, with a large army supporting Ras Makunen's division, who had advanced some distance into Tigrè. The king had advanced his army to Dessieh, within 20 miles or so of Magdala, and we were obliged, therefore, to make up our minds to this extra journey, it being quite impossible to make any arrangements or get necessary permits without a personal interview. The journey lay over the lofty plateau of basalt which stretches from the Danakil plains to the Blue Nile. Where the soil is sufficiently thin this shows through the surface in the form of a polygonal pavement—the exposure of the upper super-

CAMP CHELUNKO, FORTY MILES FROM HARAR.

ficies of the columnar structure. The characteristic form appears in marvellous perfection where the mass opens out into precipitous chasms 4000 feet deep, forming perpendicular walls of the typical polygonal columns, of which perfect examples are seen at Staffa and the Giant's Causeway. The country is almost entirely denuded of trees, except some few stunted mimosæ, and in the more sheltered parts kosso, the tree whose seeds supply medicine for the universal tapeworm, and in the rocky beds the quolquol, acacia, and aloe. On account of its great altitude, 8000 to 9000 feet high, the products of the warmer zone are rare. Wheat and barley are grown in large tracts, but cattle and sheep are the main wealth of the population.

Immediately we got outside the precincts of Addis Abbeba among the natives, we found our Abyssinians were in a strange country, among people whose language only a few were acquainted with. Addis Abbeba, it must be remembered, is a new capital of sixteen years' growth, and Harris ('The Highland of Ethiopia'), in 1842, describes a campaign against the Gallas of the region undertaken by Saleh Salassie, the grandfather of the present emperor, from his then capital of Angolala. Debra Brehan, Liche, and Antotto were the next in order selected as capital. It would be more accurate to call each of these places a permanent camp rather than a city, a movable seat of government and headquarters of the army selected according to circumstances of position or surrounding advantages in the way of supplies of wood, etc.

At Dar Nebba we enter the country of the Wollo Gallas, and approach one of those colossal ravines formed by the apparent opening of the horizontal layer of basalt in the secular upheaval of the land. The effect of travelling over a dead level plain and suddenly coming to the sharp edge of a precipice, like a huge crack in the earth's crust, is very striking, and the difficulty of the roads leading in and out of such chasms may be easily imagined.

The road leads across the two almost parallel ravines of Adabai and Wunchit rivers, affluents of the Blue Nile or Abai, as it is called in Abyssinia; the central rocky partition between the two rivers being about 6000 feet high, and the edge of the plateau on each side being about 8500 feet. The beds of the rivers are about 4500 feet above the level of the sea, making sheer depth of chasms 4000 ft. The last ascent has been well called Haya Fej, or "death to the donkey," and is vividly described by Alvarez, the Portuguese envoy, in 1520, who calls it "Haya Fagi." "Coming out of this narrow pass, one travels through a loophole which is about four spans wide, and from one end to the other these clefts are all shale. I would not have believed, if I had not seen our mules and people pass, that goats could pass there in security; so we set our mules going as if one was sending them to destruction, and we after them with hands and feet down the rock, without there being any other road." Some engineering had been attempted to improve the road, but otherwise nothing had been done for 380 years to change the description.

The whole of this country has been in chronic rebellion, and was only conquered and finally pacified about twenty-two years ago. After the occupation of Magdala by the English, Menelik found himself freed from the danger of Theodore, and able to take another step in the direction of his ambitious projects by subduing the powerful branch of the great Galla tribes. The regent was the famous Queen Workitu, who had given shelter to Menelik when he fled from Theodore in 1865. She was ordered to give him up, or her son, who was a hostage in Theodore's hands, would be put to death. With wonderful courage and fidelity, she released Menelik to return to his country, and her son was put to death by the brutal king. Menelik was finally proclaimed King of Shoa, and after more severe fighting reduced the whole province. His capital was placed at Liche, near Debra Brehan, about 15 miles to the east of our present route to the north. The chiefs of the Galla were Abba Wattò and his brother Muhamud Ali, sons of Queen Workitu. Fortifying Worro Hailo, Menelik waged desperate war with varying fortune for nearly five years, and finally gained a decisive victory over Ali, who barely escaped being taken prisoner. Menelik's cousin Mashasha then comes on the scene, backed by King John, joined his enemies the Gallas, but after severe fighting he submitted to Menelik's uncle Darghèh, Abba Wattò having, with one of those sudden tergiversations characteristic of his people, given his and his people's

A BASALT RAVINE. "DEATH TO THE DONKEY."

submission. At another shuffling of the cards Abba Wattò disappears, and Muhammed Ali is reconciled, marries a daughter of the king's concubine, turns a Christian, and blossoms forth as Ras Mikael, now governor of these very Wollo Gallas.

After Worro Hailo, always an important strategical position, the country becomes mountainous, and we pass over the shoulder of Mount Yoel, at a height of 10,400 feet, into a series of fine rich valleys walled in by wooded hills and lofty peaks. Commanding one of these well-watered valleys, on a hill 2000 feet above them, was perched the Gebi, or king's (Menelik's) camp and residence, and round it, in a succession of vast amphitheatres of hills, were grouped in concentric circles the tents of the different divisions of his army. The moment of our arrival augured well for our cordial reception. Not only had some recent events on the Nile stimulated a friendly appreciation of British virtues hitherto somewhat overlooked, but the rebel, Ras Mangasha, finding his adherents melting away as his cause looked less likely to be successful, had tendered his submission, and a triumphant ending to an anxious campaign was in immediate prospect. Again, "the lion of the tribe of Judah hath overcome," as the royal motto runs. We were as usual most cordially received, and after an interview, during which we brought forward a request to be permitted to travel through the western frontiers of Abyssinia to the Blue Nile and the Sudan, we received permission, and promises of the necessary letters of safe conduct and recommendation to the various chiefs and officials on the route.

In order to vary the monotony of a return journey to Addis Abbeba by the same route, we determined to descend from the plateau and go back by the lower road through a series of valleys, into which the lofty tableland breaks up in Titanic steps to the lower levels of the Danakil plain. The first two days' marches took us out of the dense clouds that had hung over the whole camp and surrounding hills for several days, and we found ourselves on the river Burkenna, an affluent of the Hawash, nearly 3000 feet lower than the king's camp, among a totally different vegetation and climate. Cotton grows luxuriantly, and the people also largely cultivate millet (in Abyssinian "meshella;" dhurra of the Arabs), teff (*Poa abyss.*), and Bahr mashella (maize). Groves of limes are to be seen in abundance. The trees are olives, cypress, podocarpus, and the great *Euphorbia abyssinica*, the giant cactus, with its long green arms curved up like huge candelabra. These fertile valleys and the passes which lead from one to another have been the blood-stained zones over which the fierce racial and religious struggles have swayed since the days of Amda Sion, King of Abyssinia (died 1331), and Hag-ed-Din, the Sultan of Ifat. It was through these valleys that the Moslem hoards, under the terrible Muhammed Graan (the "left-handed"), swept through the country like a destroying fire, till, towards the middle of the eighteenth century, Abyssinia had reached the very lowest gulf of disaster in all her history.

On February 23, 1889, we left the lower country, after crossing the Robi, an affluent of the Hawash, and again ascended to the higher plateau, which for seven days had been towering over us like a black wall. We passed a monastery, Debra Sinai, enclosed in a dense clump of trees, and, after a stiff climb along a well-engineered mule-road, reached a fine level grassy plain, the district of Diff-Diff, the first camp being no less than 9500 feet above the sea. We left Ancobar, the former capital, 20 miles on our left, a dwindled town of 4000 to 5000 inhabitants, largely priests; a few industries have survived the removal of the seat of government. It was here that Harris in 1842 was received by Saleh Salasseh, grandfather of King Menelik, and some idea may be given of the modern expansion of Abyssinia in this and the southern direction from the fact that Farri was then the recognized boundary between Abyssinia and the Sultan of Tajura, just at the foot of the plateau. Harris describes a campaign of the king at which he assisted along the very track where our road lay, against the Gallas of Germama and Finfinni. The latter is now the centre of the present Addis Abbeba. We arrived at the capital February 28.

Dr. Koettlitz, who was left in charge of the mules and horses, had made such superhuman efforts that, in a country where "next month" would correspond to the "to-morrow" of the most dilatory oriental, we were ready to start the next day but one. We had, besides our own pack-mules (about thirty-two to thirty-eight, according to the fluctuating conditions of their backs), a contract transport of about thirty mules for extra food, etc., to take us to Bilo, an important trading centre of Leka province, which was our first objective.

On March 2 our caravan passed out of the capital under the Gebi, or king's palace, which crowns the top of a round eminence, at the foot of the range on which the former capital Antotto stands, the ground sloping away to the south, but broken by the fine masses of Yarru on the south-east, and in the south by the towering cone of the sacred Sakwala. This mountain has near its summit a holy lake and a monastery of special sanctity. While we were away, Dr. Koettlitz made it the object of an interesting expedition. A spur of the Antotto range, called Delata, encloses Addis Abbeba on the west, a prominent landmark upon it about 6 miles from the Gebi being a conical hill, Managasha, or the King's Crowning, from a tradition that after a great battle a king was crowned here as conqueror over the surrounding country. The road is nearly due west, and skirts the Mecha range (practically a continuation of the Antotto hills), which, running parallel to the road on the north, slopes down to the hot and almost desert plain of Bechi, an extension of the Hawash valley. The reckless destruction of wood has cleared a space in this direction of 12 to 14 miles from the capital; but a wiser course prevails now, and wood-cutting is forbidden here except by royal permission. Along the lower slopes, however, of the wooded Mecha range the ground is cleared for cultivation, and the fertility of the soil is shown by the number of village settlements and the crops of millet, cotton, and tobacco. There is an important market, Jessaluffi, and a custom-house, this being the boundary (about 17 miles from Addis Abbeba) of Dejas Ubi's jurisdiction. He is stepson-in-law of the king (queen's son-in-law).

The next day (March 4) we passed the house and property of M. Lagarde, the diplomatic representative of France, raised, in recognition of his eminent services, to the dignity of his grace the Duke of Antotto. It is charmingly situated among the hills at the foot of the wooded range that still flanked our road on the north, and here called the Characha hills. It faces west over the Hawash valley, which bends to the north at this point, and we passed the river, here an insignificant stream, about 75 miles from Addis Abbeba. Still keeping due west and rising slightly, we passed the water-parting of the affluents to the Hawash valley system and the Blue Nile, the Gudr river being the most important of the latter. We passed it over that rarity, a stone bridge built across a deep rocky chasm, and the river, after keeping parallel to the road for 6 miles or so, turns north by a precipitous break in the northern range, which has gradually assumed the flat-topped, rampart-like appearance of the great plateau to the east of Shoa.

The scenery from the Hawash is very fine; the mountains are clothed in wood, conspicuous being the giant long-leaved yew, called zigwa (*Podocarpus elongatus*); every foothill or valley is covered with intermittent cultivation and abundantly watered by streams running through every ravine. The face of the country everywhere shows signs of past warfare and passing expeditions. Many houses are burnt or abandoned, and much of the rich jungle is a reconquest by nature of what was formerly land covered by crops of cotton, wheat, and millet.

We arrived at Chellaha on the 8th. The village crowns the edge of the first distinct terrace by which the higher plateau descends 3000 feet to the basin of the Gibbe. This river takes its rise among the hills at the termination of the Chellaha elevated ground, which, trending to the north-west, is the extension of the water-parting between the north and south. The headwaters of the Gibbe are actually in the lofty mass of Kwunchi, which stands up out of this lower ground. The river flows at first in an almost easterly direction, and, receiving streams from the Northern (Sobu mountains) elevated plateau, turns due south and becomes the river Omo flowing into Lake Rudolf. We passed under the Kwunchi range, and in two hours' march across a valley intersected with numerous streams, we reached the Soddo range, at the foot of which, in a rich and prosperous-looking plain on the banks of the river of the same name as the town, is the local capital Bilo. From Bilo is a two and a half days' march over an extraordinarily rich country, hilly, but well watered, and in the immense depth of the soil in the valleys showing evidence of the heavy rainfall.

The country, as before, along the road shows the destruction wrought by passing expeditions, though probably this cause has not been so pauperizing as the appalling loss of cattle through rinderpest, which has in many places almost annihilated the principal wealth of the inhabitants from Harar through the whole breadth of the country. Cotton seems to grow luxuriantly, as well as tobacco. The great grass fires disfigure the landscape with patches of blackened desolation in early spring, but the verdure that springs up with rapid luxuriance shows the value of this primitive expedient by which the natives clear the ground for grass and cultivation. The younger growth of trees gets killed off, but the great monarchs of the forest that have held out against the conflagrations stand out here and there in the landscape, and look worthy of being invested with the religious reverence which the pagan Gallas gave to certain trees. Chief among the latter is a tree that is covered in early spring with masses of white flowers of the species called "wanzeh" in Galla (*Cordia abyssinica*), while species of the giant fig ("shola") and a tree covered with blossoms like an azalea (*Sternospermum Kunthianum*), are among those most ornamental. Two and a half days' march brings us to the town of Gatama, seat of the local government under Fitaurari Waldo

LANDSCAPE BEYOND BILO.

Miskal, to whom we had letters from the king. He had been out on an elephant hunt with a small army, and had succeeded in slaying one, after one man had been wounded by an elephant, and another injured by a fellow-sportsman—the latter, I should imagine, being the most common form of casualty, judging from the numbers that assist at a battue and their style of firing. He was not encouraging as to the prospects of elephant-shooting near, but advised us to go on to Lekemti, the chief town of this district, and seat of the governor, Gabr-esgier-Gaher. We accordingly started next day, and arrived in the afternoon at Lekemti. Gatama lies south-west of Lekemti, and is situated at the edge of a high ridge separating the Gibbe from the Didesa valleys, the main direction being about north-west and south-east, and sloping to the north. The height of Gatama is 7050 feet; Bilo, 4768; and Lekemti, 6900. Immediately below Gatama can be seen the valley of the Didesa, buried in dense forests and hot jungle; it is looked upon by the natives—as indeed it is—as a feverish tropical climate compared to the comparative coolness and perfect salubrity of the higher plateau.

Gabr-esgier-Gaher was, like most of the governors, at the wars in the west, and we soon found that his lieutenant, one Busha Groskè—a suspicious underling with the face of a prizefighter—was very anxious to escape the responsibility of showing us his chief pet preserves, known to be the great forest belt of Handuk, which fills the deep valley of the Didesa. He gave us guides to show us the way, but we suspected, and soon found out later on, that they led us away from the most likely spot, but always with the assurance that the elephant did not come up the valley as formerly, but were to be found in great quantities on the frontier near the Dabus. Lekemti is a large scattered town of some 40,000 inhabitants, situated on undulating ground, with all the evidence of prosperity. All kinds of produce, corn and honey being principal, and large quantities of cotton, native and American; iron and copper metal from the west are to be seen in the markets.

From Lekemti our road was about north-west. Gradually descending by easy gradients, in thirteen and a half hours' march we cross the Didesa, a fine river flowing through a grand gorge flanked by the mountains of Sarti on the west, and fringed on each side by dense forest and bambo jungle. The river-bank is 3300 feet above the sea. Numerous schools of hippopotami were basking within a few hundred yards of the ford, and we shot one under the impression that it would be useful for food; but the Abyssinians would not touch it, and though we tried the tongue, I can safely say I never penetrated into it far enough to be able to say what it tasted like. The natives, however, disposed of it, so that our consciences were consoled for killing an inoffensive animal that scarcely can be ranked as game.

Since leaving the first camp after Lekemti, the lower altitude and greater heat had introduced us to a quite different vegetation. We travelled through forests of Gardenia (*Thunbergia*) and Protea (*Gaguedi* in Abyssinian), a tree with a leaf like a magnolia and a large yellow blossom. The latter had bloomed soon enough to be injured by the fires, but the former were in the full glory of bloom and scent, and some of them reached the height of 15 to 20 feet, with wood 8 to 10 inches in diameter. A stiff climb out of the gorge of the Didesa brought us from stifling bamboo jungle through a splendid forest of Gardenia to the district of Merichi, where we were at an elevation of 6800 feet, and our road continued along rounded ridges nearly due west for about nine hours' marching to Siban, when it turns due north, and then continues about north-west to the frontier. The features of the country are rolling down, the contours reminding one of glacial action; the violent rains, combined with the effect of sun, producing such breaking down of the volcanic rock as to give the effect of that agency in northern climes. The country is populous, villages being sprinkled in pretty close proximity over the country, and the ground kept clear of wood and jungle. At Mendi, forty-six hours' marching from the Didesa, we were at the frontier settlement of Abyssinia, at the edge of the next great ledge or terrace overlooking the Dabus valley and the watershed of the Blue Nile.

The journey from Addis Abbeba lay through the land of the Gallas, and it may not be amiss to take a cursory glance at their history. As usually happens, the name they give themselves is not that known to the Abyssinian and Arab Gallas. They call themselves Ilmormo, or sons of Orma, a sort of eponymous hero, who had eight sons—Borana, Tolama, Liban, Gudru, Jemma, Nonno, Hurru, and Amurru—from which descend the different Galla tribes. The word Galla itself means "emigrants" (cp. Agazi), and their natural traditions bring them from a great sea towards the tenth century. At any rate, they made their appearance on the Abyssinian frontiers about 1542. At first they were without horses and a pastoral race; when, however, they settled on the fertile borderland of Abyssinia they developed agricultural tastes, and became famous breeders of horses, and their horsemen formed an irregular cavalry that inflicted many reverses on their Ethiopian conquerors. The tribes used to elect in turn a president, "Abba-Buku," for a term of eight years; but at present, apparently, they have entirely submitted in the region within effective occupation of Abyssinian troops to local governors (who are, however, often chiefs of their own race), and Abyssinian headmen of villages representing the king, called Shums. Their language belongs to the proto-Semitic branch, and allied to that of the Somali and Danakil, and is generally divided into five dialects: (1) That of the east and north of Shoa, the Wollo, etc.; (2) Ittudia on the Somali side, and spoken by the Ittus, Arussi, Karains, and Alabas; (3) the Gojob, that spoken by those on the south, Enarea Gudru, Kucha, and Mecha, where our journey lay; (4) the Shoan dialect; and (5) the Equatorial. Their religion has been the subject of many investigations, and may be summed up as a belief in a supreme nebulous being, Wak, and below him two divinities, masculine and feminine, Aglieh and Atatieh.

The physical type varies very much according to the ground races the Gallas have been brought in contact with. In the neighbourhood of Abyssinia they are lighter coloured than the Abyssinians, and are of finer build, with more regular features. On the south such types as the Arussi are darker, and more approach the Somali type. Coming to the western border, *i.e.* Leka Gallas, beyond Bilo, there appears a light-coloured type, with mild brown eyes, fine delicately chiselled features, thin lips, broad flat foreheads, and straight profiles, strongly recalling an Indian type; a fact that, taken in conjunction with their national traditions and the religious characteristics of South India and Ceylon, especially in the matter of tree and serpent worship, may point to a conquering people entering the east coast and assimilating with the native races. This particular type seems to correspond to that of Enarea (Narea of the Portuguese), and described by Bruce and others. Narea may have been the position where they kept themselves more isolated, and retained in consequence their racial characteristics in comparative purity.

The frontier of a country, whether coming in or going out, is generally where the traveller's troubles begin, and we were destined

TYPES AT MENDI MARKET.

to be no exception to the rule. The governor, Dejasmach Damisi, had just conducted a campaign, *i.e.* a raid through this portion of the country of the Beni Shongul, and in view of his being still at the capital Abderrahman, the king had given instructions to the local headman at Gori to hand us over to him, Damisi being enjoined to facilitate our journey to the Blue Nile. Damisi, however, had left Abderrahman and made a wide sweep through the Dinka country and the Baro to the south. No interpretation of the spirit of a document is ever, of course, possible to a subordinate. He would take us on a wild-goose chase to Damisi, but we must not go on without special permission to Abderrahman. There was no help for it but to send a mounted messenger back to Addis Abbeba, and get special and detailed permission suitable under the altered circumstances. The permit, however, to *faire la chasse* admitted luckily of no misinterpretation, and we were relieved to find that elephants and other game were plentiful in the valley of the Dabus which lay below the hills of Mendi, and has formed for a long time the acknowledged and natural frontier between Gallaland (now Abyssinia) and the Shankalla or negroid races of the great Nile basin.

The very next day we organized a shooting-party, and started off towards the Dabus valley, where elephants were reported, accompanied

TYPES AT A MARKET, GOBI.

by the obstructive *shum*, a pock-marked ruffian, of repulsive personal habits and worse manners, and an escort of equally unattractive raga-muffins. We certainly saw many old elephant paths, but the tracks showed that they were mostly made during the rains, when it is probable the animals come up into the higher ground from the south-west Dinka country, where the gun has not yet penetrated in large numbers, and where it is well known that they still roam in large herds. Several long and fruitless days were spent in trudging over innumerable tracks in stifling bamboo jungles, but no fresh ones appeared until one day a party of our caravan disturbed, and were much disturbed by, a herd of about twenty. Word was brought to us, and though we took up the tracks at once, they had too good a start, and getting another fright they got away far enough to make pursuit hopeless for that day. The next day proved again a blank, but the next, when out by myself, I was surprised at lunch by a very big "rogue" sauntering along with an easy roll through the bamboo not 250 yards off. He got our wind enough to be startled out of his quiet stroll into a quick walk, and gave us a pretty hot run to get up to him. I got a good shot behind the shoulder, not being able to see his head as he stood behind a clump of bamboo. He turned away evidently hard hit, and gave me another chance about

FALLS OF THE DABUS.

200 yards further on, when he went on and hid in a very dark jungle of young growing bamboo. Out of this he suddenly turned and charged, but instead of charging home he swerved away at about 30 yards and gave me a good side shot, which brought him up standing, and after making an attempt to turn at me, he rolled over on his side. He proved to be a very large specimen, 11 feet 11 inches * measured to the top of the shoulder; this is bigger by 10 inches than any recorded, so far as I have been able to find out, except one shot by Mr. Foa, and given in his late publication, 'After Big Game in Central Africa,' at

* This measurement was taken lying down; the compression of the foot in a standing posture would reduce this by 3 to 4 inches.

12 feet $2\frac{1}{2}$ inches. The next day both of us went out, and Lord Lovat took on a fine active female with a good shot between the eye and ear. It seemed to be a little low, for, after staggering for a second, she went off like an engine into the bamboo. We followed her up, and found her lying in wait in thick scrub with three or four others. Suddenly the bamboo parted like grass, and out she rushed like a torpedo, charging right home. Lord Lovat waited steadily till within five yards, and gave her a good one almost exactly on her forehead over the juncture of the trunk. This swung her round as quick as a teetotum, and I, standing close by, got a shot into her as she turned. This considerably diminished her ardour, and after getting away about

DABUS RIVER.

200 yards, we found her very sick, standing motionless, and Lord Lovat gave her the *coup de grâce*.

The next day I left for the standing camp, it being imperative to get supplies sufficient to carry us right to Famaka, the country in front having been absolutely laid waste, and the people reduced to semi-starvation by the two Abyssinian expeditions of last year and this. Such a clearance had been made of the resources of the people that a regular caravan had to be organized to scour the country for ten days to get enough wheat and sheep, etc., for our caravan, and an estimated ten to fourteen days' march and halts. In the interim, finding from the head of the Abyssinian frontier police, as I may call them, that the Blue Nile, or Abai as the Abyssinians call it, was at no great distance and a good elephant country, I made an excursion there, and in barely five and a half hours' marching reached the Gumbi ridge, which bounds the horizon on the east from our camp, and found to my astonishment the valley of the Abai at my feet, and the silver sheet of water not 6 miles off. According to the maps, this point of the Abai would be nearly 70 miles from the camp at Mendi; and I think the error arose from conjecturing the course by the lie of the distant mountains, which, however, are very much to the north of the river, and attributing this stretch of the river to the lower reach of the Didesa. The latter flows into the Nile at the range called the Chochi, some 20 miles further south than its junction as placed in the maps. In ancient maps of the Portuguese (1620), the Angar is rightly put, but the Didesa is apparently taken to be the White Nile. The blank in maps of Abyssinia south of the Blue Nile is due to the fact that Gojam, with this river at its south boundary, extends some 20 miles further south at its south-westerly bend.

From here I joined the caravan, a day's march on the Abderrahman road, and, after a long march of nearly nine hours, camped on the bank of the Dabus. The next day we crossed this fine river, 200 yards wide and 3 feet deep at the ford, and next evening were joined by Lord Lovat, who had had splendid sport with elephant, and had killed seven—four in one day. He found the natives of great assistance, a race probably of the Berta tribe of Shankallas, a typical ground race as contrasted with the migrant and conquering tribes of Gallas and Somalis, deeply versed in field and forest lore, with a name for every tree and plant and bird. He witnessed a most interesting case of their finding honey by the honey-bird. This bird came into the camp uttering a peculiar note. The natives recognized it at once, and prepared to start in the most business-like way to follow the bird. They were brought straight to a tree, which they promptly proceeded to divest of an immense bees' nest, and extract the honey. The Abyssinians were much impressed with this performance (they are very fond of honey), and when the bird made its appearance again, were evidently on the alert to imitate the natives, and followed it. The difference in note and movement, however, was immediately detected by the Shankallas, who took no notice of it, and, needless to say, the Abyssinians could make nothing of the business.

The land descends to the Dabus from the Mendi plateau, and tapers away to the north in three ranges, Gumbi, Chochi, and Gonfi, the district Barke on the north side of the Dabus belonging to the level of the Blue Nile, and is practically the extreme edge of the great Nile basin. Three days' march from the Dabus, through a country seared in all directions by the fires of the invaders, brought us to Abderrahman, the capital. Abderrahman Ibn Khugli, the ruler of the country, had joined Damisi in his expedition to the south, and the ruling family was represented by his son, a child of five or six, who, with his uncle, came down in state, surrounded by a guard of variously-tinted negroes to pay us a formal visit. We entertained him with an exhibition of white rats that ran by clockwork, and a most engaging cat that, when wound up, wagged his head as he walked, and bleated like a lamb. I am bound to say that the elders of the government were as delighted as the child, and the toys were accepted as a gift, and are now, no doubt, added to the national treasury.

The name Beni Shongul * does not occur in the accounts of early travellers. The principal stock belongs to the Berta tribe, whose range is from the Blue Nile to the Bambishi mountains in the south, and Dabus on the east. Their ruling families were probably of the Fung race, who migrated north on the destruction of the Nubian power at Dongola in 1504, driving the Arabs before them, and collided with the Abyssinians under Socinius in 1610–12. They are an offshoot of the negro races of the Nile basin, though through mixture with Arab and Galla blood, they are now easily distinguished by their lighter and smaller frames and less distinctly negro features. Every gradation, however, exists from the almost pure negro to the half-bred Arab or Galla, and there is the same variety of religion, language, and weapons. Two curious weapons are characteristic of this race—a throwing-stick, or boomerang (called trumbash), of exactly the same shape as those represented in hunting-scenes in Egyptian monuments; and an ugly looking sickle-shaped knife with a prong sticking out of the middle of the curved blade, forming a two-pointed and bladed scimitar 2 feet 6 inches long. Caillaud was the first to enter this northern point of the country, which he did in company with the expedition under Ismail in 1821. Fazokl was under a Melik called Hassan, a Fung, whose family pedigree Caillaud gives for over 200 years. He submitted to Egyptian arms, and was made to pay tribute of 1000 okas of gold and 2000 male slaves. Ismail's covetousness was much excited by reports of gold, and Caillaud gives an entertaining description of his dismay and disgust at the results of some digging which seemed to have been so contemptibly paltry compared to what his Oriental imagination had led him to anticipate. Just before the Dervish rise to power in 1881 to 1882, this tract was governed by an Egyptian Mamur at Fazokl, under whom were three hereditary sheiks, viz. at Beni Shongul, Gomasha, and Kehli. Their tribute amounted to 1500 okas of gold, or £6000 a year. In 1887 the Dervishes entered the country under Khalil Hosami, but the people would have no dealings with them, and refused them supplies. They retired, but again appeared in force under Abderrasul Omar in 1889, but were again driven back by the head of the Khugli family, called Tur el Guri.

* Beni Shongul = sons of Shankala in an Arabic plural form.

The country through which we passed may be described as an alluvial plain, the strong black soil of basalt denudation lying in the lower ground, but exposing great tracts of grey trachyte in higher levels. The ground is broken by isolated outliers of broken basalt masses that raise their backs like great spines on the otherwise monotonous landscape. For some distance from the Dabus, we had still the thick woods of Gardenia, but after leaving Abderrahman we approached the scenery of the Blue Nile. After crossing the Tumat, we struggled over deep cotton soil and dense jungle, till we descended to the river valley, where the branching dom palm, nourished by subterranean waters, defines the windings of the Nile to beyond Rosaires.

On May 6, we crossed the Blue Nile, here 250 yards wide, and joined hands with the Commandant of Famaka and his detachment of gallant 10th Sudanese, which had distinguished itself at the desperate fight with Ahmed Fedil, near Rosaires. Dearth of transport kept us here for a few days, but, gradually collecting camels and donkeys, we moved down in two detachments to Rosaires along the north bank of the river, for the most part through thick wood and jungle, amidst which the gigantic *Adansonia*, Baobab trees, raised their weird gourd-like arms like the conventional trees of a Christmas pantomime. From Rosaires a gunboat took us to Senaar, and from there to Khartum we descended in a native sailing-boat, a nugger—a sailing-boat, however, that only sails up stream, and is really a drifting raft going down, the movement slightly accelerated by men working a pair of huge clumsy sweeps, two men to an oar. The result was that we were eight days slowly crawling down, scarcely beating the current, cooped up under an awning about 8 feet square at 110° in the shade, with suffocating nights from Senaar to Omdurman, a distance of almost 200 miles. On June 1 we passed under the façade of the rapidly growing governor's palace among the palm trees at Khartum, and that night we lodged in the Khalifa's house, I sleeping in his state "bedroom with bathroom attached."

The spoils of our expedition, besides geographical and geological exploration, were eighteen different kinds of antelopes, ten elephants, and two lions.

The bird collecting, which Lord Lovat took charge of with untiring energy, assisted in the skinning by Mr. Harwood, was rewarded by the result described as follows by Mr. Sclater, F.R.S., in his annual address to the Ornithological Club, November 22, 1899: "Their bird collection contains 520 specimens, representing 299 species, of which eleven are new; examples of many of the species described by Rüppell, and known only by the types in the Frankfurt Museum, are also among the number. A special point of interest in this collection is the number of birds previously only known from eastern and equatorial Africa, which have now been found in Southern Abyssinia. This extremely interesting collection is now being worked out by Mr. O. Grant." The whole collection has been presented to the British Museum.

It is always of interest to endeavour to forecast the destiny of a new country, and, without risking the dangers that beset a prophet, we may fairly take stock of the field laid open to future enterprise by the destruction of Mahdism. We have here, for no less than 10 degrees of latitude, an immense range of country, whose products are among the most valuable on earth—cotton, coffee, tobacco, and iron, copper, and gold, with a healthy climate, and above all an industrious population, with nothing wanted but greater inducements and improved communication to be brought within the circle of British commercial enterprise, and developed to the highest degree of prosperity.

The Cape to Cairo railway has generally been associated in the mind with the course of the Nile, but it is gradually being realized that this, in a great tract of country between lat. 6° and 10°, is not much better than an immense reservoir, and can scarcely be reckoned as even a waterway. The railway and telegraph will both have to leave the great catchment basin of the Nile, and tap the resources of the whole western side of Abyssinia to the Atbara. If we compare these frontier lands with the Sudan proper, I do not think it would be too much to say that there is more hope of prosperity and trade development immediately outside the Sudan than in it. The climate, soil, population, the capabilities of that great rich region of Galla land that has lately fallen under the dominion of Abyssinia, will some day prove a great accession, not only to the wealth of Abyssinia, but to bordering countries. We may safely say that an era has opened that gives hopes of a fairer destiny than has ever been the lot of these harassed regions in the stormy past, but we may add that the essential condition is a good and settled government, and that this is synonymous with friendly relations between the two powers, Great Britain and Abyssinia. In King Menelik we have as a neighbour a far-seeing and enlightened ruler, whose consolidated and extended empire we should regard with a perfectly friendly eye, so long as under his guidance it continues to advance along the path of peaceful progress and development.

Before the reading of the paper, Colonel Sir Thomas Holdich (Vice-President) said: It will be a relief to us all to-night, I think, to turn our thoughts for a brief space from Southern Africa to Northern Africa. To-night we have to follow the footsteps of Mr. Weld Blundell and his companions through the most interesting regions of Southern Abyssinia. Of the political importance of Abyssinia, situated as it is between the Somali country and the Red sea on the one side, and the Nile valley on the other, it is not necessary to speak; but I am quite sure a more intimate acquaintance with the geography of the country, and a better understanding of the manners and customs of its interesting inhabitants, will lead us to form sounder conclusions as to what ancient Ethiopia should be to us, than we can otherwise obtain.

After the reading of the paper, Dr. KOETTLITZ gave a summary of the geological observations, which is printed in the Appendix.

Dr. BOWDLER SHARPE: At this late hour of the evening, when we have had a sort of supplementary paper from Dr. Koettlitz, I will merely say that probably this expedition of Mr. Weld Blundell and Lord Lovat will rank in the history of zoology as an extraordinary feat in expeditions. A most unfortunate occurrence deprived them of the bulk of their cartridges, but you have heard from Mr. Blundell to-night that we have had five hundred specimens of birds alone, in my department of the museum, on which Mr. Ogilvie Grant has written a paper. These specimens were collected during a journey which was adventurous in the highest degree, and besides that there were the difficulties of transport and the collecting of specimens. Three hundred different species of birds were collected and are represented by these five hundred specimens. When one knows that they were short of cartridges, and that they had to examine every bird with their field-glasses before they shot it, to make sure that it wasn't already in the collection, it is really a most wonderful exploit. I believe such a thing has never been done before in the history of zoology. If you have any number of cartridges of course you can collect all round, but when you go with the intention, as Mr. Weld Blundell and Lord Lovat did, to bring back as much as possible, and find yourself very short of ammunition, there is nothing more difficult than to make a splendid collection, as they have done. The great interest to us is that since Sir Cornwallis Harris, no Englishman has penetrated into Shoa. His collection went first to the Indian Museum, and then came to the British Museum, and our specimens through India, are very old and were mounted in the old-fashioned way and exposed to the sun and dust for many years, becoming very dilapidated indeed. The travellers have generously presented to the British Museum this beautiful collection, so that we now have representatives of numbers of species of birds unknown to English naturalists, the only other representatives being in the museum at Frankfort, collected by Rüppell in the early part of the century. In addition there are fifteen new species that have not been seen before, and it is interesting that, starting as they do in Somaliland, they carry the Somaliland fauna a certain distance into Eastern Abyssinia and the borderland of Shoa. It is interesting to compare this collection with that of Mr. Lort Phillips, made during his expedition into Somaliland. Perhaps one of the most interesting facts is that in this country there is a certain East African element; there are specimens of birds we have never seen before, but which have been discovered in German East Africa, so that when Mr. Grant has finished his account, I am sure we shall find there are relations between the ornithology of this corner of Eastern and North-Eastern Africa which we had not suspected before. I have only to say that it is very nice to be able to congratulate an English expedition on having done such good work in the cause of science, and it is a pity that, with all the energy our Government shows in different directions, it never does what the French and Germans do, *i.e.* appoint a naturalist in every country they explore. If it was not for the energy of our private subjects, like Mr. Weld Blundell, Sir Harry Johnston, Mr. F. J. Jackson, and Mr. Lort Phillips, we should be far behind in the race for scientific knowledge and discovery, in Africa at least. To point the truth of what I say, I may add that when Uganda was pacified and the "Pax Britannica" reigned there, the first person to take advantage of it was the German naturalist Oscar Neumann, and the first result of Mr. Blundell's good relations with Abyssinia is for Mr. Neumann again to follow in his steps. Why the English Government cannot do what private individuals and public-spirited societies of England do, is a mystery I shall never be able to solve while I am an Englishman.

Sir Thomas Holdich: I have first of all to ask you to accord a welcome to a very distinguished traveller, who has returned amongst us from a far country—Captain Deasy. For months past we have only dimly heard of the excellent work he has been doing in a remote corner of the world, the south-west corner of Kashgar or the Chinese "New Dominion." Next we have to deplore the absence of our President on this occasion. When the expedition to Magdala was undertaken in 1868, Mr. (now Sir) Clements Markham was appointed to accompany it as historian and geographer, and it is from his excellent book on the subject that we know as much as we do about the physiography of the northern parts, which seem to differ in no very essential degree from what Mr. Weld Blundell has told us about the southern. To me the most interesting feature about Abyssinia is the existence there of a Christian community, which has lasted so much longer in high Africa than any other similar community in high Asia; where such communities disappeared before Mohammedanism. I believe the Abyssinians date their Christianity from the teachings of that eunuch of Queen Candace, of whose conversion we read in the Bible. Historical evidence places it about the beginning of the fourth century. However that may be, it is certainly a Christianity which recognizes symbols and forms and ceremonies very much more than the ordinary practices of the Christian religion. One symbol in particular, I remember, is the exhibition of something blue as an indication of a bond of religious affinity; this claims an Abyssinian's friendship and regard as to a brother Christian. The origin of this I have never been able to discover, but I observed in those very quaint pictures which decorate their churches, which are either caricatures of Byzantine works of very ancient date, or else, as I am inclined to think, of Portuguese works of later date, they carefully preserve the blue colour for the robe of the Madonna—exactly in the same way as you will see in the mediæval art of the old masters. I believe Colonel Conder also mentions, in one of his books on Syria, blue as a recognized symbol of Christianity amongst the communities there. No one, however, has been able to tell me what the origin may be. I asked my learned friend Sir Henry Yule about it, and he was unable to tell me exactly when it originated.*

Of the Abyssinian's regard for observances I had an uncomfortable proof on one occasion when surveying the upper sources of the Atbara during the Abyssinian expedition. I happened to light one day on the same camping-ground as the well-known Tigre chief Yessus, who had made himself objectionable in many ways. I was so little inclined to take up my position alongside him, that I began to make tracks elsewhere; when he sent a deputation to remind me that next day was Easter Sunday, and asked me to join him in celebrating it. I thought I had better not refuse the invitation, and I attended. It was the crudest and rudest sort of banquet at which I have ever assisted. In the centre of a big red tent we sat on the ground to eat raw meat and drink raw "tej," and my host got uncomfortably tipsy. I had misgivings as to how things would end, so I had stationed a guard outside to assist me out of difficulties, if necessary. Next day I meditated a return

* At the conclusion of the lecture, it was pointed out to me by Mr. Levi, a learned Oriental scholar, that blue was the national and religious colour symbol of the Hebrews (*vide* Numb. xv. 38, 39), and that in all probability it was borrowed from them by the Abyssinians or Ethiopians in very early days. As the colour representing the feminine principle in nature, it is at least as old as the myth of Venus rising from the sea, and in heraldry blue is denoted by horizontal lines representing the sea. Yet the colour symbol of the prototype of Venus (the goddess Ishtar) of the early Chaldæans appears to have been pale yellow.—Th. H.

call to say "thank you" for the entertainment of the day before, but my host had left, and in an absent-minded manner he had taken all my transport with him.

I must ask you to join with me in rendering thanks to Mr. Blundell for his admirable lecture, which has interested us exceedingly.

(*To be continued.*)

HUDSON'S VOYAGE TO SPITSBERGEN IN 1607.*

By SIR MARTIN CONWAY.

The most puzzling of all the accounts of early voyages to Spitsbergen is that which describes Hudson's voyage of 1607. The fault was probably not Hudson's, for he is known to have been an accurate observer, but John Playse's. Playse (or Pleyce) was one of the ship's company, who kept a journal and seems to have copied into it extracts from Hudson's log. It is clear, however, that he either misunderstood what Hudson wrote, or altered it in the copying, for the purpose of claiming new discoveries beyond those made by Barents in 1596, as well as the attainment of a far higher latitude than was actually reached. In support of this contention I now proceed to analyze Playse's account, as printed by Purchas (vol. iii. p. 567), and reprinted by the Hakluyt Society in 1860 ('Henry Hudson the Navigator,' edited by G. M. Asher, pp. 1–22).

On May 1, 1607, the *Hopewell*, eighty tons, with Henry Hudson for master, John Colman mate, William Collins boatswain, and a crew of eight men and a boy, weighed anchor at Gravesend and sailed for the northern seas. After spending some time on the coast of Greenland, they sailed eastward for Spitsbergen, of whose discovery by Barents they were aware, and by whose chart they apparently directed their course. The claim that they independently rediscovered the island cannot be sustained. On June 27 (p. 8), "about one or two of the clocke in the morning, we made Newland [*i.e.* Spitsbergen], being cleere weather on the sea; but the land was covered with fogge, the ice lying very thick all along the shore for 15 or 16 leagues, which we saw. Having faire wind, we coasted it in a very pleasing smooth sea, and had no ground at an hundred fathoms foure leagues from the shoare. This day at noone, wee accounted we were in 78 degrees [*i.e.* near the mouth of Ice fiord], and we stood along the shoare. This day was so foggie, that we were hardly able to see the land many times, but by our account we were neare Vogel Hooke [the north end of Prince Charles foreland, lat.

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* Not 1608, as misprinted on Hondius' chart of 1611 in Pontanus, and often elsewhere in the early literature of polar exploration.

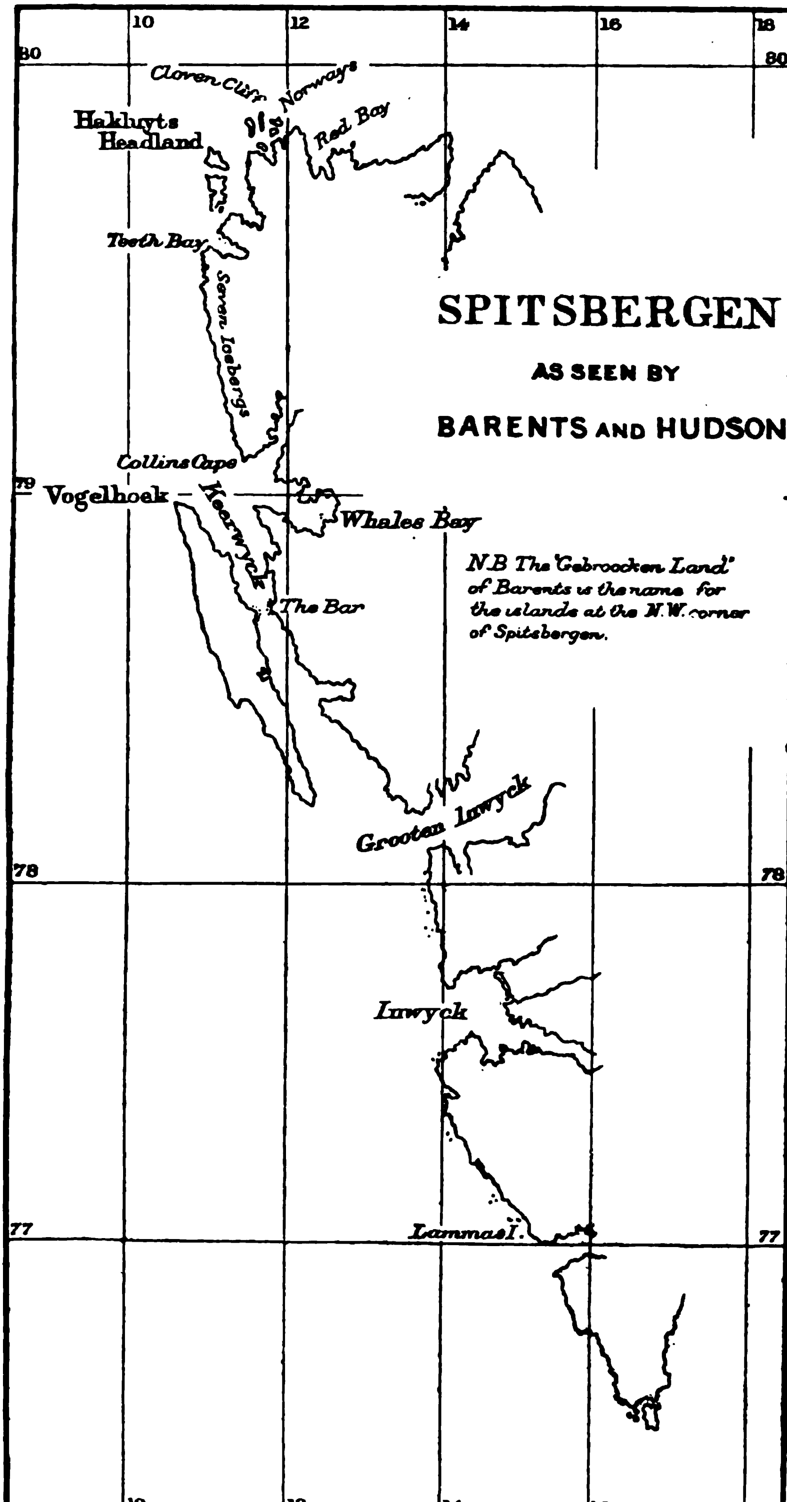
79°]. About eight of the clocke this eevening, we purposed to shape our course from thence north-west."

They tried to get away from the land, but the ice drove them back. About midnight after the 28th they were west and in sight of Vogel Hook. On July 1 at noon (p. 10), "wee were embayed with ice, lying between the land and us. By our observation we were in 78 degrees 42 minutes, whereby we accounted we were thwart of the great Indraught." The "great Indraught" is the "Grooten Inwyck" of Barents, the modern Ice fiord. The latitude of its mouth on Barents' chart is 78°, which is approximately correct. If they were in 78° 42′, they must have been off Cape Sietoe of Prince Charles' foreland. "To free ourselves of the ice, we steered between the south-east and south, and to the westward, as we could have sea [*i.e.* they could not have been making rapid progress; yet] about six this evening it pleased God to give us cleere weather, and we found we were shot farre into the inlet, being almost a bay, and environed with very high mountains, with low land betweene them; wee had no ground in this bay at an hundred fathoms." The description of the bay and the depth suggests that they were inside Ice fjord, 90 miles sailing from their position at noon, which is impossible. If the position was fairly correct, as is probable, they must merely have been somewhat east of the south point of Prince Charles Foreland, but certainly not up Foreland sound.

The log continues, "Being sure where we were, we steered away west [the natural course if they were off the mouth of Ice fiord, but an impossible course if they were in Foreland sound], the wind at south, east and calme, and found all our ice on the northern shore, and a cleare sea to the southward."

On July 2, "the wind at north-east, a faire gale with cleere weather, the ice being to the northward off us, and the weather shore [*i.e.* land being to the northward], and an open sea to the southwards under our lee," they were outside the mouth of Ice fiord, but not yet clear of the south extremity of Prince Charles Foreland. They sailed 10 leagues to the north-west, and at noon, by observation, they were in lat. 78° 56′, *i.e.* nearly off Vogel Hook again. On the third (at noon ?) they were, by observation, in lat. 78° 33′, *i.e.* off the middle of Prince Charles foreland. "This day wee had our shrouds frozen; it was searching cold; we also trended the ice, not knowing whether we were cleare or not, the wind being at north. The *fourth* was very cold, and our shrouds and sayles frozen; we found we were farre in the inlet." They accordingly stood south-south-east, south, and south-west by west, which seems to prove that they must have been at the southern entrance to Foreland sound, up which the tide may have carried them in the fog. Such courses would not have taken them out of Ice fiord.

At twelve on July 5, "we strooke a hull, having brought ourselves neare the mouth of the inlet." On July 6 they were in the open sea,


SPITSBERGEN
AS SEEN BY
BARENTS AND HUDSON
Cloven Cliff
Norways
Hakluyts Headland
Red Bay
Teeth Bay
Seven Icebergs
Collins Cape
Vogelhoek
Keerwyck
Whales Bay
The Bar
N.B The 'Gebroocken Land' of Barents is the name for the islands at the N.W. corner of Spitsbergen.
Grooten Inwyck
Inwyck
Lammas I.
10
12
14
16
18
80
79
78
77

in 77° 30′ by observation; that is to say, off Bell point, south of the entrance to Bell sound. The day was clear, but nothing is said of land in sight. The 7th was again clear. They reckoned that they were in 78°, and "out of the Sacke." What is meant by the Sacke I do not know, but it cannot have been either Ice fiord, or Foreland sound, or any other land-locked bay. The recorded latitudes prove that Hudson had not spent his time during the whole of the first week of July either in Foreland sound or in Ice fiord, as commentators generally assume.

"Now, having the wind at north-north-east, we steered away south and by east, with purpose to fall with the southermost part of this land, which we saw; hoping by this meane, either to defray the charge of the voyage [? by discovery], or else, if it pleased God in time to give us a faire wind to the north-east, to satisfie expectation." If the intention was to sail round the south cape of Spitsbergen and then to the north-east, it was soon abandoned, for, after some hours' calm on the 8th, they "stood away north-east," and continued sailing north-east as steadily as possible during the 9th and 10th. But in the afternoon of the 10th they had to sail south-south-west out of the ice "to get more sea-roome." On July 11, "having a fresh gale of wind at south-south-east, it behoved mee * to change my course, and to sayle to the north-east by the souther end of Newland." Clearly here "souther" is a misprint for "norther," for they went on sailing towards the north. At noon their latitude was 79° 17′, and the sun on the meridian bore "south and by west, westerly," which gives the compass deviation.

They soon ran into ice again, and had to turn south once more. At noon on July 12, "by our accompt we were in 80 degrees," but this is probably an error for 79°. They continued sailing north and north-east. At midnight (p. 13), "out of the top William Collins, our boatswaine, saw the land called Newland by the Hollanders [*i.e.* Vogelhook],† bearing south-south-west twelve leagues from us." ‡ This would put them in lat. 79° 30′ or less, as they generally overestimated distances. On July 13, at noon, "by observation we were in 80 degrees 23 minutes." Seeing that we know their courses from this point till next day, when they were off the mouth of Whales [King's] bay, and can thus reckon back from a known position, it is demonstrably probable that for 80° 23′ we should read 79° 23′.

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* Passages written in the first person singular are assumed to be copied by Playse, *verbatim*, out of Hudson's own log. The whole passage relating to July 11 (p. 12) is of this character.

† Which throughout this log is assumed to be the most northerly point seen by Barents.

‡ This emphasis on the land discovered by the Hollanders is intended to prepare for a claim presently to be made for "land by us discovered," Playse's idea being that Barents only discovered as far as Vogelhook—an utter blunder, if not an intentional fraud.

On July 14th, "at noone, being a thicke fogge, we found ourselves neere land, bearing east off us; and running farther we found a bay [Whales bay] open to the west and by north northerly, the bottome and sides thereof being to our sight very high and ragged land. The norther side of this bayes mouth, being high land, is a small island [really a mountain cape, Scoresby's Mitre cape, which from the south looks like an island], the which we called Collins Cape, by the name of our boatswaine, who first saw it. In this bay we saw many whales, and one of our company having a hooke and line overboord to trie for fish, a whale came under the keele of our ship and made her held; yet by God's mercie we had no harme, but the losse of the hooke and three parts of the line. At a south-west sunne from the north-west and by north, a flood set into the bay. At the mouth of this bay we had sounding thirtie fathoms, and after six and twentie fathoms; but being farther in, we had no ground at an hundred fathoms, and therefore judged it rather a sound then a bay. Betweene this high ragged [land], in the swampes and vallies lay much snow. Heere wee found it hot. On the souther side of this bay lye three or four small islands or rockes.* In the bottom of this bay, John Colman, my mate, and William Collins, my boatswaine, with two others of our company, went on shoare, and there they found and brought aboord a payre of morses teeth in the jaw; they likewise found whales bones, and some dosen or more of deeres hornes; they saw the footings of beasts of other sorts; they also saw rote-geese; they saw much driftwood on the shoare, and found a streame or two of fresh water. Here they found it hot on the shoare, and drank water to coole their thirst, which they also commended. Here we found the want of a better ship-boate. As they certified me, they were not on the shoare past half an houre, and among other things brought aboord a stone of the countrey. When they went from us it was calme, but presently after we had a gale of wind at north-east, which came with the flood with fogge. We plyed too and againe in the bay, waiting their coming; but after they came aboord we had the wind at east and by south a fine gale; we minding our voyage, and the time to perform it, steered away north-east and north-north-east. This night proved cleere, and we had the sunne on the meridian, on the north and by east part of the compasse; from the upper edge of the horizon, with the crosse-staffe, we found his height 10 degrees 40 minutes, without allowing any thing for the semidiameter of the sunne, or the distance off the end of the staffe from the center in the eye."

The latitude, therefore, was approximately 79° 5′. The latitude of the mouth of King's bay is 79°. Moreover, King's bay agrees with the bay described in all particulars. The sounding at its mouth is 27 fathoms, whilst within there are 250 fathoms. Near its southern shore

* Here begins another extract from Hudson's log.

are four or five small islands or rocks, near Coal haven. Hudson named it Whales bay, as we gather from a later entry (p. 20) in Playse's log, where he says (July 27), "we found the want of a good ship-boate, as once we had done before at Whales bay." The name was used in 1611 in the Moscovy Company's instructions to Thomas Edge, who was ordered to take his ship to Whales bay, and there fish for whales, and who sailed accordingly to King's bay.

In the morning of July 15 "was very cleere weather, the sunne shining warme, but little wind at east southerly. By a south-east sunne we had brought Collins cape to beare off us south-east, and we saw the high land of Newland, that part by us discovered on our starboard, eight or ten leagues from us trending north-east and by east [really north magnetic; their bearings are frequently very wrong], and south-west and by west, eighteene or twentie leagues from us to the north-east, being a very high mountaynous land, like ragged rockes with snow betweene them [the so-called Seven Icebergs, a good description]. By mine account the norther part of this land which now we saw stretched into 81 degrees." The furthest point they could possibly have seen was Hakluyt's headland, which Edge records to have been named by Hudson on this voyage, but that is only in lat. 79° 49′. Probably they did not at this moment see further than the point south of the entrance to Magdalena bay. The claim to have discovered the land north of Collins cape is as unfounded as was their claim to have reached a very high latitude.

In the morning of July 16 the weather was warm and clear. "Being runne toward the farthest part of the land by us discovered [*i.e.* to Hakluyt's headland], which for the most part trendeth nearest hand north-east and south-west [really north and south], wee saw more land joyning to the same, trending north [really east] in our sight, by meanes of the clearnesse of the weather, stretching farre in 82 degrees and by the bowing or shewing of the sky much farther."

There is a serious blunder here. Having reached Hakluyt's headland, they mistook the easterly trending north coast for a northward extension of the west coast, and so added on longitude to latitude. Believing, or pretending to believe, that Hakluyt's headland was in 81°, instead of 79° 49′, they then concluded that the land they saw stretched on northward (instead of eastward) into 82° and further. "Which when I first saw," continues Playse, now clearly quoting from Hudson, "I hoped to have had a free sea between the land and the ice and meant to have compassed this land by the north [*i.e.* to have sailed along the north coast]. But now, finding by proofe it was impossible by means of the abundance of ice compassing us about by the north and joyning to the land, and seeing God did blesse us with a faire wind to sayle by the south of this land [*i.e.* round the South cape] to the north-east, we returned, bearing up the helme, minding to hold that part of the land which the Hollanders had discovered [*i.e.* Prince Charles foreland and the coast below Ice fiord] in our sight; and if contrary winds should take us, to harbour there, and to trie what we could finde to the charge of our voyage, and to proceed on our discoverie as soone as God should blesse us with winde. . . . I think this land may bee profitable to those that will adventure it. In this bay before spoken of [Whales bay], and about this coast, we saw more abundance of seales than we had seene any time before, swimming in the water. At noone this day, having a stiffe gale of wind at north, we were thwart of Collins cape, standing in 81 degrees and a halfe."

Seeing that on the previous page (p. 15) he had recorded a very correct observation which gave 79° 5′ as the latitude of Collins cape, it is evident that there must have been some jockeying of the figures here; but upon whom the responsibility should lie for the falsification it is now impossible to say. It is, at all events, certain that the most northerly point reached by Hudson was Hakluyt's headland, and that, the year being very icy and the pack fast down on the north coast of Spitsbergen, he was unable to proceed thence to the eastward as Barents had done.

From noon on July 16, and throughout the 17th, 18th, and 19th, they proceeded southward. At eight o'clock in the morning of the 20th "wee saw land ahead of us under our lee, and to weatherward of us, distant from us 12 leagues, being part of Newland. It is very high mountainous land; the highest that we had seene untill now [an incorrect observation]. As we sayled neere it, we saw a sound [Bell sound] ahead of us, lying east and west. . . . From eight till noone was calme. This day, by observation, we were in 77 degrees 26 minutes [the mouth of Bell sound is 77° 40′]. On the norther side of the mouth of this inlet lie three ilands [really blocks of mountains divided by valleys, which would look like islands from the distance (10 leagues) they were from land], not farre the one from the other, being very high mountainous land. The farthest of the three to the north-west [*i.e.* the block of the sea-front just south of the entrance to Ice fiord] hath four very high mounts [Mount Starashchin], like heapes of corne. That iland next the inlets mouth, hath one very high mount on the souther end [true!]. Here one of our companie killed a red-billed bird."

They were still in sight of land on the 23rd and 25th, but then they sailed away west towards Greenland, meaning, as he afterwards states (p. 20), quoting from Hudson, "to have made my returne by the north of Greenland to Davis his Streights, and so for England," if there had been a passage, which of course there was not. So he sailed back westward, and on July 30 saw some part of Spitsbergen again.

"In the evening, we saw an iland bearing off us north-west [? N.E.] from us 5 leagues, and we saw land bearing off from us 7 leagues. We had land likewise bearing off us from east-south-east to south-east and by east as we judged 10 leagues." The name Lammas island marked on Hondius' map, which professes to embody Hudson's discoveries, probably refers to this island, though Lammas-day is not July 30, but August 1. What they saw was, not an island but a mountain, for there is no island in the south of Spitsbergen that can be seen 5 leagues away—certainly not the Dun islands, which correspond in latitude with the Lammas island of the map. It is highly probable that they were off the mouth of Horn sound, and that the island was Rotchesfell. Sailing on slowly south, they accounted that at midnight they were in lat. 76°. This must be a misprint for 77°, which agrees with their probable position. The parallel 76° runs nearly 30 miles clear south of the South Cape. The land, 10 leagues distant, "was the likeliest land that wee had seene on all parts of Newland, being playne riggie land of a meane height and not ragged, as all the rest was that we had seene this voyage, nor covered with snow." Probably this refers to the low hills and large flats that flank the coast for about 10 miles south of Horn sound. Early on August 1 they were thwart of Bear island. "In ranging homewards," says Thomas Edge in Purchas (iii. p. 464), Hudson "discovered an island [Jan Mayen island] lying in seventy-one degrees, which he named Hudson's Tutches." On September 15 the *Hopewell* "arrived in Tilberie Hope in the Thames." Thus ended a voyage to which, as far as Spitsbergen at any rate is concerned, more historical importance has been attached than it deserved. No new land was discovered and no very high latitude attained. Its one important result was the discovery of the number of whales frequenting Whales bay. A comparison between Playse's log and that of Barents' companion Gerrit De Veer demonstrates the great superiority of the Dutchmen's work, both as explorers and as recorders of what they discovered.

Maps.

There are only two maps which throw any light upon Hudson's voyage of 1607. The portions of both which include Spitsbergen are here reproduced. The first is Barents' own map, engraved in 1598, and published in 1599 by Cornelius Claesz, in the second part of the abridged Latin edition of Linschoten's Itinerarium. The second is the north polar chart published by Jodocus Hondius in 1611, in Pontanus' 'History of Amsterdam.'

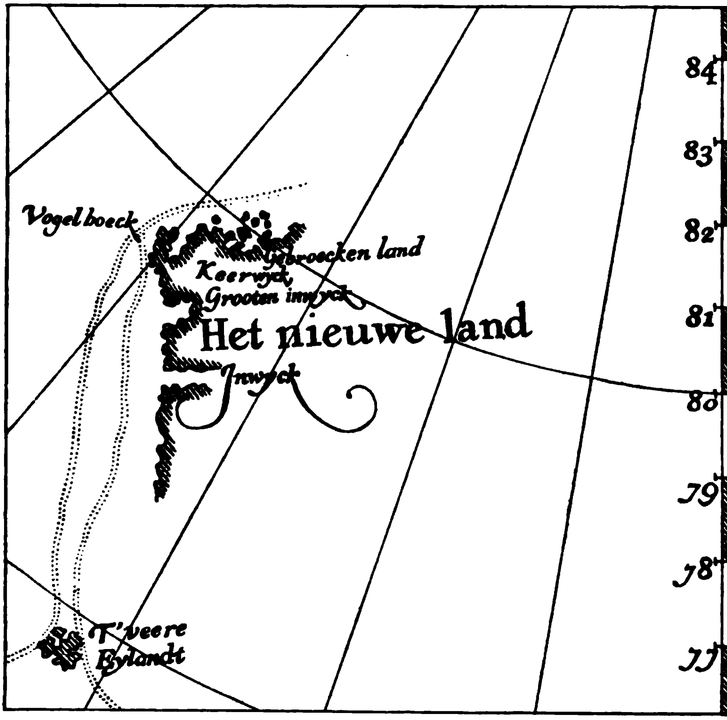
Hondius' map is nothing more than a copy of Barents' with Hudson's new names introduced (Collins cape being misspelt Colnis), and with the outline of the ice-pack likewise quite incorrect, labelled *Glacies ab H. Hudsono detecta ann.* 1608 (for 1607). As far, therefore, as the outline of the land is concerned, we have only to consider Barents' map and its relation to his discoveries.

Barents' discoveries in 1596 were as follows:—

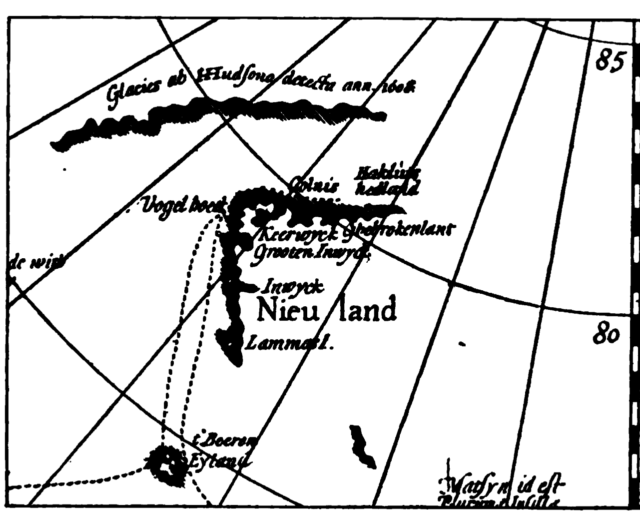
June 13.—Sailed from Bear island, keeping well to the west, out of sight of land or in fog.

June 17.—Lat. 80° 10′; steering S.S.W., sighted north coast of Spitsbergen, which was visible approximately from the mouth of Liefde bay to Hakluyt's headland; they sailed west along it.

June 20.—Twenty miles N.N.E. of Hakluyt's headland at noon; sailed to mouth of Red bay.



SPITSBERGEN FROM BARENTS' CHART.



SPITSBERGEN FROM HONDIUS' CHART.

June 21.—Anchored west of Cloven cliff.

June 22.—Explored Fair haven and discovered the Norway islands.

June 23.—Rounded Hakluyt's headland, observed the west coast trending S. ½ E., and returned to anchorage.

June 24.—Sailed southward.

June 25.—Anchored in Magdelena bay, and named it Teeth bay; landed at the cove now called English cove, and took formal possession in the name of Holland.

June 26.—Sailed into the north end of Foreland sound, and named it Keerwyck, because the bar forced them to turn back; named Vogelhoek.

June 28.—Sailed south along the Foreland and past the mouth of Ice fiord (Grooten Inwyck) and Bell sound (Inwyck).

June 29.—Continued south along the land till noon (lat. 76° 50′), when ice forced them out to sea.

July 1.—Sighted Bear island again.

It will be remembered that Barents died in Novaja Zemlja the following winter. His chart was therefore drawn for engraving without his supervision; hence probably the strange blunder it set on foot which was first corrected in Daniel's chart of 1612. Barents' chart depicts the west coast of Spitsbergen as running approximately N.N.W. and S.S.E. from his southernmost point (near Horn sound) to the north end of Prince Charles foreland, and this is correct. It erroneously depicts the foreland joined by an isthmus to the main, as Barents' log shows him to have well known it was not. North of Vogelhoek, instead of the coast continuing N. ½ W. (as Barents' log for June 23 shows him to have observed), it is made to bend away at a right angle to the north-east, the draughtsman having confused Vogelhoek with Hakluyt's headland, and the coast north of Vogelhoek with the north coast of Spitsbergen. This error, which was not Barents', but the draughtsman's, perhaps confused Hudson, and made him think that north of Vogelhoek the land he trended as far as Hakluyt's headland was a new discovery, and the wrong bearings in Playse's log may have been taken off Barents' chart, and not copied out of Hudson's log.

Hondius' outline is a copy of Barents', with the addition of a few names and the prolongation of the erroneously north-east trending west coast further and yet more erroneously to the north-east. If the form of the coast is corrected by being straightened, the new names—Hakluyt's headland, Collins cape, and Lammas island—will be found to fall approximately into their right positions relatively to Barents' names; but the *Glacies ab H. Hudsono detecta*, i.e. the edge of the polar ice-pack, which I have shown was in 1607 fast down on the north coast of Spitsbergen, is hopelessly out of its true position.

NEW LIGHT ON SOME MEDIÆVAL MAPS.

By C. RAYMOND BEAZLEY, M.A.

II.

We have briefly considered how much new light has been gained by the labour of recent scholars, and especially of Konrad Miller, upon the "Beatus" group of early mediæval mappemondes. In this paper we may examine the results of this higher criticism upon some of the other cartographical works of the earlier middle ages, and for this purpose we may take here the "Cotton" or "Anglo-Saxon" map of the tenth century, the map of "Henry of Mainz" of the early twelfth century, the "Jerome" maps of the same age, and the "Psalter" of the thirteenth century.

These are all dealt with in Miller's 'Ältesten Weltkarten,' part iii. ('Die kleineren Weltkarten,' 1895); and on a comparison of this most recent treatment with that of Santarem in the 'Essai sur Cosmographie' of 1849–1852, we can readily see how great an advance has been made. For although the great Portuguese geographer, like Joachim Lelewel, rendered invaluable services as a pioneer in this department of historical inquiry, both his writings and those of his Polish fellow-worker were lacking in that critical acumen, that laboriousness of detail, and that synthetic power which has characterized the highest German and French scholarship of our time. The work of Bevan and Phillot shows a distinct advance, in its account of the maps here in question, upon that of Santarem; but the studies of Jomard, of Cortembert, of Walleser, of Philippi,* and of Konrad Miller himself, mark a great advance even upon the high standard of the 'Essay on Mediæval Geography.' †

I. The Cotton or Anglo-Saxon map, now in the British Museum,‡ and measuring 21·2 by 17·6 centimètres, is among the most interesting of all mediæval world-pictures, and it supplies us with a design far more accurate than is usual in the cartography of this time. It is also more extensive and more detailed than most of its rivals; it pourtrays with comparative fulness regions of the Earth which are often outside the knowledge of the mediæval draughtsman; and it records not a few places and natural features elsewhere omitted or misunderstood. Its delineation of the coast-line of the continents and their separate countries shows a very different hand from that which gave us, for instance, the Ashburnham-Valcavado of 970. In fact, there is hardly any map of the middle age, before the beginning of the Portolani, which can sustain a comparison in the matter of contour § with the "Cottoniana." In its general shape, the οἰκουμένη, or Habitable World, is here represented as square, and in this it recalls some of the most debased examples of the "Beatus group." But in the execution of this right-angled design there is all the difference between the gross and narrow ignorance of an uncompromising symmetry, and a certain far from contemptible, though not highly developed, knowledge and scientific insight.

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* Cf. especially, Philippi, 'Zur Rekonstruktion d. Weltkarte d. Agrippa,' 1880; Walleser, 'Die Welt-Tafel des Ravennaten,' 1894; Cortembert, 'Trois des plus anciens monuments de Géog.,' 1877; Jomard, 'Monuments de Géog.,' 1862.

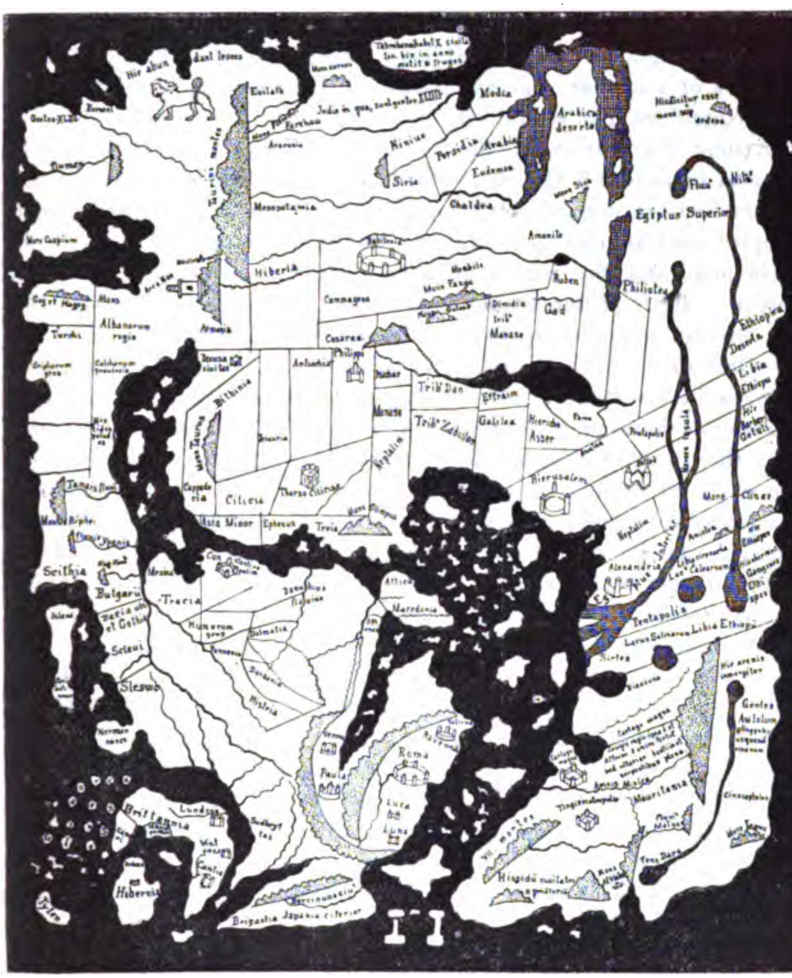
† 'The Hereford Map: an Essay on Mediæval Geography.' By the Rev. W. L. Bevan and the Rev. H. W. Phillot. 1877.

‡ Cotton MSS., Tiberius B.V. Its colouring is *green* for the ocean and most seas, but *red* for the Persian and Arabian gulfs, and for the whole course of the Nile with its lakes; *vivid green* for the mountains.

§ I refer here to the general contour of the great land masses, not to that of separate countries, in which, *e.g.*, Matthew Paris, for England, is much superior.

As far as we can see, the Cottoniana does not belong to any one of the ascertainable families of mediæval maps. It is far removed from all the members of the Beatus class; it is equally far removed from the school to which Henry of Mainz, the Psalter, the Hereford, and the Ebstorf maps (with the addition of the related Jerome designs) belong. Nor has it any relation with the various types of zone- or climate-map which we know under the names of Macrobius-, Sallust-, or T-O—sketches. A certain relationship, at least in the excellence of contour, may be descried between the Cottoniana and the Matthew Paris maps of the thirteenth century, especially in the form and content of the British Isles. But this is not the detailed and conscious relationship of works really in touch with one another, as model and copy; but the unconscious and general likeness of different periods of high-class cartographical work. Matthew Paris, moreover, has all the advantage of his period. He lived in one of the most flourishing and highly developed of the mediæval eras, whereas the Cotton map comes upon us as a surprise from one of the gloomiest of the dark ages. Some have pushed back the date of our present example to the ninth century and the time of King Alfred; it is more probably of about a century later; and Prof. Miller, with his usual constructive skill, has suggested that it belongs to the time of Archbishop Siric or Sigeric, of Canterbury (990–994). The map itself occurs in a manuscript of the Latin 'Periegesis' of Priscian (based upon the Greek original of Dionysius), but its content is in no special agreement with the work it professedly illustrates. It is, indeed, far more closely related to Orosius; it has also some relationship with Pomponius Mela, St. Isidore of Seville, and the geographical writings and plans of St. Jerome; finally, it bears clear marks of a later time, the time of the northern invasions at the end of the first Christian millennium. Thus the correspondences with Adam of Bremen (who died circ. 1076) afford at least a probability that the Cottoniana in certain places drew material from the same original as the great northern annalist; while some of the names in the British Isles, in Gaul, and in the far East and North-East thoroughly bear out the tenth-century date, which most scholars are now inclined to accept.

The resemblances which have been noticed, or fancied, between the Cottoniana and the designs of the Beatus group, and also between the present work and the writings of Julius Honorius, are but shadowy at the best; on the other hand, there is undoubtedly a use of scriptural matter in this design. It would be strange if it were otherwise; for every specimen of the earlier cartography of the Christian Middle Age naturally, and as a matter of course, shows the influence of the Jewish and Christian scriptures. Some have questioned the tenth-century date, now usually assigned to the Cottoniana, on the ground of its being too good for the time; but, though it is unquestionably the best in contour of all the earlier mediæval mappemondes, yet certain parts of other works, equally emanating from the dark-age time, show a comparative accuracy which proves that even at the worst periods it was possible to give a respectable sketch of some land-outlines. As to the abundant and valuable material of this map, no one has a right to argue therefrom against the tenth-century



THE COTTON OR ANGLO-SAXON MAP RESTORED.

claim. For, as we see from the map of St. Sever (circ. 1030), a work of even greater elaboration, though of less scientific character, was produced by the generation immediately after Sigeric; and we have already learnt from the Beatus family that the goodness of a map is by no means an absolute matter of date; on the contrary, it depends not a little upon the copyist or draughtsman himself and his immediate original.

The comparative excellence of the Cottoniana is perhaps due to its being the work of an Irish scholar-monk. We are all well aware that in pre-Norman "England" and "Britain" (*i.e.* in the British isles between the age of Justinian and the age of William the Conqueror) there is no school of learning, of art, of religion, of literature, or of science, comparable to that which sprang from the Irish Church of Patrick, Colomba, and Aidan. The insertion of Irish names,* especially that of Armagh, on our present map strengthens the view that it is the work of a scholar who was trained in Irish schools, or derived his knowledge from men so trained.

Among the sources of the Cottoniana, as we have already said, the most important is Orosius. Out of a hundred and forty-six legends, seventy-five are derived from the writings of St. Augustine's favourite disciple; and in these seventy-five we find the textual basis of the whole map, and the names of almost all the countries enumerated thereon. Prof. Miller argues ingeniously, from various details, that this Orosian material appears to be derived more directly from the lost Orosian map than from the existing text of the geographical passages in the *Historiæ adversus Paganos*. In any case, the work here in question shows us a certain, though small, body of antique material other than that existing in the Orosian writings, as at present known. The scribe or draughtsman tells us that he found, in the manuscript of Priscian's 'Periegesis,' a map which he thought was drawn by Priscian himself. This map he supposed to have been meant by Priscian as an illustration of his treatise, originally a translation from the third-century Greek of Dionysius; † but it is plausibly conjectured by Miller to have been a copy of the lost Orosian scheme; and, in any case, it was obviously the immediate original of the Cottoniana. Thus the latter design, unique among its contemporaries, and therefore mysterious, in its cartographical merit, is brought into a certain relation with an ancient geographical school of no contemptible attainment; and in this case, as in others, we find a law of evolution, of inter-connection, and of historical development, bringing together the most surprising and distant parallels, and throwing light upon a field where, as in natural science, the mistaken ideas of separate and unconnected existence had long prevailed.

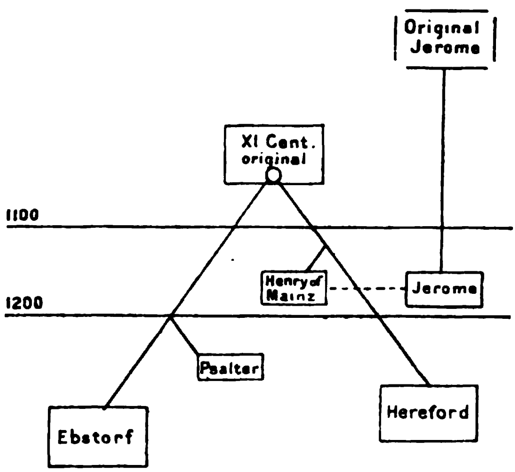
The connection with Mela appears in the general idea of the Oikoumenê, or Habitable World, as an oblong (tending to square), and in the delineation of various outlines, rather than in the detailed legends

* A very unusual feature in the earliest mediæval maps of continental origin. This Irish theory is not inconsistent with the suggested Sigeric connection. The Cottoniana may have been draughted by an Irish scholar in the archbishop's household.

† Also paraphrased in Latin by Rufus Festus Avienus (at the end of the fourth century) in his 'Descriptio Orbis Terræ.'

and place-names. Some of the non-Orosian data of the Cotton map may be derived from Jerome, though they may, for the most part, be explained, and perhaps better explained, directly from the Bible. But the treatment of the Twelve Tribes in this map certainly suggests a reference to the lost plan of the great Latin doctor illustrating this subject.

With St. Isidore there are several peculiar coincidences,* mostly of a classical type; and with Adam of Bremen others, equally striking, of a much later character. Here the mention of the Turks and the Bulgars, of Iceland and the Slavs, together with that of the "South Britons" of North-West Gaul, points us, like the handwriting of the map itself, to an era not very distant from the year 1000. With Julius Honorius, and with the anonymous geographer of Ravenna, there is slight, but curiously definite, connection in a few place-names; † and the same may



PEDIGREE OF THE HEREFORD MAP.

be said of the correspondences between the Cottoniana and the works of the Beatus family. A Roman province-map was probably the source of the divisions so clearly marked in Asia Minor, in Central and South-Eastern Europe, and in North Africa. Lastly, the biblical relationships of the Cotton design may be traced, not only in many names, but in a good part of what we may call the general design. It is obvious that our present scheme was not merely indebted to the Scriptures for details such as almost all mediæval maps exhibit, but was to a large extent drawn for a special Biblical lesson. Just as the mappemonde of Beatus had for its radical purpose (in part at least) a delineation of the Twelve Apostles, their dioceses, and their distribution over the Oikoumenê as

* *E.g.* the "abundant lions" in the extreme north-east of Asia.

† Cf. The *Bulgari*, *Salerno*, *Verona*, *Tarsus*, *Hypanis*, etc.

"sowers of the Word through the field of this World," so the Cottoniana, probably based on a lost design of Paulus Orosius, had for one of its main objects a picture of the settlement of the Twelve Tribes of Israel.

II. The map of Henry of Mainz (circ. 1110) belongs apparently, like the Psalter map of later date (circ. 1230), to another group or family of cartographical works, which may be compared with the more closely-knit members of the Beatus genealogy. To the present stock may be also assigned, as the younger brothers of "Henry" and the "Psalter" respectively, the "Hereford" and "Ebstorf" examples of the closing thirteenth century—huge wall-pictures which represented (in size though not in execution), more faithfully than their older relatives, the probable eleventh-century original. Lastly, the Jerome maps (of about 1150) are connected with this same group, not by common descent, but by conscious intercourse, through the medium of Henry of Mainz.

The last-named design is contained in the 'Imago Mundi' of a certain Henry, probably the same person as the Canon of that name, who in 1111 appears before the Episcopal Court of Mainz; possibly he is the same as the Archbishop Henry who ruled this Church between 1142 and 1152. In any case the map accompanies a work which was written about 1110 and was dedicated to Matilda, wife of the Emperor Henry V., and mother of Henry II. of England. The 'Imago Mundi' here referred to was copied and interpolated, but not originally composed, by Henry of Mainz; on the contrary, it was the work of a slightly older contemporary, Honorius of Autun (who died in 1140). The map, however, is apparently the addition of the scribe Henry, and is not derived from Honorius, though it is based on another and older design.

It is oval in form, measures 29½ by 20½ centimetres, and contains 229 legends, with a large number of unnamed cities, mountains, and rivers, whose titles can for the most part be ascertained with the aid of the other members of this cartographical family—the Psalter, Ebstorf, Hereford, and the Jerome plans. Though the present world-scheme professedly illustrates the 'Imago' copied by Henry, the relationship between the two is not close. As in the case of the Cotton map and the text of Priscian which it accompanies, the peculiarities of the chart are not in the manuscript, nor are those of the manuscript represented in the map. On the other hand, the Mainz design is obviously in relation with the Hereford, as an elder with a younger brother; and the relationship of these two works may be traced in almost every part of the world, and in nearly every important feature of the draughtsmanship. At the same time, the greater size of the Hereford enables it to admit a far larger content; and this superior mass of material is still more shown on the Ebstorf; while the tiny Psalter is naturally more limited, though far more crowded, than the Mainz copy.* In

* 229 legends on Henry of Mainz; 1021 on Hereford; 1224 on Ebstorf; 145 on Psalter.

particular, the larger examples (Hereford and Ebstorf) contain more* matter of classical origin than the smaller ones (Henry and the Psalter);

THE MAP OF HENRY OF MAINZ.

but all these works alike may be fairly supposed to spring from a common

* *I.e.* a greater bulk of classical matter; as we shall see, in some respects the Psalter shows itself more classical in spirit than any other of this family.

original—a great wall-map, as already suggested, of the eleventh century. Of this original, Henry's transcript is more accurate, but more limited; the Hereford more complete, but less true and less scholarly. Thus, for example, the latter, unlike the former, makes Jerusalem the centre of the Earth, and adopts an absolutely circular instead of an oval form.

The relationship between Henry and the Jerome maps is pretty nearly as close as between the Mainz and Psalter designs. We only possess the eastern parts of the *Orbis Antiquus* in the Jerome examples; but here the likeness is marked; while the careful treatment, in Henry's work, of the Twelve Tribes and their settlements corresponds with the well-supported tradition that the translator of the Vulgate, who passed so many years in Syria, did compose a separate treatise and map (now lost) on this subject.*

The details in the Mainz design which are foreign to the Jerome tradition may be divided into three classes, respectively based upon Æthicus of Istria, upon Solinus, and upon the contemporary knowledge of the central Mediæval period. Among the last we may specially notice the names of Rouen, Pisa, Iceland, Lombardy, Noreya or Norway, and the "German" and "Venetian" gulfs. The peninsular form of Italy is more developed in Henry of Mainz than in the Hereford map; but the two agree in so many points that differences such as this become unimportant. Both maps have the same widening of the Mediterranean at its eastern extremity, the same projecting horns to represent the angles of the Levant, the same elongation of the Black sea and the Sea of Azov, and the same approximation of the last to the Northern ocean. Once more, both have practically the same Nile-system and the same representation of African mountains, Asiatic rivers, and Oceanic islands; both give the boundary between Asia and Africa in much the same way; both omit to specify any definite boundary between Asia and Europe; both agree in their arrangement of the surrounding ocean, in their drawing of the most important parts of the continental coast-lines, and in such other typical details as the Caspian and Baltic seas, the neighbourhood of Paradise, and the lands of the Gog-Magogs, the Hyperboreans, and the Dog-headed folk.

III. The Jerome maps, though a work, as they stand, of the twelfth century and written in the script of that time, were almost certainly drawn under the direction, if not by the hand, of that Father, and were intended to illustrate one of his lesser treatises.† Of these two map-sketches, one represents only Palestine and lower Egypt; the other deals with the Levant in a wider sense, reaching out to the Far East. Both are perhaps fragments of a more general work, now lost. They were evidently designed in colour, but this has only partly been executed.

* Cf. the Cotton map just noticed in illustration of this 'Divisio Filiorum Israel' in cartography.

† 'De situ et nominibus locorum Hebraicorum.'

As they stand, they are of about A.D. 1150, and measure respectively 35·5 by 35·8 centimetres and 23·6 by 22·4 centimetres. They are in a uniform hand of late Romanesque character, and cover the whole leaf of the manuscript without any margin. Certain almost invisible marks show, for one thing, that the scribe wrote rough copies of various names as if to get his hand in for the fair draught; and for another, that the larger map was probably a section, and a section only, of a mappemonde or complete sketch of the Oikoumenê. St. Jerome himself, in another place,* declares how he translated Eusebius' description of the land of Judah, and his enumeration of the chief places and natural features mentioned in Scripture. This geographical work of the famous Church historian was apparently composed soon after A.D. 324; and his description of Judæa, according to Jerome, was illustrated by a "picture," or plan, of Jerusalem and the temple. Eusebius also seems to have drawn a genealogic tree, or scheme, showing the division of the Twelve Tribes,† and this scheme was soon after embodied on a mappemonde, which had probably a good deal of influence on mediæval cartography.

Among others, the historian Bæda, in his work, 'On the Place-names in the Acts of the Apostles,' shows an intellectual relationship with the Jerome maps so close (both as to insertions and omissions) as to support the belief that he knew and used these works. In the content of the same, we may notice that there is only one entry—and that may well be an interpolation—which refers to a time distinctly later than St. Jerome's. The identification of Bulgaria and Mœsia brings us down to the latter part of the seventh century, when (about A.D. 678) the Bulgar emigration from the Middle Volga was first definitely settled in this region. On the other hand, the grouping of Crete with the Cyclades, as the Seventh Province of the Greeks, squares with the imperial arrangements of the fourth century. Again, the identification of Emmaus and Nikopolis is a confusion which is exactly reproduced in another passage of St. Jerome's works. Once more, the distribution of the Roman provinces of the Levant (as shown on these maps) for the most part agrees closely with the known position of affairs at the end of the fourth century. Lastly, the Jerome plans are lacking in matter of a purely mediæval type; in other words, are emphatically pre-mediæval. The Earthly Paradise is not marked, nor the world centre at Jerusalem. Moreover, the richness and abundance of ancient geographical detail,‡ untouched by later legend, point to an origin not later than the fourth century after Christ.

In examining this detail it is clear we have on one hand scriptural, on the other hand quite general, material. Jerome's original purpose was evident to depict Biblical localities, just as Beatus started with a purpose of illustrating the distribution, preaching, and chief

* Preface to 'Liber de Locis.' † Have we here one original of the Cotton map?

‡ *E.g.* 278 legends in the larger map, 195 in the smaller; 66 being common to both.

centres of the various apostles, or as the Sallust and Macrobius plans originated in the desire of explaining certain passages in those authors. This Biblical map-work of Jerome's was closely connected with the 'Onomasticon' of Eusebius, which in many ways serves the purpose of an accompanying text; but of course the scope of Jerome's larger design is wider than the range of this work of Eusebius.* Even in the smaller, the sectional Palestine-and-Egypt, map there is a difference. For whereas the Onomasticon had left out some of the larger Syrian towns and enumerated many insignificant ones, St. Jerome's sketch supplies us with nearly all the capitals and omits some of the hamlets.

The non-Biblical content of the Jerome maps belongs to the oldest type of post-Ptolemaic mappemonde. The later classical school, especially as represented by Pliny and Solinus, has evidently much influence on these works, whose use of Plinian material is closely parallel to the employment of the same by the author of the 'Collectanea.' As Konrad Miller has also suggested, it seems probable that the draughtsman of the present examples has made some use of a Roman road-map, similar to the Peutinger Table, in which the imperial provinces were marked, with two of the leading towns in each.

IV. The "Psalter" map of the British Museum is the last example we need take here of the school or family of cartography which also includes Henry of Mainz, Ebstorf, and Hereford, and is related collaterally to the Jerome designs. In this case the work in question has been so often and so carefully described that a brief notice of the most recent criticism will suffice. Its connection with other works is not entirely unsuspected by Bevan and Phillot, by the British Museum map catalogue, by Santarem, and by the older school of geographical scholars; but Prof. Miller, here as elsewhere, has made clear advances on earlier study. No one could fail to notice the resemblance of the Psalter—as a wheel map, which specializes on monstrous races—with the Hereford and Ebstorf of similar characteristics. But Miller has been the first to show that the newly rediscovered † map of Ebstorf is an even closer relative of the Psalter than that of Hereford; and that the present design is more antique in character, though not in the mere *amount* of derived material, than any other of this family. In other words, it bears a more immediate relationship to the common original than Henry of Mainz, Hereford, or Ebstorf. Especially this would appear to be true of the contour and general delineation; the argument from the text of the legends and other written matter on the map, though it supports this conclusion, is weakened by the obviously weak scholarship of the draughtsman. Outside its own family, the Psalter has some points of agreement both with Beatus and with Lambert of St. Omer. Of modern names it gives us several of some interest.

The following points have been noticed by various scholars, not

* 'Onomasticon de locis hebraicis.'

† First noticed by Wömpner, 1833.

without occasional exaggeration: First, the extreme smallness of the design, which is a circle with a diameter of only $8\frac{1}{2}$ centimetres. Secondly, the abundant and crowded content, supplying no less than 145 legends and inscriptions. Thirdly, the semi-mythical and dark-age character of the work in general, removed as far as any from the comparative science (though not from the nomenclature) of the ancient world, and almost untouched by the new light of the Mediæval Renaissance. Fourthly, the similarity of the map itself with the Hereford example, and of its ornamental border with the rim ornament of the latter. Prof. Miller has pointed out, however, that the Psalter ornament in question is Romanesque in feeling, while that of the Hereford is pure Gothic; that in the Psalter's enumeration of the great winds a severely classical nomenclature is used; that the mountain ramparts forming the prison of the Gog-Magogs, with the Gates of Alexander, in North-East Asia, are unusually developed; and that Paradise is detailed, with the sacred rivers (here *five* in number) not quite in agreement with other designs of this type.

The chief work of the latest study of this map has certainly been to demonstrate its close connection with the Ebstorf example, beyond all other parallels. This is to be traced not only in the Gog-Magog region and in the zone of monsters that runs along the southern shore of Africa, but also in the nearness of East Africa to West India, in the form of the Mediterranean, and in the unnatural abridgment of the three peninsulas of Southern Europe. Along with the larger Jerome map of the Levant, the Psalter helps us to fill up the gap which occurs in the Far East of the Ebstorf. The trees of the Sun and Moon in the present example are very important marks of the geographical mythology of this time; whether they are, or are not, perversions of the older story of the Eastern pillars of Alexander balancing the Western pillars of Hercules. The chief additional references to what may be called the fact and fiction of the central Mediæval period do not lie in the monsters of South Africa (as some have supposed), for these are almost purely Solinian. They are rather to be found in the mention of Damietta, of the Ruscitæ or Russians,* of the Olcus or Volga, of the land of the Western Slavs, of Ala or Halle, and of two later names in the British Isles, viz. Wales and Scotland.

Lastly, we may compare this map, as an illustration of a Psalter, or manuscript of the Book of Psalms, with the plan of Beatus, at least in this —that both originate in the ornamentation or illustration of a certain portion of Scripture; of the Hebrew poetry in one case, of the Apocalypse in the other. Illustrated Psalters are very ancient; the British Museum alone possesses one of about A.D. 700; and the Albi map of the eighth century, which occurs in a manuscript of Glosses on the Gospels, furnishes another parallel to this Biblical cartography.

* Cf. the *Ruzzia* of Adam of Bremen.

A MAP OF ST. KILDA.*

By J. NORMAN HEATHCOTE.

When I first contemplated making a map of St. Kilda, I was under the impression that it would be an easy place to survey, but I have since come to the conclusion that it is not the best sort of country for a tyro in cartography to commence upon. The absence of level ground makes the measurement of a base-line a matter of considerable difficulty, and the precipitous nature of the cliffs renders an accurate delineation of the coast-line practically impossible. With the exception of Village bay, there is no point where it is possible to reach the sea-level from above without a more or less difficult climb, and many parts of the coast cannot even be seen from a height without some peril to life and limb. The alternative of mapping the shore from a boat is made more troublesome by the never-ceasing swell. I twice rowed round the outside of Soay, an expedition taking some five or six hours, and on both occasions the swell was so heavy that it was dangerous to come near the rocks in many places, and the tossing of the boat added materially to the difficulty of drawing. Probably an old hand at surveying, with luck, might take all necessary observations in a fortnight, but what with delays caused by wind, rain, and mist, which sometimes hung about the hills without intermission for a week or ten days, and what with loss of time in learning the idiosyncrasies of the theodolite, and mistakes due to ignorance or carelessness, I found that I had to work pretty hard to get everything done in two months.

My first idea was to measure a base-line on the sandy shore in Village bay, but as the sand is covered at high tide, the station points had to be placed among the large boulders above high-water mark. This made it difficult to make an accurate measurement, and as I found that there were comparatively few points of importance visible from both ends, I practically only used this base to determine a few heights, and made the map from a base on Mullach Sgail. Here there is a large expanse of nearly level ground, and by measuring two sides of a triangle and the angles, I was able to get a base-line of 700 yards, one station point overlooking Village bay, the other commanding the glen. I measured this twice with a steel tape, made the correction for difference of altitude, and took angles with the theodolite to cairns which I had erected on the top of Connacher and Oisaval from all three points of the triangle. My principal station points were on Connacher, Oisaval, Ruadhval, Mullach Bith, Mullach Mor, Cop a's àirde, and Cambargh; but I also took angles from several other places, so as to be able to fix the principal points all round the coast.

As landing is always a risky business owing to the incessant swell, and the ascent of Soay or Boreray entails a difficult climb, I did not attempt to get the theodolite ashore on those islands, but took angles to all

* Map, p. 204.

conspicuous points on Boreray from Connacher, Cambargh, and Oisaval, and in the case of Soay, from Cambargh, Mullach Bith, and from a point between the two. Then by calculating the distances from both bases, *i.e.* Connacher to Cambargh, and Connacher to Oisaval, and finding that the results agreed near enough for practical purposes, I considered that I should get the shape of the islands with sufficient accuracy by sketching in the other sides from notes, sketches, and photographs taken on land and from a boat.

With regard to altitudes, I took double readings of the vertical angles from all the station points, and in the case of the main points worked out the height from the calculated distance, but in some cases depended on the measured distance on the map. I used the first base on the shore to ascertain the height of the station point on Mullach Sgail, and for the peaks of Dun, and tested them by measuring very accurately a base entirely on the sand when the tide was low. Finding that my estimate of the height of Connacher did not agree with the Admiralty chart, I was careful to test it in every possible way, but as in every case my results came about the same, I feel confident that my estimate is not far wrong. The natives were not actually hostile to my surveying efforts, except that I occasionally found a cairn pulled down; but they thought there was something uncanny about a theodolite, and never seemed particularly anxious to give me any assistance.

As might be expected in an island so remote, they are a primitive people, with simple habits, charming manners, and no vices; but I am afraid the march of civilization is tending to demoralize them. Visitors in yachts, and tourists, who go in considerable numbers every summer in steamers, have always given them presents. Well-meaning people from the south have sent boats, furniture, fishing-tackle, and all sorts of things at various times, and the result is that they distrust strangers and try to get as much out of them as possible. They look upon presents as a right, and are beginning to think that not only need they not pay rent, but that meal, potatoes, and other necessaries of life should be supplied by MacLeod of MacLeod, the landlord, without payment. Until recently, they were quite ignorant of the value of money, and even now all transactions with the landlord are carried out by barter. One has to break through this crust of antagonism to find out their good qualities. To people they know and like they are charming, pleasant companions, anxious to please, perfectly honest, and not at all grasping. Their houses are not always models of cleanliness, but they are clean in their persons, absolutely sober, and as industrious as most people who are not compelled to work. Their principal occupation is fowling. A fat, oily fulmar petrel is their favourite food, and large numbers of young fulmars and gannets are salted for winter consumption. In the intervals of bird-catching they cultivate a little ground, catch a few fish, and look after their sheep, while in the winter months they weave a considerable quantity of homespun cloth.

St. Kilda was inhabited at a very early period. There are several underground houses similar to those made by the aborigines of Scotland, and the legend recorded by Martin, of the warrior queen who hunted deer on the land between St. Kilda and Harris, points to the possibility of men having found their way there at a time when the island still formed part of the mainland of Scotland. The present inhabitants are descended from emigrants from Skye or the outer Hebrides early in the last century, when the island was repeopled after being devastated by small-pox. They are seventy in number, but though there has been little or no importation of fresh blood, they show no signs of deterioration caused by in and in breeding. They are a fine, powerful race, sound in mind and body, and the children all look remarkably healthy. There used to be great mortality among newly born babies, but this was due to improper treatment, and the eight-day sickness, as it was called, is no longer known in the island.

THE MASHONALAND RAILWAY SURVEY.*

We have received from Mr. Harry Good the route-plan of the projected Mashonaland railway (reproduced in the present number of the *Journal*), based on a recently completed survey by theodolite and chain. The chain work was commenced from the 222nd mile-peg, which marks the terminus of the Beira railway. This railway, which was originally constructed on the 2-foot gauge, was to be relaid on the gauge of 2 feet 6 inches during the last dry weather. Mr. Good's original map shows the flood openings allowed at the more important waterways to be crossed by the Mashonaland railway, and thus gives an idea of the size of the streams during the rainy season. The largest of these all occur on the first part of the route from Umtali to Salisbury, on which the Odzi and other important branches of the Sabi are crossed. Beyond the Rusapi the route finally adopted deviates from the original line, which coincided roughly with the direction of Selous's road. By skirting the basin of the Sabi to the north, and so running mainly along the watershed between that river and the Zambezi, the crossing of large streams is here avoided.

Mr. Good remarks that the astronomical positions of Umtali and Salisbury have not been determined, but in the case of the former this has lately been done, as mentioned a short time ago in the *Journal*, by signals exchanged with Cape Town, the longitude obtained being 32° 40′ 18″. No doubt that of Salisbury will shortly be fixed by members of the Geodetic Survey; meanwhile the value recently given in a report of the South Africa Company, viz. 30° 49′, may be taken as approximately correct. It should be mentioned that the orientation of the map is not due north and south, Salisbury lying considerably north of Umtali.

* Map, p. 204.

FINLAND AND ITS PEOPLE.

By HUGH ROBERT MILL, D.Sc.

THERE is no country of Europe, or in the world, the statistics of which have been so thoroughly mapped with regard to all features and conditions as Finland. The remarkable Atlas of Finland, a unique epitome of the geography of any large region, has already been noticed in the *Journal* (vol. xiv. p. 692, December, 1899), and the present review is concerned with the volume of text * prepared to accompany the atlas, and issued in three separate editions, Finnish, Swedish, and French, by the Geographical Society in Helsingfors. There are two editions of the atlas, one in French, the other in Finnish and Swedish; but all the work of survey, statistics, discussion, cartography, and printing is Finnish work carried out in Finland, and executed in a manner to excite the admiration, if it cannot arouse the emulation, of the best geographers and map-makers of Britain or Germany. The work, it is pleasing to notice, is a direct result of the exhibition held at the Sixth International Geographical Congress in London in 1895, when the Finnish Geographical Society exhibited a number of maps, many of them specially constructed for that occasion. These were so well received both in London and subsequently in Helsingfors, that the Government of the Grand Duchy assisted the Society by a grant of £520 in completing the work in the form of an atlas, to which this special volume of *Fennia* forms the text. The whole work was under the charge of a committee presided over by Prof. E. R. Neovius, and including J. A. Palmén, M. Alfthan, J. P. Norrlin, E. G. Palmén, O. Savander, and J. J. Sederholm.

Each plate in the atlas is the subject of a separately paged description in the text, forming usually a fairly exhaustive memoir on the subject in question. The reasons for the adoption of the projection are given in full. It is a modified conic projection cutting the sphere along the parallels of 61° 15′ and 64° 45′, with the meridian of Helsingfors as the central line. The scale for the chief maps is 1 : 2,000,000, or about 32 miles to an inch. Taking the country as a whole, over 11 per cent. of the surface is occupied by lakes and rivers, this proportion rising to nearly 25 per cent. for the governments of St. Michel, Kuopio, and Viborg. The eight provinces or governments are divided into 51 bailiwicks, which are subdivided into 269 parishes, each of which is clearly shown on the first map of the atlas. The hypsometric map is fully described; it shows the land rising steadily towards the east and north from a low coastal plain on the west and south, a surface

* 'Atlas de Finlande.' Texte. Publié par la Société de Géographie de Finlande. *Fennia*, vol. xvii. Helsingfors, 1899.

broken by innumerable hills and lake-basins roughly arranged in ridges and furrows running from north-west to south-east. Certain minor ridges running in two rows nearly parallel to the south coast are not very prominent on this map, nor does the map of solid geology throw any light on them; but the drift-map brings them out, in quite a startling manner. Here they are shown to be lines of åsar, or terminal moraines; but it requires the railway map to reveal their true importance as regards lines of communication. The main railway from St. Petersburg to Hangö does not run along the coast so as to pass through Helsingfors, but sweeps inland to the shore of Lake Saima, whence it follows the crest of the åsar almost without interruption, usually sharing the ridge with a high road, for 200 miles to Hangö. This ridge forms a watershed for the most part, but is breached by the larger rivers. The geology is fully described so as to emphasize the remarkable character of the great expanse of ancient sedimentary and igneous rocks worn down to faint relief, and overspread with a sheet of moraine material, edged by a border of washed clays deposited in the Litorina sea. It is curious to notice that the solid geology shows Finland to be one of the most ancient lands on earth, yet the actual configuration of the country is the result of the most recent changes during the glacial and post-glacial periods.

The climate of Finland has been the object of scientific study on the part of the University of Helsingfors since the middle of the eighteenth century, and the Finnish Society of Sciences, and later the Meteorological Institute, have organized a large number of observing-stations. The mean annual temperature of all Finland lies between 36°·5 and 37°·5 Fahr., which is more than 10° higher than the normal temperature for the latitude, the amelioration of climate being most marked in winter. The temperature at all seasons falls from the south-west towards the north-east. During the months of November, December, January, February, and March the mean temperature of the whole country is below the freezing-point, and in the south February is the coldest month. In April, however, the mean temperature in the south is over 36° Fahr., and frost remains only to the north of lat. 64° N. In July, the hottest month, the south-west has a mean temperature exceeding 63° Fahr., practically the same as that of the south of England. The monthly temperature maps are constructed as the average of the ten years 1881–1890; but there are not sufficient data for total precipitation except for the two years 1894 and 1895, which are mapped separately. Much attention has, however, been paid to the snowfall, both with regard to amount and duration. Snow begins to fall in October, but rarely lies until the middle of December, and about Christmas the country is covered to a depth of from 6 inches to a foot. It is the middle of March before the depth of fallen snow comes to a maximum, which averages from 2 feet to 2 feet 6 inches, although over a large area in the centre of the country it exceeds 3 feet. The thaw comes in April, but it is the end of May before snow vanishes from the north of the Gulf of Bothnia.

The occurrence of night-frosts in summer is the chief anxiety of Finnish farmers, and since 1892 the phenomena have been carefully studied, and the distribution of a selection of the more disastrous cases has been mapped.

The distribution of the native and cultivated plants of Finland has been a matter of long and careful study, and maps are given showing their range. The most general crop is barley, which is cultivated far to the north of the arctic circle, its northern limit being approximately 68° N. Rye is not cultivated quite so far to the north. Oats are grown only to the south-west of a line joining the north of the Gulf of Bothnia and the north of Lake Ladoga, and wheat is only grown in the south-western corner of the land. Potatoes and beet-root are cultivated over the entire country, even in the remotest north.

One of the chief resources of the country is furnished by the extensive forests, which cover practically the whole country outside the farm-clearings, and spread almost unbroken over the north. Most of the woodland in the north of Finland, and a good deal in other parts, belongs to the state and is under strict regulation and supervision. The principal tree of Finland is the Scots pine (*Pinus sylvestris*), and next to it comes the fir (*Picea excelsa*), both trees being found over the whole country. The birch is by far the most important of the deciduous trees, appearing in many varieties, and reduced in size to a mere shrub in the far north. The alder and aspen are also widespread, but the oak is confined to the south of the country.

The habit of burning off forest to obtain land for cultivation is still very widely practised in Finland. More legitimately the forests are used for the preparation of tar, for firewood, and for timber, and of the forest produce 85 per cent. is retained for domestic use or home manufactures, only 15 per cent. being exported. The extent of country under forest amounts to 47 per cent. of the total area, the cultivated land to 10 per cent., the lakes and rivers to 10 per cent., and the waste-lands to 33 per cent.

The population of Finland is treated in great detail, the vital statistics being tabulated for every year since 1750, when the total population was 420,000, down to 1890, when it was 2,380,000. The birth rate, which was 44 per 1000 in 1751, fell to 33 in 1890, the death-rate falling in the same time from 24·6 to 19·6 per thousand. The density of population is greatest in the south-west and south, and diminishes rapidly to the north and east, where considerable areas are practically uninhabited. In the towns two-thirds of the people talked Finnish, and one-third Swedish, but in the country districts eight-ninths of the people were of Finnish speech in 1890. For the whole country 93 per cent. were

Lutherans, and only 1·9 per cent. belonged to the Orthodox Greek (Russian) church. Education is practically universal, but of the whole population of the country only 20 per cent. are able to write, although 98 per cent. are able to read. Notwithstanding the adverse climate, three-quarters of the population are engaged in agriculture. Several articles are devoted to the system of popular education, and maps show the position of all schools of various grades, according to the language of instruction.

Other important articles and maps go into detail as to the relative yield of the various crops in different parts of the country; the amount and nature of the exports and imports; the extent of the railways, roads, telegraph lines, and especially of the almost universal telephones. The mineral resources are discussed and mapped; they consist mainly of iron, much of it in the form of bog ore, although a little copper, tin, and gold are also worked. Various industries are increasing in importance, especially in connection with wood-pulp, wood-working, and ironwork. The want of coal makes water-power specially valuable, and although there are few waterfalls of any height, the rivers of Finland, rushing from lake to lake, form rapids so numerous that we should be tempted to call them innumerable did we not find them all catalogued in the text and indicated on the map by bars across the river, proportional in length to the height of the fall, and circles proportional in size to the available horse-power. This is certainly the most novel and one of the most useful maps, showing that the Finnish people are keenly aware of the importance of neutralizing their want of coal by their abundance of water-power, and anticipating the general use of electricity in industrial work.

The concluding articles and the last maps deal with the prehistoric remains of Finland and the earliest maps of the country, published by Olaus Magnus in 1539, and Andreas Bureus in 1626. The whole gives such a picture of the country as to compel the admiration of every reader for a people who have taken part so bravely in the battle of life in surroundings which are far from encouraging, and who have so carefully ascertained the nature of their country and the extent of its resources. There is here an educated European people of diligent habits and mainly agricultural in calling, struggling successfully with a poor soil and an adverse climate. Such a people, of sound physique and morally superior, would be an acquisition to any country, and if circumstances should compel them to emigrate in large numbers to the congenial climate and more fertile lands of Western Canada, it will be a fortunate circumstance for the Dominion and for the British Empire.

No scenery in different countries has ever struck me as more similar than that of South-Eastern Finland and South-Western Ontario. The rock-bound lakes and open forest of birch and pine, the mossy glades amongst the trees, and even the log-houses have a similarity, which should greatly soften the breaking of old ties and the transition from the land of the Kalevala to that of the poem whose metre it inspired—"Hiawatha."

MRS. BISHOP'S TRAVELS IN CHINA.*

Mrs. Bishop's latest volume, describing her adventurous journey through Central China in 1896–97, is undoubtedly one of the most important contributions to English literature on that country which have appeared within recent years. Regarded merely as a book of travel, it is fully entitled to rank with such well-known works as the late Captain Gill's 'River of Golden Sand,' while the authoress's high descriptive powers and painstaking determination to obtain an insight into the inner life of the people with whom she comes in contact, render the work particularly valuable for the light it throws both on the country and its inhabitants.

As Mrs. Bishop has already presented the Society with an outline of the events of her journey, it is unnecessary to recapitulate them here. A brief word, however, must be devoted to her descriptions of scenery and other subjects more strictly connected with the geography of the country. Of these her account of her voyage in a native house-boat up the Yang-tse gorges is perhaps the most striking, and, in spite of the many descriptions which have previously appeared, brings home in an unusually vivid manner the characteristics of this part of the great river. Hardly less useful is her detailed account of her journey through Central Se-chuan, which has not been so carefully described by any previous traveller. The agricultural and industrial resources of this important region are fully dealt with. Of special interest, too, is the account of the mountainous region of North-Western Se-chuan, with its aboriginal inhabitants the Miao-tze, where Mrs. Bishop was, at her furthest point, breaking ground never before visited by Europeans.

Describing a day's journey on the threshold of the Miao-tze country, she writes, "I cannot attempt to convey to the reader any idea of the glories and surprises of that long day's journey. It was a perfect extravagance of grandeur of form and beauty of colouring, and the sky approached that of Central Asia in the brilliancy of its bright pure blue. Every outline was sharp, but the gorges were filled with a deep blue or purple atmosphere. . . . Peaks and precipices are piled on each other, and through the rare openings there were gleamings far away of sunlit cones of unsullied snow." A few only of the many instructive studies of Chinese life and character can be touched upon. They deal with such subjects as the New Year festivities and the ceremonies and duties

* 'The Yangtse-Valley and Beyond.' By Mrs. J. F. Bishop. London: Murray. 1899.

connected with them; Chinese charities and educational methods; the system of government and the failings and virtues of the mandarins; and many other questions of importance for the future of the empire. For the Chinese mobs—at whose hands her life was on two occasions in actual danger—Mrs. Bishop has naturally no good word to say; but she found much to like in the dwellers in the country districts, who are generally quiet and harmless. She is far from sharing the views of those who regard the empire in a hopeless state of decay, and, while acknowledging the evils of the system of government, points out various counterbalancing features which tend to the stability of the country. The "open door" policy, as opposed to the political encroachments of European nations, finds in her a vigorous champion. We have said nothing of the many hardships encountered during the journey, but though the writer does not dwell on these, she says enough to make us wonder at the spirit and hardihood which enabled her to persevere in spite of all obstacles, and carry through her undertaking to so successful a termination.

NARRATIVE OF A JOURNEY TO THE LAKES RAKAS-TAL AND MANASAROWAR, IN WESTERN TIBET, UNDERTAKEN IN SEPTEMBER, 1848.*

By Lieut.-General Sir RICHARD STRACHEY, R.E., G.C.S.I., F.R.S.

August 8–16.—Accompanied by my friend Mr. J. E. Winterbottom, I left Almora on August 8, 1848, with the intention of going *viâ* Milam, as far as the Satlaj river in Tibet, and if possible on to the lakes. The first part of the journey presented little that was remarkable, and it was hot and rainy. Our route lay, for about 50 miles, over the outer Himalayan ranges, at elevations between 3000 and 7000 feet, to the valley of the Gori river, at the head of which Milam is situated. Into this valley we descended from the Kalamundi pass, over a ridge rising to over 9000 feet, at the foot of which lies the cluster of villages of which Jalat is the centre and most important. These form the winter residences of the inhabitants of Juhar, the name given to the highest portion of the valley of the Gori, that of the lower part, in which Jalat is situated, being Munshari.

The direct road to Milam lies up the bed of the Gori, but it passes through a gorge between lofty and precipitous mountains, and at this season was impracticable, as bridges, which are each winter destroyed by avalanches, had not yet been repaired. Earlier in the year, when the migration of the people of the highest valleys commences from their winter quarters on the outer ranges, the snow which is accumulated by these avalanches itself affords the means of crossing the river. At the time of our visit the snow had melted, and the Gori was unfordable; we therefore had to take a more circuitous route by the Ralam valley, which joins that of the Gori a little above Jalat.

August 21.—Crossing the Gori, we soon got into dense forest, which became continuous until we left it in ascending the Ralam valley, at an elevation of about 11,000 feet, beyond which arboreous vegetation ceases, and the alpine herbaceous

* As this narrative has not before been published, the information it contains has been considered by the Council of sufficient value to be placed on permanent record.—Ed. *G. J.* Map, p. 204.

MAP OF THE MOUNTAINS ON THE NORTHERN BORDER OF KUMAON AND OF THE ADJACENT PARTS OF TIBET.

Scale of Statute Miles
0 10 20 30 40 50

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zone is entered, which by its wonderful luxuriance characterizes the southern flanks of the snowy ranges at these elevations. In the six days occupied by our journey from Jalat to Milam, upwards of 250 species of flowering plants were added to our collections.

August 23.—Ralam, 12,000 feet, is a wretched-looking village with flat-roofed mud and stone houses, which cut no figure when compared with the far smarter slated abodes of the more civilized inhabitants of Juhar. The people are poor and uncouth, approximating in their habits to the semi-Tibetan population of the contiguous valley of Darma, which is so difficult of access that I was told that no European had entered it since the surveyors in 1817. Ralam is said to be famous for its turnips, but I had no means of testing this.

August 24.—From Ralam our route lay over the Barji-kang pass, 15,400 feet.

Hansa ling, 18,200 feet. Dhánsi, 19,200 feet.

Bed of the Gori, 4000 feet.

VILLAGE OF JALAT, 6400 FEET.

The ascent was easy, and the vegetation abundant and varied, and no fewer than thirteen species of saxifrage were collected between Ralam and the top of the pass. From the summit we looked down into the head of the Gori valley, seeing right up it to the extremity of the great glacier from which that river rises. For a few minutes the peaks of Nanda-devi, 25,700 feet, and Nanda-kot, 22,600 feet, distant about 15 miles to the west, were visible, but they were soon covered by the clouds that constantly hung about the higher points of the snowy mountains during the rainy months. The contrast between the view on the two sides of the pass was most striking. To the north the Milam valley looked bright, cheerful, and dry, chiefly in sunshine, though a few detached clouds threw patches of shadow here and there on the bare brown hillsides; while to the south the Ralam valley was densely filled with mist, which rolled up just over the crest of the pass, but soon dissolved on the dry north face.

August 25.—In the morning, which was wet and cloudy, the temperature of the air was not below 38°·5, but next day, after a clear night, it fell to 32°, and a thermometer exposed to the sky on loose cotton fell to 23°·2. The maximum afternoon temperature was 51°, with the sun shining and the sky tolerably clear.

August 26.—The descent from the pass lay over the faces of the beds of the schists, which dipped steeply to the north-north-east, the uptilted southern ends of which we had crossed during our ascent. The surface was well clothed with the plants common to alpine pastures, such as Potentilla, Ranunculus, Primula, Polygonum, etc., but afforded few new species. With the exception of a dwarf willow (*Salix Lindleyana*), which was found at 14,000 feet, the first woody plant met with was the birch, *Betula utilis* (*Bhojpatra*), which appeared at about 13,500 feet.

The change from the forest-clad mountains and luxuriant vegetation, with the soaking wet and clouds of the outer ranges through which we had come, to the dry and relatively sunny climate of the bare valley of Juhar was very striking, and most acceptable to all of us, and not less so to our herbarium, which, in the constant rain of the last few days, was not improving.

August 27.—We reached Milam, 11,400 feet, on August 27, and it at once became apparent that we had been long enough exposed to the vicissitudes of wet and heat, for almost every one of our servants had been attacked by intermittent fever, some of them rather severely. We fortunately did not suffer.

The highest inhabited part of the valley of the Gori, lying between 10,000 and 12,000 feet above the sea-level, is called Juhar. It is about 10 miles in length, with a bottom breadth of 1 or 2 miles, beyond which the mountains rise steeply, but not very abruptly in their lower portions. The summits of these mountains, for the most part, enter the region of perpetual snow, and most of the larger side ravines are occupied by glaciers. The vegetation is generally scanty, and, with the exception of a few stunted birch, a juniper or two, *Juniperus communis* and *macropoda*, near Milam, and a small cluster of *Pinus excelsa* near Tola, there are, I think, no trees whatever in this part of the valley. The shrubs also are diminutive and confined to a few species, the herbage, where not under the influence of a stream of water, being equally scanty. The flora, however, though poor, is interesting, as containing a very distinct proportion of Tibetan elements, no representatives of which spread into the Gori valley below Juhar. Of these may be mentioned *Caragana pygmæa* (*versicolor*), the commonest of the bushes of the Tibetan uplands, called in Tibetan "trama," but corrupted by the Bhotiyas into "dama." It is a thorny and usually a stunted shrub, which may be compared to our English furze. Other Tibetan forms are *Clematis orientalis*, *Hippophaë rhamnoides*, and species of *Potentilla*, *Lonicera*, and *Pedicularis*.

In the upper part of this valley we come upon the base of the great fossiliferous series of rocks that constitute the mountains forming the ranges on which are situated the principal passes into Tibet. To this line of elevation I have applied the general designation of the *Indian watershed* of the great Tibeto-Himalayan tableland. The occurrence of well-defined series of fossiliferous strata, first established by my observations during this journey, and those made in the following year in the neighbouring valley of Niti, is of special importance, as it supplies an unquestionable basis on which speculation as to the geological history of this vast mountain region may now be founded.

The most important village in Juhar is *Milam*; the next is *Martoli*, and, as a natural consequence, there is a feud between them. The men of Milam are, however, generally recognized to be the most enlightened and most enterprising of the Juharis, *i.e.* people of Juhar, and much superior to any other branch of the half-bred races, commonly spoken of as *Bhotiyas*, found along this part of the frontier between India and Tibet.

Milam, though large for Juhar, is in reality but a small village. The houses are usually built of stone, often whitewashed, two-storied, and roofed with slates. The inhabitants are almost wholly traders, agriculture being of quite secondary importance with them. The crops, such as they are able to raise, are wheat, the beardless barley of Tibet, and two species of buckwheat, *Fagopyrum esculentum*, *Ogal*, and *F. tataricum*, *Phaphar*; besides mustard and turnips. The year of our visit the wheat and barley were very poor, hardly more than 15 inches in height, owing to an unfavourable season, with less rain than usual.

The trade with Tibet is carried on almost exclusively by the Bhotiyas distributed along the higher valleys of the Himalaya, the Tibetans taking little part in the carrying business on the south side of the passes. The chief articles dealt with are salt and borax from the Tibetan side, which are exchanged for grain from the Indian side, miscellaneous merchandise being taken to Gartok, a mart beyond the Satlaj. The inhabitants of the parts of Tibet contiguous to Kumaon and Garhwal—and the same may be said of those bordering on Nepal—are almost wholly dependent on foreign supplies of grain for their sustenance, their

PEAK OF NANDA DEVI.
As seen from the south, through a telescope, at a distance of 50 miles.
Elevation 25,693 feet.

own country being almost incapable of producing it. The population, however, is so scanty that the quantity they require is small, and their poverty is such as to afford them little means of supporting an import trade in miscellaneous goods of any considerable value. The material difficulties of transit over the snowy mountains might seem likely to be nearly fatal to the development of the traffic carried on, as it is mainly on the backs of goats and sheep, which can only carry loads of 20 or 30 lbs. weight each. It has been estimated that the trade of Milam amounts in value to upwards of 60,000 or 70,000 rupees, each way, during the season. Fortunately, there is perfect free trade on our side, though the Tibetan authorities exact a duty on all imports.

A cross-breed of horned cattle, called *jhobu*, peculiar to the borders of Tibet, is also employed in this carrying trade, though less extensively than goats and sheep, the multiplication of which animals is favoured by the small number of beasts of prey, such as abound on the outer ranges of the Himalayas. The jhobu is used for the heavier and more bulky merchandise, as well as for riding by the more wealthy Bhotiyas. This breed, which is called *jhobu* by the Bhotiyas, and *dzo* by the Tibetans, is a cross between the Indian bull and the Tibetan or yak cow. The best are said to be raised in the neighbouring valley of

Niti. It is more tractable and less uncouth in its appearance than the shaggy yak, which has much of the fierce look of the bison. The yak is incapable of supporting a hot climate, to which the jhobu is better suited, being from its Indian blood less impatient of heat, and hence more fitted for the Bhotiya trade, which at times involves journeys into the warmer valleys of the Himalaya.

A good *jhobu* is valued at from twenty to thirty rupees, while a yak, called by the Tibetans *chanwr*, costs only seven to twelve rupees. The other cross-breed, between the *chanwr* bull and the Indian cow, is said to be far less valuable than the jhobu. These mule races are said to be sterile *inter se*, but to breed with the pure stock of either species.

The load of a jhobu is about 120 lbs., or equal to that of three men, and the ordinary distance they can travel in a day is about 10 or 12 miles. The cost of a goat or sheep varies from one to two rupees, and they are seldom driven more than 5 or 6 miles a day.

The Bhotiyas of Juhar are smart and intelligent men, decently educated, all things considered, and even have some knowledge of Hindi literature, such as it is. They are commonly short and stout, and some of them decidedly obese. Their dress consists of a long coat, called *baku*, the skirts reaching below the knee, of white or grey woollen cloth, with loose trousers to match. They are cheerful and well-mannered. Theft is unknown among them, and their chief vice is drunkenness, to which they are somewhat addicted.

We employed the interval required after our arrival at Milam for the necessary preparations for our journey into Tibet, in making an excursion up the great glacier which fills the head of the Gori valley, and from which that river issues, with the object, amongst others, of measuring its motion. The glacier terminates about a mile and a half above the village of Milam at a height of about 11,590 feet above the sea. Its main trunk extends nearly 10 miles up the valley, which there ends abruptly in a ridge, on which is a cluster of snowy peaks, the altitudes of which are from 22,500 to 23,600 feet. Six tributary glaciers of smaller dimensions occupy as many ravines or valleys on the west, on which side the mountains are extremely lofty, culminating in the great peak of Nanda-devi, before referred to. Three smaller glaciers descend from the somewhat lower ridge to the east of the central valley. The ice from two or three of these tributaries does not, however, now join the main glacier, though it appears to have done so formerly from all of them.

The line that I selected on which to fix marks for the measurement of the motion of ice was 7 miles from the lower extremity of the glacier, which was here about 4000 feet across. The elevation of the surface of the ice was about 14,600 feet, and the highest part of the main stream of the glacier rose in a great dome of clear ice immediately above, reaching probably to a height of 15,000 or 16,000 feet. Beyond this the glacier bifurcated to the right and left, and the branches were lost sight of behind projecting angles of rock.

The most remarkable feature of this glacier was the immense quantity of *débris* with which its lower part was covered, so that for the last 5 miles no clear ice at all could be seen, the entire surface being concealed by a confused mass of rocks and *débris*, with many large pools of water scattered over it. The indications thus afforded of a great shrinkage of a glacier of former far greater proportions are everywhere confirmed. The lateral moraines show this in a striking manner. In many places several parallel lines are to be seen one within the other, left stranded on the valley floor, as the main body of the glacier has shrunk and subsided. The enormous accumulation of *débris* that has taken place at the extremity of the glacier entirely covers and conceals the ice, so that the terminal face, instead of being convex, as is usual, is concave, the ice on the flanks being protected by the *débris* piled over them, while the centre is being constantly eroded by the river which rushes, a giant at its birth, from the terminal cave that appears in the concavity formed by the projecting flanks.

These signs of the gradual diminution of this glacier are confirmed by the testimony of the people of Milam, who point out a rock up to which the ice formerly extended, but is now several hundred yards below its termination. But a still greater and more ancient extension is shown by an old moraine that is to be seen to the east of the village, which reaches for about a mile below it, or altogether not less than 2¼ miles from the present end. The evidence of any extension of this glacier farther down the valley is wanting, though there is probably another ancient moraine filling up the mouth of the ravine at which the village of Martoli is situated. This mound rises to about 500 or 600 feet above the present level of the river, but whether it has been caused by a former extension of the

THE GLACIER OF THE GORI.

great Gori glacier, or by the glacier which exists higher up the ravine, or is an accumulation formed by running water, is somewhat uncertain. Such accumulations at the ends of lateral ravines are to be seen in all mountain valleys under similar circumstances, and villages are commonly placed upon them, as, from their constituents, they afford a surface more capable of tillage than is usually to be found elsewhere.

Our route up the great glacier followed a track along its east flank leading to grazing-grounds used by the people of Milam. The vegetation was scanty, but interesting. Among the shrubs last seen were two roses, *R. sericea* and *R. Webbiana*, white and red. One of the most conspicuous of the flowers was an *Allardia*, a genus of Himalayan and Central Asian Compositæ, with a beautiful rosy ray. On some of the moraines we crossed I found Lower Silurian fossil remains, among which was a trilobite, the first, as I believe, ever met with and recognized as such by any traveller in these mountains. The rocks further down the valley were solely metamorphic schists, the fossiliferous beds all lying to the north-eastward, higher up the mountain face, from which the fossils, among which were remains of brachiopods as well as trilobites, had been brought down by glaciers and avalanches.

In several places small streams of water running down the mountain-sides cut quite through the lateral moraines, occasionally keeping open deep-recessed spaces in the ice several hundred feet in breadth. At the meeting of one of the side glaciers with the main ice-stream, the veined structure was very distinctly seen in both, the bands curving upwards towards the line of junction where they were nearly vertical, the beds of apparent stratification being in planes perpendicular to the lines of pressure, quite in accordance with the accepted views of the method of the formation of glacier ice-structure by the combined result of the pressure and motion of the ice-particles.

While on the glacier, we witnessed the fall of a magnificent avalanche from among the great snowy peaks at its head. Its approach was notified by a loud roar, like that of distant heavy artillery; then what appeared to be a pure milk-white torrent poured down a ravine, followed by a vast white cloud of snow, having the appearance of a great column of steam, or of smoke after an explosion of gunpowder, thrown up 100 or 200 feet or more into the air when the avalanche reached the surface of the glacier.

In order to ascertain the rate of movement of the glacier, I revisited the marks that had been set up on August 29, on my return from Tibet on September 30. The results were as follows:—

	Movement in 32 days.	Movement in 24 hours.
	ft. in.	in.
Station 1. At 900 feet from cliff on east ...	33 0	12·4
" 2. " 1052 " " " ...	34 9	13·0
" 3. " 1289 " " " ...	38 0	14·7
" 4. " 1763 " " " ...	44 9	16·8

These rates do not differ in an important degree from those commonly observed in the summer months on glaciers in the Alps, which lie between 9 and 27 inches in 24 hours.

The motion of a smaller glacier, that of the Pindar, on the outer face of the Himalaya, observed by me in the month of May, was found to be 9½ inches for the 24 hours at the centre of the clear ice; and for the whole period between May 21 and October 15, when it was revisited, the motion was 98½ feet, giving an average rate of just 8 inches in the 24 hours. The surface of the ice where the measurements were made in this case was at an elevation of 13,000 feet, and the extremity of the glacier was at 11,900 feet.

On the Milam glacier we found, lying in considerable numbers, the remains of locusts, which had been preserved from decomposition by the cold for a period of two or three years, so far as I could learn, the last flight of locusts having occurred at about that time. Such flights penetrating into the very heart of the snowy mountains are not uncommon, the insects being, no doubt, facilitated in their journey by the periodical winds which so regularly blow from the plains of India up the valleys during the day hours, from about 10 a.m. to sunset.

On August 29, at our encampment 6 or 7 miles above Milam, we caught a bat flying about at dusk. It seemed rather a curious locality in which to find such a creature. Here, at an elevation of 13,700 feet, the thermometer rose to 57° at about the hottest time of the day, and the temperature of the earth about 3 feet below the surface was 48°. There was no trace of snow on the ground or neighbouring rocks, and the vegetation was abundant. At Milam at 6 p.m. on

October 2, at 11,500 feet, the temperature of the earth 1 foot below was 59° 6, and at 3 feet below the surface, 55°. The maximum temperature during the day was a little below 60°.

The terminal moraines of the glacier extend to the junction of a side stream, the Gonka, with the Gori, and have forced the Gonka up against the face of the mountain, into which that stream has now cut itself a bed in the solid rock. The gradual depression and erosion of the Gori river has cut away a series of terraces out of the unconsolidated mass of the moraine, on the highest of which the village of Milam is situated. The lower terraces are cultivated, and the soil is in all respects identical with that laid out by the river that now flows below them.

PLANTS FOUND AT AND NEAR MILAM, 11,000 TO 13,000 FEET.

Clematis orientalis.
Thalictrum platycarpum.
Ranunculus—sp.
*Aconitum Napellus.
„ heterophyllum.
Berberis vulgaris.
Draba lasiophylla.
Sisymbrium himalaicum.
*Brassica campestris.
Lepidium capitatum.
*Silene inflata.
Stellaria decumbens.
Arenaria serpyllifolia.
„ holosteoides.
Impatiens Thomsoni.
Thermopsis barbata.
Caragana crassicaulis.
Guldenstædtia himalaica.
Astragalus himalayensis.
„ multiceps.
Cicer songaricum.
*Potentilla fruticosa.
„ ambigua.
„ bifurca.
Rosa Webbiana.
„ sericea.
Artemisia scoparia.
„ biennis.
„ sacrorum.
Cousinea Thomson.
Crepis glauca.
Lactuca rapunculoides.
Campanula cashmiriana.
„ aristata.
Androsace Chamæjasme.
Gentiana cachemerica.
Pleurogyne carinthiaca.
Polemonium cœrulium.
Eritrichium strictum.
*Verbascum Thapsus.
Pyrus aucuparia.
Cotoneaster microphylla.
Saxifraga flagellaris.
„ Stracheyi.
*Ribes grossularia.
„ glaciale.
Sedum asiaticum.
„ trullipetalum.
„ Ewersii.
Epilobium latifolium.
* „ roseum.
„ origanifolium.
Pituranthos nuda.
Sesili trilobum.
Pleurospermum Candollei.
„ stellatum.
Heracleum Brunonis.
Lonicera glauca.
„ obovata.
„ alpigena.
Galium triflorum.
Nardostachys Jatamansi.
*Erigeron alpinus.
Anaphalis Royleana.
Allardia tomentosa.
Tanacetum tibeticum.
Axyris amaranthoides.
Polygonum islandicum.
* „ aviculare.
„ tubulosum.
„ glaciale.
„ polystachyum.
Rheum Webbianum.
Hippophaë rhamnoides.
Parietaria debilis.
Ephedra vulgaris.
*Juniperus communis.
„ pseudo-sabina.
„ macropoda.
Allium victorialis.

Scrophularia lucida.
Veronica ciliata.
„ biloba.
Pedicularis megalantha.
„ tubiflora.
Orobanche epithymum.
Elsholtzia eriostachya.
*Origanum vulgare.
Nepeta spicata.
„ discolor.
Scutellaria prostrata.
Potamogeton pectinatus.
*Scirpus setaceus.
„ caricis.
Hierochloa laxa.
Deyeuxia scabrescens.
Avena ænea.
Danthonia cachemyriana.
Bromus tectorum.
Agropyron longe-aristatum.
„ semicostatum.
Elymus sibiricus.

N.B.—An asterisk prefixed in this list, and in subsequent parts of this journal, implies that the species is also British.

September 2, 1848. *Milam to Shelong*, 6 *miles*.—All preparations being completed, we left Milam this day. Our retinue consisted of sixteen Bhotiyas, taken two or three from each village in the valley, so that the pains or profits of the expedition might be fairly distributed. The nominal head of the party was one *Bachu*, a relation of the principal native official in Juhar, stout and short, but young and active, not very wise, yet intelligent enough, reputed to be a good sportsman, and having no objection to a glass of grog. He was provided with a jhobu of his own, but was the only one excepting ourselves who habitually rode. Next to him in importance was *Boru*, the *Padhan* or headman of *Tola*, a village near Milam; he was oldish, thin, and taller than the ordinary run of his countrymen. He was a shrewd fellow, and had been over a good deal of *Hundes* (*i.e.* country of the Huns), as the part of Tibet bordering on the Indian watershed is commonly called by the Hindu inhabitants of this part of the Himalaya. *Boru* naturally became our guide, and on him would devolve the duty of answering any questions put by over-inquisitive Tibetans who came in our way. In doing this, as he could not have given a satisfactory account of us if the truth had been strictly attended to, he never failed to draw freely on his imagination, and with most successful results. To the rest of our people were allotted the miscellaneous functions of loading and driving the cattle, pitching the tents, getting firewood and water, cooking our dinners, and performing other domestic services.

We were victualled for a month, as no provisions were to be got after we had once entered Tibet. We carried two small tents, 8 or 10 feet in length, one for our own use, the other for the Bhotiyas; and if it be asked how our sixteen men could get into one such tent, it must be explained that there is an aristocracy even in the heart of these snowy mountains, who appropriate such comforts of life as are to be had to themselves, and that the underlings were expected to live wholly in the open air, day and night, which they did without any apparent inconvenience, being as rough and hardy as any of the twenty jhobus that carried our baggage.

The jealous policy of the Chino-Tibetan Government rigorously excludes all strangers from its territories, and it is only by adopting some disguise and avoiding any contact with the people, or, in some rare cases, by boldly advancing in spite of the prohibitions of the authorities, that it is possible to penetrate to any distance into the inhabited parts of Tibet. On the present occasion we adopted the quieter plan, and made such modifications of our costume as would enable us, without attracting special notice, to hurry past any Tibetans we met unexpectedly, and with whom we might be forced into proximity; for we altogether gave up the idea of being able to pass ourselves off as authorized travellers if we were distinctly seen. Hats were abandoned, their places being supplied by felt skull-caps, such as are worn by people of the country, while over our ordinary clothes we put on the Bhotiya *baku*, a garment of the cut of a dressing-gown, which answered sufficiently well the purpose of a great-coat.

Our scientific equipment consisted of a few bundles of paper for drying plants; a small theodolite, azimuth compass, and reflecting circle; a short barometer, which I had myself prepared for the purpose, suited for the great elevations at which we were about to travel, with a spare tube in case of accidents; and thermometers, with apparatus for observing the boiling-point of water. The barometer was carried by one of the men; all the other things were packed on the jhobus' backs, and travelled with perfect safety.

We left Milam about noon. A token of the Tibetan affinities and sympathies of the inhabitants stands a few hundred yards from the village, by the side of the path we followed, in the shape of one of the Budhistical buildings commonly called *Mane-pane*. The structure in this instance is a rudely built dry stone wall, 20 or 30 feet long, 4 or 5 feet thick, and as many high, with a recess in one of the longer sides in which are inserted three wooden cylinders revolving on vertical iron axles, while a fourth is similarly fixed in one of the ends. These praying-cylinders, as they have been called, are without ornament or external inscription. It was not possible to examine their interior, but such articles are commonly filled with rolls of paper covered with sacred texts, or inscribed many hundred times over with the sacred legend, "*Om mane padme hum*," which signifies, "O Lotus-bearer, Hun!" the mythical personage thus addressed being an important character in Budhistic ritual.

On the top of the wall are placed slabs of stone, on which the same words are roughly carved. The devout passer-by, touching the cylinders, causes them to revolve, and each mystic sentence within them, as it is carried round, becomes endowed with the same efficacy to the passer as though it had been spoken by him in adoration. Hand-machines of a similar description, often richly carved in brass or silver, are used by pious individuals; but some of the monastic societies of Tibet employ for their more serious devotions a more ponderous liturgy, and call to their aid water-power and a praying-cylinder 6 feet high.

Crossing the old moraine before noticed, which is covered with barberry, gooseberry, and rose bushes, we descended and passed the stream, called on the old maps *Gonka*, by a wooden bridge. Gonka is really the name of the ground near the bridge, though it is applied to the bridge also. It means "below," and has been given to this locality because it is below an old fort on the moraine. The river itself, as is often the case in Kumaon and Gurhwal, has no special name. In a state of society such as here exists, geographical names, as Humboldt has well observed ('Aspects of Nature'), are only necessary to distinguish places which are likely to be confounded one with another. Thus we find that in these mountains—and this holds good in many other parts of India—the great rivers are called by the inhabitants simply *Ganga*, *i.e.* "the river," while distinctive names are hardly used or known except by strangers. So with respect to the mountain peaks and ranges, many have no other names than those of the *Deotas*, or local deities, who are supposed to reside on them. The passes, pasture-grounds, and regular halting-places have definite names, and it will often be found that one of these supplies the deficiency, when a European traveller insists upon having a name given to him, for peak, ridge, or other locality, which in reality has no recognized name at all.

The old fort is a small enclosure surrounded by a ruinous wall a foot or two high, regarding which stories are told of heroic defences by the ancient people of *Milam* against lowland invasion. Regarding the origin of this ancient people of

Milam, tradition says that an adventurer from *Daba*, the chief place in Guge, the neighbouring province of Tibet, was led over the mountains by a mysterious stag to the place which he called *Mi-dum*, or *lame man*, inasmuch as he was lamed by his walk over the passes. There were stories also of a dragon, a standard dish in the myths of Tibetans, and of an old woman—a witch, I suppose—but it was not clear what these had to do with the foundation of *Milam*. It is curious that the *Shea*, a stag with great antlers, which enters into these histories, though now quite unknown in this part of the mountains, has a real existence. It is the *Cervus Wallichii*, of which specimens have been lately got from Tibet by Mr. Hodgson, as well as from the north of Kashmir by Captain Cunningham. Some of the names of the places on the road we were following are connected with these traditions: *She-long* is the place where "the stag got up;" and *Sam-gong*, "happy heart," the spot the beauty of which captivated the trans-nivean immigrant. [I have since been informed by Dr. W. E. Blanford that the greatest doubt attaches to the existence of Hodgson's *Cervus Wallichii*, though it is possible that the stag of Kashmir may have been found in the Bhotiya valleys of Kumaon.]

My own taste, I confess, differed from that of the Tibetan explorer. The valley of the *Dung* river, as the stream along which our route led us may more properly be called, is nothing more than a mere ravine, down which rushes a roaring torrent jammed in between mountains, that rise from the very edge of the water either in shattered cliffs, or more frequently in great slopes of loose *débris* that extend upwards without a break for thousands of feet. The vegetation was miserable, the heat of the sun and the glare from the bare surfaces were most disagreeable, and the whole aspect of nature was wretched in the extreme.

The road, which, however, hardly deserves the name, in spite of an affectation of repairing it that had been gone through in our honour, is a track, and that a bad one, keeping generally near the stream, sometimes pretty level over a talus of *débris*, now descending to cross a side ravine, now ascending abruptly over some prominent point of solid rock that juts out into the centre of the valley. The accumulations of mud and stones heaped together by torrents, avalanches, and glaciers, over which the road goes, though compact and firm enough when dry, are quite otherwise when the snow is melting or after any considerable fall of rain, and this road then becomes difficult and even dangerous. In these heterogeneous accumulations of loose material, curious pinnacles or rough cones of various sizes often detach themselves from the general mass as it decays, capped with stones which have afforded protection to the summit of the pile, while the materials around it have melted away under the action of rain or weather. Great fragments of rock of considerable dimensions are thus left perched high in the air on very slender columns of mud and stones, in positions which at first sight seem strange enough. These pinnacles are frequently met with in other places on the borders of Tibet, where the conditions of soil and climate are similar. I remember, also, to have seen precisely the same thing in some of the unconsolidated boulder strata of the Siwalik hills, and the analogy with the ice-tables on glaciers is complete.

As we increased our distance from *Milam*, the vegetation became more and more scanty, and we passed the last bushes worthy of the name (* *Juniperus communis*) a mile or so before we reached *Shelong*, where we halted. As far as the pass of *Unta-dhura* there is only one route from the valley of Juhar into Tibet, though beyond that pass a choice is possible between two or three lines. Consequently, on this portion of the route the frequent demands for firewood for travellers, and the attacks of sheep and goats for fodder, have nearly annihilated the vegetation, which, had it been left undisturbed, would have been miserably poor.

Shelong is a mere ledge a few hundred feet square on the valley-side, at an elevation of 12,860 feet. It supports a show of vegetation and tries to be green, but the multitudes of sheep that pass over it, succeed in depriving it of any claim to such an epithet. The plants observed were *Astragalus strictus*, an *Artemisia*, *Sedum trullipetalum*, and *Cotyledon oreoides*. Immediately above us rose a great talus of *débris* issuing from a narrow rent in the cliffs behind, and spreading out into a broad-based cone below. These cones of *débris* are among the characteristics of these regions; their formation seems partly due to avalanches, and partly to torrents caused by melting snow, which take their place later in the season, and they often terminate as this one did, in a snow-bed. Such accumulations, when their ends are cut away by the eroding action of streams at their bases, often exhibit an appearance of stratification, which may cause them to be mistaken for river-deposits at great elevations above the existing waters, where, in fact, no such deposits have ever been formed. The origin of this false stratification is readily understood: the fresh material which is brought down from above, as it rolls onward, spreads out and covers up, with some regularity, the older and inferior parts of the slope.

A first trial of a ride upon a jhobu, though highly satisfactory as to the sure-footedness of the animal, gave but a sorry augury of the pleasures of a long day's journey. We thought it prudent on this journey to use the ordinary saddle of the country, as it was important to avoid anything that would attract attention, and to those not accustomed to them these saddles are excessively uncomfortable. I have, however, subsequently used an ordinary English saddle on a jhobu's back with perfect success. The pace of the jhobu is very slow, hardly more than 2 miles an hour at best, and often much nearer a mile. They are usually quiet beasts, though sometimes impatient when being mounted or loaded. They are driven or led by a nose-rope fixed in the cartilage between the nostrils in the ordinary Indian fashion of dealing with horned cattle, but it is hardly worth while to attempt to guide them, as they resolutely take their own way, and it is soon found that they may be trusted implicitly. Like other animals, they are treated by their human masters with a peculiar language. *Chu* and *Ryu* are the words of exhortation most common, the latter being the more emphatic. Whistling is in these regions an invariable accessory to all driving, either of horned cattle or sheep, but with the latter animals the noise is incessant and accompanied by the most outlandish guttural sounds, which it would be difficult to imitate with a civilized throat, and quite impossible to represent upon paper.

At 9 p.m., therm.—air, 45°; earth, 9 inches below the surface, 52°.

September 3, *Shelong to Topidhunga*, 13 *miles*.—At a.m., therm. 44°. To-day we were to cross the first great pass, and here, therefore, we left behind our ordinary servants, and assumed our complete Bhotiya costume.

The road still follows up the same valley, with the same characteristics as yesterday, as far as *Dung*, shortly before reaching which place we passed over the terminal moraines of a small glacier, the ice of which was visible a few hundred feet above us on the right.

Dung, 13,570 feet above the sea, is the name of the halting-places on both sides of the river, near the junction of the stream from the *Lasar* glacier, and that from the *Shikal-gal*, another glacier, up which our road lay. Attempts have been made to establish a route over the *La-sar* (*La*, "pass," *sar*, "new"), which will be seen from the map to lead direct to *Chirchun* and Tibet generally; but the difficulties—glacier crevasses, I think—are said to have been found insurmountable, and the only road now used is that over *Unta-dhura*, which leads up the *Shikal-gal*. The river at *Dung* is crossed by a solid causeway, built on some large masses of rock which have fallen from the cliffs above or have been brought down by the glacier, and which now form a sort of natural bridge. There are a great number of these fragments of rock near this spot; the majority lie on the right bank of the river, from which they have fallen, but many are found also on the left bank. Good shelter is to be had on the left bank under some of these rocks, which form spacious caves, or, as they are here called, *udyar*. These masses of rock are composed of an impure concretionary limestone, which here forms the upper member of the Lower Silurian series, and I have seen rocks which no doubt form a continuation of the same beds as far nearly as the *Niti* pass.

The present extremity of the *Shikal-gal* is about a quarter of a mile from *Dung*, but there are evident marks of the glacier having formerly extended to that place. The face of the ice at its lower end forms a great precipice, the lateral portions projecting beyond the centre, so as to give it a general concave outline, like the *Gori* glacier. The conchoidal structure is finely exhibited. Keeping to the southern side of the lateral valley we had entered on passing *Dung*, we at once ascended and crossed the glacier. This was done with remarkable ease, the ice being very little crevassed, and its whole surface being entirely covered with broken and disintegrated stones. A tedious and disagreeable ascent along the north moraine, over sharp angular fragments of Silurian limestones and the quartzites that cap them, brought us to a flat-topped knoll of firm ground called *Bompras*, at an elevation of about 14,500 feet, on which we found a few new plants, *Arenaria glandulifera*, *Erigeron alpinum*, and *Lloydia serotina*. Here we left the *Shikal-gal*, and, crossing over a low ridge, came upon another smaller glacier called the *Shetu-gal*, which ends before it can effect a junction with the *Shikal-gal*, into which, therefore, it pours, not ice, but only a small stream of muddy water. *Bompras*, having a little vegetation, is sometimes made a halting-place for parties travelling with sheep. Among the last plants which straggled up to this spot, we found *Carex Lehmanni*, *Saussurea sorocephala*, *Arenaria glandulifera*, and a larkspur, *Delphinium Brunonianum*. The latter, which has a strong smell of musk, is one of the flowers to the poisonous effects of which the hill people attribute the distress caused by the rarefaction of the air at great altitudes.

I may here remark that my own experience leads me to the conclusion that the pains and aches of which travellers complain at great heights, are almost entirely to be placed to the account of the bodily exertions they usually make in their ascent in the rarefied atmosphere. I have always found that so long as I remained at rest, I felt no real inconvenience whatever at any height that I ever reached, up to about 18,400 feet. A very moderate amount of exertion, however, at the greater elevations, is sufficient to bring on violent headache and painful shortness of breath. Above 13,000 or 14,000 feet even, when remaining quite still, I have frequently found myself drawing a long breath, hardly different from sighing, the lungs, I suppose, demanding more air than they could get with their ordinary degree of action. Below 11,000 or 12,000 feet, I am not conscious of ever having noticed anything abnormal in my respiration. During this ascent, by sitting quietly on our jhobus we escaped all inconvenience, though the difficulty of breathing was felt the moment we attempted to exert ourselves by walking up any part of the mountain. The beasts got on wonderfully well, though evidently not by any means insensible to the rarefaction of the air. It is, I presume, from the groans which the yak utters in working its way uphill under such circumstances, that it has received its specific name of *grunniens*; and the jhobu, a hybrid between the yak and Indian cow, inherits this peculiarity.

The morning had been cloudy from the beginning, but before we had got half up the ascent we were in a dense mist, which almost wholly prevented our seeing where we were going, excepting that we had an occasional glimpse of the glaciers with which we were at times surrounded. We were, however, more fortunate on our return journey, when we saw everything most satisfactorily, otherwise it would have been difficult for me to have said much of this day's journey.

The *Sheta-gal*, or White glacier, is no doubt so called from its general clean appearance. It forms a wide basin-shaped expanse fed by several small tributaries. The mountains rise from it in precipices, the strata being violently shattered and contorted. Along its south-east face the dip is nearly vertical, but otherwise on the whole northerly. The south-east moraine of this glacier is of black slates, I think probably Jurassic, and the strata from which it is derived are perhaps connected with the Jurassic beds that crown the *La-khur*, a pass a few miles to the east of *Unta-dhura*. The north-west moraine, however, and the ridge beyond it on which is the pass of *Unta-dhura*, are probably Palæozoic, the moraine being chiefly composed of a pale quartzite which caps the Palæozoic beds of this part of the Himalaya. The ridge of Unta-dhura is, I think, of the impure limestones already noticed at *Dung*, which occur under these quartzites. On these points, however, there may be some doubt.

Having crossed this glacier, we reached the foot of the final ascent of about 1000 feet which ends in *Unta-dhura*. This is very steep at bottom, and is covered with loose fragments of black slaty limestone, without the least appearance of vegetation on any part of it. There was no snow whatever on the ground on this ascent, nor on the summit of the pass, the immediate approach to which is tolerably easy for some distance.

We reached the top at about 4 p.m., the weather having got gradually worse as the day advanced and as we ascended, till the afternoon closed with a decided fall of sleet and rain, which, though not in any great quantity, was painful in the extreme, owing to the violence of the southerly wind. This was so high that it was impossible to put up the barometers on the crest of the pass, and the attempts I made to get water to boil were for a long time ineffectual, so that we were delayed here till past five o'clock. The cold we experienced on the pass was much more dependent on the wind than on the low temperature of the air, for the whole ground was worked up into soft deep black mud by the feet of the cattle that had lately crossed, and the snow melted as it fell, the thermometer standing at 33°·5. But the quantity of heat lost by the human body in a strong wind, even with external temperatures as high as 45°, is distressingly great, more especially if the air is much rarefied or very dry.

The height of the pass is 17,530 feet. It is at a break in the precipitous face of the mountain that rises from the *Sheta-gal* glacier. The ridge on either side of the pass had patches of snow on it at no great height, and on the northern slope a considerable accumulation of snow remained that extended 200 or 300 feet down, apparently the effect of the drift caused by the southerly diurnal winds that so constantly sweep through the gap in which the pass lies. The snow-line may be estimated to lie a few hundred feet above the pass. From the accounts of former travellers, it would appear that the ridge is hardly free from snow on the south side at the end of May, and that the descent to *Topidhunga* on the north is then chiefly over snow quite to the bottom.

As is so often the case among high mountains, the view from this pass is not very striking, the immediately surrounding heights preventing any distant prospect. The whole scene is one of utter desolation among huge precipitous barren mountains, the strata violently contorted and shattered, with snow and glaciers lying on all sides. Under favourable circumstances there is still, no doubt, much that is grand to be found in such situations, but the mists which hang over the passes of the Himalayan watershed during the summer months, when alone they can be crossed with safety, give a traveller few opportunities of really seeing where he is going; and the long-continued exposure to the extreme violence of the winds, to which he is almost always subjected on these passes, too often effectually quenches any sparks of enthusiasm which might otherwise have survived an ascent to an elevation of 17,000 or 18,000 feet. This certainly was the case with us now; nor was our descent from *Unta-dhura* made under a happier star. It commenced over filthy mud in a miserably cold wind, with drifting rain and sleet, and ended in darkness, in which we reached our tent at *Topidhunga*, worn out by fatigue and cold, and in a state of extreme wretchedness. Nor were our troubles concluded even then. In such cold and rain, a fire of some sort was an essential to anything like comfort. But the green bushwood soaked with wet, which had been brought for fuel, and nothing else was to be had, filled the tent with such horribly pungent smoke that it was quite intolerable. No approach to a blaze could be made, even with the help of a magnificent pair of bellows, which seemed to form part of the regular equipment of our Bhotiyas, and to have been specially intended to meet such an emergency as the present. We therefore had to put up with a cold and scanty supper, and to prepare our beds on the ground, which was thoroughly saturated with water, and which was not the more sweet or pleasant for having been used, as it seemed to us, as a halting-place for sheep in all past ages. Thus ended our first day painfully enough.

The vegetation recommenced on the north face of the pass, after a descent of about 500 feet, with a cruciferous plant, *Cheiranthus Himalayensis*, *Elsholtzia eriostachys*, var. *pusilla*, and the curious tufted *Thylacospermum rupifragum*, the dense hemispherical cushion-like masses of which, a foot or more in diameter, might easily be mistaken for moss by a casual observer. A few other species were observed as we came down, but in such miserable weather botanizing was not an exciting task, and night soon made it altogether impossible.

On arriving at our halting-ground at *Topidhunga*, we found that a Tibetan of *Kyunglung* on the Satlaj was already there, on his way home from Milam with sheep loaded with grain. Now, as *Kyunglung* was near the place to which we had intended to go in the first instance, and as it was therefore desirable that we should keep out of this man's sight, we decided to halt a day, to let him get on and out of our way.

September 4. *Halt at Topidhunga.*—After a wretched night, we woke to find our hopes of finer weather doomed to be disappointed, and we passed the day, during the greater part of which it was raining and snowing, in our tents at this place, which has been most deservedly called by other travellers a dismal pit. *Topidhunga* is a small piece of open and level ground about 300 or 400 feet above the *Girthi* river, a stream which, flowing westward, falls into the *Dhaoli* near *Malari*, in Garhwal. It lies at the bottom of a deep gorge between *Unta-dhura* and the *Kyungar* pass. The elevation, 14,950 feet, is such that the vegetation is only herbaceous. The chief novelties were three gentians, *G. nubigena*, *tenella*, and *squamosa*, all common in this region; *Veronica ciliata*, *Lychnis macrorhiza*, *Androsace villosa*, *Isopyrum grandiflorum*, *Artemisia biennis*, *Anaphalis nubigena*, *Microgynœcium tibeticum*, **Poa bulbosa*, **pratensis*, and **alpina*. In this neighbourhood, also, was found the only fern seen in these lofty ranges, **Cystopteris fragilis*. Our firewood, obtained from species of juniper and Lonicera, was brought from a mile or so down the river. As to outlook, we had almost none, and clouds choked up the gorge nearly all the time we were here. The thermometer varied from 34° to 41° during the day, the snow melting almost immediately it fell.

September 5. *Topidhunga to Laptel*, 8 *miles.*—At 8 a.m. at *Topidhunga*, thermometer 37°. To-day we resumed our journey, leaving *Topidhunga* at

9 a.m., and crossing the *Kyungar* pass, the height of which is probably about the same as that of *Unta-dhura*. I unfortunately broke my barometer on the top of the pass, and was therefore unable to make any certain measurement of its height.

The *Girthi* river, which flows in a most savage gorge along the south face of the *Kyungar* ridge, follows a line of dislocation of the strata, which seems to be continuous with that found further to the west along the *Hoti* river. The rocks immediately to the south of this line are Palæozoic, those to the north being Triassic and Rhætic. To the south-east of *Topidhunga*, the line of separation of the formations probably nearly follows the road we had taken, as far as *Dung*, beyond which I have no information. *Girthi* is a deserted village on the stream which is named from it, about halfway between *Topidhunga* and *Malari*, on the *Dhaoli* in Garhwal; near it are said to be lead and copper mines, but they are only occasionally worked, and then on the most insignificant scale. The Government, which possesses the proprietary right in all the mines of these mountains, has, I understand, not often made a larger sum than five rupees per annum from the *Girthi* workings. The ascent to the pass is up a small tributary of the *Girthi* river, and is excessively steep and rugged, lying over or among fragments of the surrounding cliffs of all sizes. The rocks are limestones mixed with black slates, containing fossils, probably Liassic. The strata are wonderfully shattered and disturbed, and some immense sheets of bare rock, dipping at an angle of 45° to the south, were conspicuous objects on our left. The summit of this pass is a long rounded depression between high bare crags. It rises to about 17,500 feet. The ground is covered with small angular fragments of stone without any appearance of soil, and this is commonly the case at these great elevations. There seems to be a transverse rupture of the strata along the ravine up which we came, which is continued through the opposite face of the ridge down to the *Laptel* river, the dip having been in opposite directions on our right and left hand the whole way.

The vegetation on the ascent was very scanty; a few plants were, however, noticed almost to the very top, namely, two Boragineæ, *Eritrichium spathulatum* and *Microula Benthami*; a nettle, *Urtica hyperborea;* and **Taraxacum officinale*, the common dandelion of England. Besides the foregoing, may also be mentioned a Ranunculus, common and very varying in size and form, *R. hyperboreus*, *Arabis alpina*, and **Thalictrum minus*. We crossed no snow whatever, except a small bed in a sheltered place at the bottom of the very narrow ravine up which we came, and the mountains with a south exposure were still clear of snow for several hundred feet above the pass. On the north face a large bed, evidently perennial, lay a little below the summit. This is very usually the case on these passes, and a similar patch is often to be seen under the lee of a peak, from the south face of which the violent southerly winds, which, as before observed, almost constantly blow during the afternoon over these passes, sweep all the snow, which consequently drifts into some sheltered place just under the ridge.

The view from the pass, though striking, was not very picturesque. The weather was still cloudy and unpleasant, and *Unta-dhura* looked dismal enough behind us. To the north the prospect was rather more cheerful; patches of sunlight and clouds less dense gave hope that we should enter a more agreeable climate as we advanced. The range of *Balch*, that still lay between us and Tibet, was 10 or 12 miles distant, and seemed almost snowless, though certainly rising above 18,000 feet in altitude. The pass over which we were to go was clearly seen, and in the valley below us lay the halting-ground of *Laptel*, looking brilliantly green, with deep red cliffs (Lower Carboniferous) rising close behind it.

The descent from the pass, the summit of which we reached at half-past eleven, lay for a mile or two over a long tiresome slope covered with angular loose fragments of rock. After crossing the bed just under the pass, we saw no more snow; nor is there any sign of a glacier to be met with beyond this ridge. Vegetation commenced in rather a languid way about 1000 feet below the pass, the nettle before named and a yellow saxifrage, **Saxifraga Hirculus*, var. *Hirculoides*, being the first plants met with. The grazing-ground of *Kyungar*, which gives its name to the pass, is a little green spot well down the hill at 15,000 feet, on the edge of a stream coming from the eastward, and near it we found three of the characteristic labiate plants of Tibet, *Nepeta tibetica*, *Lamium rhomboideum*, *Dracocephalum heterophyllum*; also *Draba alpina*, growing on the slopes of loose stones, their roots, in the absence of any soil, penetrating deep among the interstices between the fragments.

Beyond *Kyungar* we came upon a small ridge, which, starting up almost in the centre of the great valley that we had followed from the top of the pass, ran on our left straight down to the *Laptel* river, to which we were descending. We here, for the first time, entered the rotten black shales that represent the Jurassic strata in the Himalayan Mesozoic rocks. The hills formed by these crumbling shales are rounded, and covered with small loose fragments, among which exceedingly hard spherical argillaceous nodules are very frequently found, sometimes containing an embedded ammonite or shell, but oftener a nucleus of iron pyrites without any trace of organization. As we continued to descend, our path lay along a small stream which falls into the *Laptel* river, and the vegetation began to improve greatly. Small shrubs again appeared—*Caragana pygmæa*, *Lonicera glauca*, and *Salix sclerophylla*. A geranium, **G. pratense*, a British species, was common, as well as a polygonum, *P. tortuosum*. The leaves of the last-named plant, and of a euphorbia, *E. Stracheyi*, but especially of the latter, had changed their colour into brilliant reds, and formed most conspicuous contrasting objects on the long, steep, and crumbling slopes of the black shale. A blue violet, *Viola kunawarensis*, and *Corydalis Gortschakovii*, were also found on the descent.

Here, too, we first made acquaintance with the Tibetan marmots, *Arctomys bobac*, called *Phiya* by the Bhotiyas, and our sporting friend Bachu managed to shoot two of them. They live in villages, so to speak, twenty or thirty of their burrows being usually found together, at the mouths of which, if come upon very suddenly, they may be seen squatting (precisely as I have since seen the prairie dog doing in the United States), for they disappear underground in a moment when disturbed. Our specimens were in capital condition, and their fat is considered a specific for rheumatism. The Bhotiyas, I was told, sometimes manage to get the marmots out of their holes by turning a stream of water down them.

The *Laptel* river is a good-sized stream flowing over a broad shingle bed, and is seen to issue from a fine gorge half a mile above the point where we crossed it, again disappearing in a similar cleft as far below. Fording the river at an elevation of about 13,700 feet, a short easy ascent brought us to *Laptel* at 13,860 feet, an encamping-ground of the brightest emerald green, the charms of which were heightened by the utterly bare hills all round. The rills of water that flow down these hills seem somewhat capricious in their effects, at one time running over a bare shingly bed, at others giving rise to a most luxuriant growth of small herbage, which, as at *Laptel*, was in places almost a bog. Besides forms before observed, we here found two shrubby plants, *Myricaria germanica* and *Clematis graveolens*, and **Aconitum Napellus*, *Silene Morocroftiana*, *Lychnis brachypetala*, *Cicer soongaricum*, **Epilobium alpinum*, *Aster tibeticus*, *Lindelofia Benthami*, *Polygonum viviparum*, *Eurotia ceratoides*, *Juncus sphacelatus*, *Carex rigida*, *Allium Jacquemontii*, *Elymus dasystachys*, and *Deschampsia cæspitosa*; also *Gentiana aquatica*.

one of the least showy of the tribe, and everywhere found on the banks of streams at these elevations. *G. tenella* and *Pleurogyne carinthiaca* are also common in similar situations.

We reached *Laptel* about half-past three, and I immediately set to work to restore the barometer, the tube of which had its top knocked off on the pass by a jerk in taking it out of its leather case. I had taken a spare tube already filled in case of accidents, so I soon got this into its place, and I had no more disasters afterwards. The indications of this barometer were corrected by comparisons subsequently made with barometers that had been left at Milam.

September 6. *Laptel to Shangcha*, 4 *miles*.—As we wished to let our Huniya friend get a little ahead of us, we made a short march to-day. This was also otherwise desirable to enable us to get over the *Balch* pass, which was now before us, early on the following day before the wind got up. The route the whole way lay over undulating easy ground, often on the black shale, and it was throughout fairly covered with vegetation. Almost the only shrubby plants were **Potentilla fruticosa*, of which there are several well-marked varieties, a *Lonicera*, and the *Caragana*, all of which were common enough, growing perhaps to 2½ feet high, but not more; and the bright blue *Delphinium cœruleum*, another characteristic Tibetan form, began to be conspicuous.

In many places, strewed on the surface of the ground, are seen fragments of ammonites and belemnites, more particularly the latter, which are at times seen in great masses composing almost the whole substance of the rock. Portions of these same Jurassic beds we afterwards found on the very summit of the Lakhur pass, at a height of 18,400 feet.

Shangcha, 14,800 feet, where we halted, is on a stream that flows from the *Balch* pass, past Laptel. It is a flat-bottomed narrow ravine, with nothing remarkable in it. The rocks here again become much harder and more craggy, and gave indications of having suffered alteration by the intrusion of the greenstones and porphyries seen in the vicinity. I found no fossils in these strata, and they have perhaps been obliterated. In this sheltered ravine the vegetation was still cheerful, and, in addition to the plants before noticed, we observed *Campanula aristata*, and several European or Siberian forms of Ranunculus and Potentilla that are very common in Tibet; e.g. *R. pulchellus* and *hyperboreus*, as well as *P. multifida*, *sericea*, and **anserina*. The fern * *Cystopteris fragilis*, the only one of these regions, was also seen in cracks in the rocks.

On one of the hills above, as we went along, we saw for the first time three or four of the wild asses, *Asinus* or *Equus Kiang*, Tib. "Kyang." These animals are so common in the open plain of Guge, that the landscape is hardly complete without one. An attempt of our friend Bachu to get near enough to them for a shot proved futile on this occasion, as on every other during our expedition. He was, however, more fortunate in his attentions to two wild sheep, *Ovis Burrhel*, or *Nahura*, Hind. *Barhal*, Tib. *Sna*, which he managed to bring down; though a third, which was discovered later in the evening on the cliffs over our heads, managed to escape in spite of the scientific stalking of our Bhotiya sportsman, whose operations we watched in inglorious ease, sitting in front of our tent.

Having secured the skins of the barhal, our retainers made a more serious attack on the remains of the slaughtered sheep, concluding their operations with a manufacture of sausages, the details of which may be left to the imagination of the reader. A fine warm evening ushered in a feast which made grand havoc with the game, though our *chef de cuisine* providently reserved certain legs and loins for our special consumption, and we found the barhal, though cooked *à la Bhotiya*, very good.

My friend Mr. W., who had been somewhat upset by the effects of the cold on *Unta-dhura*, was still suffering a little; but matters were clearly mending, and our anticipations of better luck were not doomed to be disappointed. The thermometer at 9 p.m. was 36°·7.

September 7. *Shangcha to Tisum*, 13 *miles*.—As it was always necessary for us to eat our morning meal before we started, we never got off much before eight o'clock. To-day we began to ascend almost immediately over a steep mountain face, if possible more than usually barren, and we reached the summit of *Balch* pass a little before ten o'clock. In the stream of *Shangcha* I had seen a good many pebbles of greenstone, and I was therefore not surprised to find this rock soon appear *in situ*. It forms, indeed, the summit of the *Balch* ridge, the peaks of which rise, as I have said, to upwards of 18,000 feet. The rocks through which these eruptive rocks are intruded are of Cretaceous age. There were a few patches of snow lying about, but this range hardly comes within the limits of perpetual snow. Phænogamous vegetation exists to the very summit, within a few feet of which we found a pretty little composite plant (*Allardia tomentosa*), growing freely on the rock on which I hung up the barometer. Here also we found two species of Saussurea, so numerous at these elevations, *S. Hookeri* and *bracteata*, *Nepeta longibracteata*, and *Arenaria musciformis*. The wind was already blowing too hard to permit of a halt on the actual crest of the pass. On the rocks exposed to the south were very curious incrustations of ice, icicles indeed, but standing out horizontally like fingers towards the wind. I was not able to understand how they were caused, nor can I tell why they were confined to particular spots. The thermometer stood at 41°, and though the dew-point at the time would probably have been below 32°, and the cold produced by evaporation sufficient therefore to freeze water, yet it is evident that no condensation could ever take place simultaneously with the evaporation. I am afraid that I did not pay sufficient attention to the facts of the case at the time to be able to say more about this apparent puzzle, but I think that I afterwards saw something of the same sort on beds of snow under *Unta-dhura* pass and on the *Milam* glacier. The circumstances of these icicles being noticed by Captain Weller on the *Balch* pass several years before my visit, shows that they are not the result of mere accident. [It has since occurred to me that these icicles were caused by radiation. I found subsequently, in a somewhat similar position, that a thermometer suspended vertically, and simply exposed to the sky in front of it, was depressed as much as 20° Fahr. below the true temperature of the surrounding air. This result was, of course, due to the radiation through the extremely dry and rarefied atmosphere at the great elevation at which the thermometer was exposed. As radiation takes place freely from a surface of ice, the growth of such icicles as those described might be due to the condensation of vapour brought up by the southerly day winds that so constantly blow over these passes, and its accumulation in the form of ice on the exposed extremity of the icicle, the temperature of which might thus have been greatly reduced.]

From the *Balch* pass, 17,490 feet, we looked down over the part of Tibet we were about to enter. The view was somewhat restricted by the projecting points of the mountains on which we stood, and the distance was obscured by clouds, but we naturally looked with great interest at what lay before us. The plain of *Guge*, which we afterwards found to be, as indeed we had expected, much more extensive than it appeared from this point of view, was so much broken up by small ranges of hill and ravines as not to be very striking as a plain, and though its general barren, brown, and red tints certainly looked warm and comfortable from the pass, where we were shivering with cold, they did not otherwise give promise of much either in a botanical or picturesque point of view. A distant line of blue mountains having an ordinary serrated outline, and a confusion of clouds over them, with very few snowy peaks visible, looked on the whole rather commonplace. It will be seen, however, from the map, that our position was particularly unfavourable for a general view of the country—such, for instance, as I afterwards had from the top of *Lanjar* peak, near the Niti pass.

On the descent, within 500 feet of the summit, or at an elevation of about 17,000 feet, the vegetation had reappeared pretty freely, and by the side of a small stream, which to the north of the Indian watershed is an essential for any approach to vigorous vegetation, we found several new plants. A large flowered gentian, *G. nubigena*; *Draba lasiophylla*, a form closely allied to *D. stellata* of the Alps; three or four species of *Pedicularis*, *P. versicolor*, *rhinanthoides*, and *cheilanthifolia*; some grasses, including *Avena subspicata* and *Deschampsia cæspitosa*, and *Carex ustulata*.

Having reached the *Jankum* river, which lies at the foot of the descent, we crossed it, and, ascending its steep bank, at length emerged upon the plain of *Guge*.

PLAIN OF GUGE, IN WESTERN TIBET, 15,000 TO 16,000 FEET.

The margin of the plain immediately in contact with the outer ranges which constitute the Indian watershed is about 16,500 feet above the sea, and was hence sufficiently elevated above the central parts, which perhaps average 15,000 feet, to enable us to see well over the whole surface. We now, too, caught a partial glimpse of the great snowy peak of *Kailas*, which rises to a height of very nearly 22,000 feet. Heavy clouds were hanging over the distant ranges, and here and there rain was seen to be falling. The sunshine and dark shadows intermixed made it difficult to seize upon the arrangements of the ridges, or to judge of their distances. The plain appeared to be perfectly flat and open for nearly 10 miles to the north, with small ranges of hill here and there rising sharply from it, while it ended abruptly on the south on the flanks of the mountains under which we stood. The *Jankum* river ran straight before us, cutting out a huge furrow from the plain, nearly in a direct line, its sides sloping at an angle of about 45°, and almost as even as a railway cutting. Other smaller ravines were seen to originate near us, and deepening as they went at length to unite with the larger one just mentioned.

Down one of these our road led us, and, following its course, we at length reached a halting-ground called *Tisum*, near the junction of the *Chaldu* ravine with that of *Jankum*. It had been intended that we should halt on the *Mamin* ravine before reaching that of *Chaldu*, but there was no water in it, so we had to go on.

The sections of the plain here made by these ravines, to a depth of 200 or 300 feet, showed that it was a great deposit of gravel or boulders, the magnitude of the stones varying from a moderate-sized boulder, a foot or two in diameter, to fine sand. The beds were laid out horizontally, or rather parallel to the surface of the ground, for the plain has a strong fall towards the *Satlaj*. The surface was generally very even, the stones being, with few exceptions, embedded in the soil, which was everywhere scored over with depressions, something similar to those seen on mud when drying, but less definite, probably arising from the draining off of the water as the snow, with which the surface must be covered in the winter, melts away. Stunted bushes of *Caragana*, the *Dama* of the Bhotiyas, or *Trama* of Tibet, and tufts of the half-shrubby *Eurotia ceratoides* hardly exceeding a foot in height, were sparingly scattered over the ground, mixed with a few grasses, Artemisia, Allium, Larkspur, and Potentilla; but I estimated that not one-tenth of the surface was covered by these plants near the Himalaya, where the vegetation was most vigorous, while further on the proportion did not probably exceed one-twentieth. The alluvial plain, indeed, is nearly an absolute desert, and it is only near the streams at the bottom of the ravines that habitations are to be met with. The footprints and other signs of the *Kyang* are to be seen in greater or less abundance on all parts of this plain, and it is possible that these animals are more numerous here in spring, for at the time of our visit there was hardly anything for them either to eat or drink. In one or two places we saw their bones lying in the ravines, to the seclusion of which, I suppose, they had retired to perish.

Tisum is the name applied to three halting-places, within a mile or so of one another, near the junctions of the *Jankum*, *Mamin*, and *Chaldu* ravines, and we were told by our Bhotiyas that it was derived from the two words of the Hindu and Tibetan languages, both of which mean "three," viz. *ti* and *sum*. A more probable etymology, however, is that the name is a compound of *ti*, which in the Kunaori-Tibetan dialect means "river," and *sum*, meaning "three." But all such etymologies may be looked on with suspicion. It should, however, be said that *sum-do* is the regular Tibetan term for a junction of two ravines where a flat space suitable for villages or encamping is usually met with, and it will be seen that this word also has *sum* or "three" in it, no doubt from the three portions of alluvial ground at the junction of two streams.

At 9 p.m. the thermometer was no lower than 45°, though *Tisum* is 14,690 feet above the sea; but the night was cloudy.

(*To be continued.*)

THE LIVINGSTONE EXHIBITION.

UNDER this name, Dr. Harford Battersby, of the Livingstone Missionary College, organized an exhibition of travellers' equipments and health requisites in the St. Martin's Town Hall, which was open to the public from January 1 to January 5. The exhibition was divided into two parts, the first consisting of relics of Dr. Livingstone and of other travellers, and the second of trade exhibits shown by some of the leading equipment and food-preserving firms.

The Livingstone relics included a bust and portraits of Livingstone, two of his original MS. maps, his sextant and photographs of the tree under which his heart was buried, lent by the Royal Geographical Society. Mr. Frank Wilson, son-in-law of the explorer, showed a very interesting series of books, including the journals written in notebooks, on the edges cut off pamphlets, and on pieces of newspaper. He showed also the watch, drawing-instruments, binoculars, and firearms carried by Dr. Livingstone, as well as other objects associated with his work and expressive of the recognition it received at home. Perhaps the most interesting of all was the cast of the broken and mis-set humerus by which the body, when it was brought to this country, was proved to be that of David Livingstone.

Mr. W. H. George, son of the late map-curator of the Royal Geographical Society, Mrs. Horace Waller, and others also contributed photographs, portraits, models and other relics.

On the evening of Tuesday, January 2, the exhibition was reserved exclusively for Fellows of the Royal Geographical Society and their friends, who were received by Sir George Taubman Goldie, Vice-President of the Society. Mr. Frank Wilson gave a short address, illustrated by the appliances to which he referred, showing how vastly all kinds of travellers' equipment have been improved since the journeys of Livingstone.

The second part of the exhibition contained specimens of tents, portable boats, firearms, travellers' clothing and boots exhibited by S. W. Silver & Co., the Military Equipment Company, the Jaeger Company, the Berthon Boat Company, and J. Tucker. Portable foods were shown in great variety, special features being the prepared meat-rations of the Nao and Bovril companies. Much interest was shown in the exhibit by the British Preserving Company, of Rayne, Essex, of desiccated vegetables prepared in an absolutely dry form without preservative or colouring matters, which only require to be soaked in water to assume the appearance, colour, and characteristic smell of fresh vegetables or fruit. A great variety of medicines in forms specially adapted for portability and resistance to bad climates were shown by Burroughs, Welloome & Co., Allen & Hanbury, Howards & Son, Oppenheimer, Sons & Co., T. Howard Lloyd & Co., and others. Many of the methods of preparation are extremely ingenious. Filters, cooking appliances, etc., were shown in considerable variety. Some exhibits appeared to have little connection with travel or travellers, *e.g.* babies' clothes, but such were merely exceptions to an otherwise excellent and practical exhibition. There was, however, a very remarkable want of a kind little creditable to firms which rely doubly on travellers; this was the total absence of maps, charts, or books of travel or geography. Smith, Elder & Co. showed some books on medical travel, but that was all. How very different the department entitled "Literary and Educational" would appear in a similar exhibition held in Germany!

A series of lectures was arranged to explain and to be illustrated by the exhibition. These were given by Dr. Harry Guinness, on "South America;" by Mr. W. Wilway, on "Health Precautions in Cold Climates;" by Major Ross, I.M.S., on "The Malarial Mosquito;" by Miss Mary Kingsley, on "West Africa;" and by Dr. Harford-Battersby, on "The Preservation of Health in the Tropics."

THE MONTHLY RECORD.

EUROPE.

Geography of Europe.—In the latest volume of the new issue of Stanford's Compendium, Mr. G. G. Chisholm treats of the southern, central and eastern countries of Europe,* the whole forming a practically new work, constructed on a new plan, and almost entirely rewritten. After a general introduction on the geography of Europe as a whole, the countries are taken up in the order of the Mediterranean peninsulas, Central Europe, and finally Eastern Europe. The treatment of Italy is very full, and is so planned as to form a key to the whole geography of Europe from the historic side. In dealing with the other Mediterranean countries, Mr. Chisholm is assisted by Mr. J. T. Bealby. There are over a hundred illustrations, chiefly views of towns and scenery, and a complete equipment of maps, including the orography, rainfall, geology, and ethnography of Europe. The geological map is, we believe, the first to show the whole of Europe with the formations coloured in accordance with the rules drawn up by the International Geological Congress, for their large-scale map of the continent. The second volume will contain descriptions of the United Kingdom, Scandinavia, Holland, and Belgium.

The Biological Geography of Europe.—Dr. Robert Scharff has been kind enough to supply us with the following synopsis of the contents of his newly published book, 'The History of the European Fauna.'† When we examine the composition of the British fauna, we find that the native element is very inconspicuous. The general range of the majority of the British species clearly indicates that they have migrated to the British Isles from the continent of Europe, most of our familiar forms of animal life occurring there also. A few of these may possibly have found their way to these islands in an accidental manner across the sea, but the main mass of the fauna must have travelled in the normal mode by land when the channel between England and France did not exist. As a rule, species are known to be grouped round certain centres, near which the genus probably originated, and we can thus approximately ascertain the original homes of the component elements of our fauna. The former history of mammals and mollusca is revealed to us to some extent by the remains which we find preserved in our geological strata, while other groups of animals have left few fossil traces. By carefully mapping out the geographical range of the British species of animals and taking into consideration their past distribution, it is possible in a number of cases to discover the direction from which their migration took place. There are species which have undoubtedly come to us from the north, which form part of what we might call an arctic migration. Another group of species came from Siberia and across Central Europe, and these are members of the Siberian migration. And we have, besides, animals which originated in the Alps and in South-Western and also in Eastern Europe and in Southern Asia. The late Edward Forbes was the first to apply such methods of analysis in tracing the history of our fauna, and to demonstrate the great importance of the study of zoogeography. He held that the south-western or Lusitanian element of

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* 'Stanford's Compendium of Geography and Travel' (new issue)—Europe. Vol. i. By Geo. G. Chisholm. London: E. Stanford. 1899.

† 'The History of the European Fauna.' By R. F. Scharff, B.SC., PH.D. With illustrations. The Contemporary Science Series. London: Walter Scott, Limited. 1899.

our fauna was the oldest, and that the eastern, Teutonic, or Siberian was the newest. Discontinuity in the range of a species, as Darwin has taught us, is always a sign of antiquity, and many of the Lusitanian species no doubt exhibit such a distribution. The general distribution of the different elements of the British fauna, moreover, proves that Forbes was quite correct in his estimate. Now, if we would ascertain precisely the geological age of any of the various migrations which entered the British Islands, the relative age of the others could thus be fixed. As we should expect, the most modern of the migrations has left the most satisfactory fossil traces. We can actually follow the former migrations of many of the species right across Europe from their native home in Eastern Europe or in Siberia. A number of characteristic Eastern forms make their first appearance in England in the Forest-bed deposit, whilst in Germany and Russia their remains occur only in beds overlying the lower boulder clay. These continental beds are believed to have been deposited during an inter-glacial stage of the Glacial period, and their fauna would indicate that they are contemporaneous with the Forest-bed. The subjects just alluded to are fully discussed in the book. Then follows an account of the nature and history of the Siberian fauna—the former occurrence of southern species in the New Siberian islands—and the origin of the Caspian fauna, and these studies incidentally lead to the belief that a comparatively mild but damp climate must have prevailed in Europe and Asia during the greater part of the Glacial period. Under these circumstances an enormous northern *mer-de-glace* could not have existed. The old Lyellian theory of the marine origin of the boulder clay thus finds confirmation, and this hypothesis explains many anomalies of distribution which would otherwise remain inexplicable. According to the reconstruction of the ancient geography (maps of which are given in the book), Scandinavia continued northward as far as Greenland, and southward to Scotland, whilst England was connected with France at the beginning of the Glacial period. A submergence of the northern plains of Russia and Germany—*i.e.* a transgression, in the sense of Suess—took place, so that a continuous sea existed between the White sea and the east coast of England, which, however, did not communicate with the Atlantic. The composition of the Scandinavian fauna indicates that that country was isolated from continental influences for a considerable time. The occurrence of marine species in fresh-water lakes in Northern Europe seems to support the view that not long ago the latter was covered by the ocean. It is also demonstrated clearly that the fauna of the Alps is not due to the Siberian migrants having retired to the mountains from the plain after the Glacial period, but that it is mainly of Central and Southern Asiatic origin. It must have survived the Glacial period on the Alps themselves, even though, no doubt, extensive glaciers spread beyond the lower outliers of that great mountain chain. The conclusion arrived at as to the origin of the Alpine fauna thus supports the view as to the temperate character of the climate during the Glacial period, and the survival of a considerable proportion of our pre-glacial animals in all parts of Europe in those areas in which they had previously established themselves.

Recent Researches at the "Karlseisfeld" (Dachstein).—Baron von Hübl, director of the technical section of the Austrian Military Geographical Institute, has during the past summer carried out a series of measurements, effected by the aid of photography, of the famous "Karlseisfeld" glacier in the Alps of Upper Austria, the scene of Friedrich Simony's classic labours. The results are most satisfactory, and will be utilized for the construction of a minutely detailed map of the glacier, the scale of which will be 1 : 10,000 (that of Finsterwalder's map of the Vernagt glacier), or even larger. Simultaneously with this new survey, which is intended to supplement and rectify that published in 1897 by Colonel von Groller, investigations have been made by Dr. August von Böhm into the glacial phenomena of the region, particularly the moraines and the periods of advance and retreat of the glacier.

Dr. Karl Oestreich's Explorations in Macedonia.—Dr. Karl Oestreich, whose investigations in 1898 in the north-west of European Turkey have already been described in the *Journal*, has since continued his work, during the summer of 1899, by a scientific examination of parts of Macedonia. Writing to the Berlin Geographical Society in August and September last (*Verhandlungen*, 1899, Nos. 8 and 9), he briefly describes the chief results of his journeys, which, he says, show that even the best geological maps of the region in question must be superseded. Dr. Oestreich reached Monastir by way of Üsküb, and the principal result of the journey between those places was the discovery of a limestone range with patches of *névé* (in July), "karen," and lakes. From Monastir he made an expedition to Lakes Ochrida and Prespa, which resulted in considerable additions to our knowledge of the geology of their neighbourhood. The whole of Lake Ochrida lies in a limestone area, and the same is the case with the Western and Southern portions of Prespa, *i.e.* the west coast and the two southern bays. The character of the country round these parts of the lake resembles that of the Dalmatian islands, while the lake itself is of the nature of a "karst" lake. Dr. Oestreich found on the cliffs marks of three different water-levels, at intervals of one or two feet. He thinks that these point to a continued, as well as a periodic, sinking of the water—the latter possibly seasonal—although the natives assured him that the level was constant. From the fishermen he learnt that the greatest depth is forty times the span of the outstretched arms in the northern basin, twenty times in the south-west bay, and five to seven times in that towards the south-east. This last is now cut off from the rest of the lake by a neck of land, and has no outlet, though an almost level valley—the site of a former outflow or inflow—leads from its upper end to the Devol plain. The most remarkable discovery, however, was a subterranean outlet of the lake near Han Gorica on its west shore, the water running in a full stream into the limestone, which dips to the west-north-west. Whether or no it falls into Lake Ochrida cannot be determined. Among other features of interest examined was the solfatara of Kozel, near Ochrida, which gave the smell and other signs of sulphur. During the latter part of the journey Dr. Oestreich passed through entirely new ground on the way from Vodena over the mountains to Gjevgelii on the Üsküb-Salonica railway, and here too made some interesting geological discoveries, including that of *Hippuritidæ* on the declivity of the Kaimakcalan towards the plain of the Moglena. The Murichovo, the region of the gorge of the Crna, is a volcanic tableland, while mountains of over 6500 feet altitude round its margin are also composed of volcanic rocks.

Limans of the Black Sea.—The Odessa University undertook several years since a detailed exploration of the limans, or salt lakes, situated close to the sea-coast in the neighbourhood of Odessa. The results of a detailed exploration of the Kuyalnik liman are now given in the *Memoirs of the Novorossian (Odessa) Society of Naturalists* at the University, vol. xxii. 2. The topographical part is by A. Wassilieff, and represents a volume of 300 pages, with a most detailed large map of the liman, with its depths, on the scale of 1 : 16,800, which will be a valuable document for all later exploration of the same liman, and a series of profiles. The astronomical and topographical work is given in great detail. Together with the previously published work of A. Lebedintseff and V. Krzyzanowski (same Memoirs) and the work of N. Sokoloff, 'On the Origin of Limans in South Russia,' which contains a full bibliography of the Limans (*Memoirs of the Geological Committee*, vol. ix. 4), we have now valuable material for physico-geographical considerations relative to the origin and life of these interesting formations. The same volume contains also a paper on the bacteria which are found in the mud of the same liman, by L. Silberberger and M. Weinberg.

The Eichener See in the Black Forest.—In a note in *Globus* (vol. lxxvii. p. 20), Dr. Halbfass summarizes an article by Herr Knierer in the publication of the Baden Schwarzwaldverein on the subject of the Eichener See, a remarkable periodic lake near Schopfheim in the south of the Black Forest. The lake makes its appearance sometimes at intervals of several years, at others several times in the same year. At the last high-water period, in 1882–83, it reached a depth of 11½ feet, and persons have more than once been drowned in it. The lake owes its origin to the swelling of underground watercourses which traverse the "Muschelkalk." High level is reached only when some weeks have elapsed after the fall of heavy rain. Dr. Halbfass urges the importance of exact observations extending over a considerable space of time.

ASIA.

Exploration in Northern Asia Minor.—Between September and November of last year a scientific journey was carried out by Dr. Richard Leonhard of Breslau, through some of the less-known parts of Northern Asia Minor between Angora and Eregli—the ancient Galatia and Bithynia. Dr. Leonhard's work was hampered by the amount of rain and mist which prevailed, but in spite of this he succeeded in climbing the culminating point of the Ala-dagh, the highest range of the northern part of the peninsula, and also in crossing the Bithynian chains to the shores of the Black sea. The latter journey was accomplished in the face of unusual difficulties.

Dr. Karl Lehmann's Visit to Armenia.—We learn from the *Geographische Zeitschrift* (1899, p. 708) that Dr. Karl Lehmann has lately returned from a visit to Armenia in company with Dr. Balck, which occupied eighteen months. The objects of the journey were mainly antiquarian and ethnological, but results of value to geography have been obtained by the determination of a series of altitudes. The inscriptions brought back are said to throw a flood of light on the history of the old North Chaldæan empire. Linguistic traces of the Chaldæans could not be found, but are most probably to be looked for in the country behind Trebizond. The rock-dwellings examined by Dr. Lehmann are, however, in many cases probably to be referred to the time of the Chaldæans, if not to a still earlier date.

Shrinking of the Dead Sea.—According to a note in the *Deutsches Rundschau*, the water of the Dead Sea has lately undergone a marked diminution in volume, mainly, it is said, owing to the increased diversion of the water of the Jordan for irrigation purposes. The bed of the lake is said now to appear like a deposit of dry salt.

Return of the Danish Pamir Expedition.—The return to Copenhagen of Lieut. Olufsen, who for the greater part of two years has been engaged on an expedition to the Pamirs, has recently been announced. During the past summer the expedition, which, as already recorded in the *Journal*, left its winter quarters on March 1, appears to have continued its work in the southern borders of the Pamirs, returning home by way of Khiva, Resht, and Teheran. Important results in the field of cartography, ethnology, and natural history are said to have been attained.

The Count de Barthélemy's Latest Journeys in Annam.—The Count de Barthélemy, who during the last few years has made various journeys of exploration in French Indo-China, in 1898–99 carried out an expedition through the mountainous region of the Mois to the south of Hue, which is described in the third part of the *Bulletin* of the Paris Geographical Society for 1899. The term Moi is a collective one, signifying the primitive inhabitants of a district hitherto little explored, who differ much among themselves both in race and language. M. de Barthélemy, with two European companions, made a preliminary trip from Hue southward to the Song-kai river, passing through a number of Moi villages between the basin of the Hue river and the Song-kai. As far as the streams are navigable by *sampans* the villages are inhabited by Annamites, but beyond the limit of navigation the Moi districts begin. The Annamites, who are very active as small traders, carry on some intercourse with the latter. The Moi houses are poor but lofty, and there is a common building in the centre of the village for the reception of strangers. The journey was rendered difficult by constant rain and the badness of the tracks, but at last the first French settlement towards the Song-kai, An-dien, was reached, and the travellers proceeded down the coast for a more important tour in the Moi countries further south. The starting-point was now Tra-mi, celebrated for the trade in cinnamon carried on with the Mois. This trade, in spite of all the efforts of the authorities, remains entirely in the hands of the Chinese of Fai-fu. The first Moi tribe encountered was that of the Daviats, distinguished by their narrow almond-shaped eyes. They are more wild and war-like than the Mois first seen, and their villages are strongly stockaded. Reaching the basin of the Song-trakuk, the travellers found that this was incorrectly shown on the map of M. Pavie, extending further to the west. The watershed towards the Mekong was crossed at an altitude of 5250 feet, heights of 6500 feet being observed in the neighbourhood. The Krong-bla was then followed southwards through the country of the Sedangs—taller and stronger than the Daviats, but dwelling in unfortified villages, well hidden in the woods. In the neighbourhood of Kon-Tan, the point of divergence of several routes into the Laos country, the Bla enters a fine, well-cultivated valley. Proceeding down-stream, the travellers reached the Catholic Mission among the Banars, and their further route was south-west through well-known country to Binh-dinh.

The Lukchun Depression.—It will be remembered that when the brothers Grum-Grzimailo discovered in 1890 the remarkable depression of Lukchun in the midst of Central Asia, the Russian Geographical Society asked Roborovsky to carefully explore this depression during his last journey. Accordingly, Roborovsky established at Lukchun a permanent meteorological observatory, at which observations of the meteorological instruments were carefully made for two years in succession, from November 1, 1893, to October 18, 1895. The station was situated 2½ miles east of Lukchun town, and was visited in September, 1894, by Obrucheff. Now, General Tillo gives in the *Izvestia* of the Russian Geographical Society (1899, 1), a full analysis of the results of these important observations. The nearest meteorological stations, the altitudes of which are known from levellings, are unfortunately only Barnaul (Altai) and Irkutsk—the altitude of which last still remains doubtful to some extent. Consequently, there is no means of obtaining an absolutely reliable altitude of Lukchun. However, from three series of comparisons of the two years' barometrical observations made at Lukchun with the observations at Barnaul and Irkutsk, as well as with the isobars of Hann, Buchan, and Tillo, it appears that the altitude of the Lukchun station must be 17 metres (56 feet) below the sea-level, with a possible error of ± 15 metres (50 feet). A careful levelling of the whole of the Lukchun depression having been made (a map of it, 13 miles to the inch, is given with Tillo's paper), it appears that its lowest spots are from 95 to 112 metres below the meteorological station; so that the altitudes of these spots are −112 metres, or −368 feet below the sea-level at Bojantetura, and as much as −130 metres (428 feet) at Tash-tura. Besides, the meteorological observations made at Lukchun are highly interesting in themselves. The difference between the monthly averages of the barometer in January and July is greater at Lukchun than at any other spot known on the earth; it attains full 30 millimetres. In December, January, and February, the maximum of barometric pressure is in the middle parts of the continent of Asia. The daily range of the barometer in these regions of maximum pressure is as great as in several tropical lands. The temperature of the summer months is also very high, and is the same as in the Sahara. The maximum temperature observed (48° C. or 118° F., and 64° C. or 147° F. in the sun) is also a maximum one, while the dryness of the air and the absence of rain in the Lukchun depression are also excessive.

AFRICA.

Surveys of the Bonchamps Mission.—We learn from the *Politique Coloniale* for December 19 last that a large-scale map (1 : 200,000), in fourteen sheets, of the regions traversed by the Bonchamps Mission in South-West Abyssinia, has been constructed by M. Charles Michel, the second in command. This map will, it is said, constitute the most important authority on the geography of the little-known regions with which it deals. Since his return to France, M. Michel has devoted all his time to working up the large amount of material brought back by the expedition. This includes, among other collections, a large number of specimens illustrating the insects of the country traversed, no fewer than thirty having been previously unknown to science. Drawings of these, prepared by M. Michel, will eventually be published.

The French in the Northern Sahara.—Recent news shows that French activity in the Sahara, south of Algeria, has now entered upon a new phase. Although travellers of that nation have for many years devoted their attention to those regions, which since 1890 have been formally acknowledged as a French sphere of influence, the definite establishment of sovereignty has not hitherto been effected beyond the outpost of El Golea, on the great southern road to Insalah and the Tuat oases. The extension of French influence over the latter has long been only a question of time, for, although some vague claims were once made by Marocco to the Tuat oases, these were quite unsupported by the actual exercise of sovereignty, and have been virtually abandoned for some years past. The way has lately been prepared for a definite advance by the work of various French travellers and officers in the Insalah region, who have executed important surveys, and introduced many corrections into our maps. Among these, M. Flamand, who in 1896 undertook a mission to Gurara, and Captains Germain and Laperrine, who more recently surveyed the route from Fort Macmahon to Insalah, deserve special mention. The present Governor-General of Algeria, M. Laferrière, has been a zealous advocate of a forward policy, which, it is said, has now been definitely decided on by the French Government. M. Laferrière's views have been clearly expounded in the *Revue Française* (1899, p. 205; 1900, p. 11). He has shown the importance of affording protection to the tribes friendly to France against their more obstructive neighbours by the military occupation of Tuat, which would also have the beneficial result of permitting the extension to that district of the railway now under construction to Jenien-bu-Resg. According to the latest reports, the occupation of Insalah has not been effected without opposition, and fighting has taken place around that centre. M. Flamand's name has been mentioned in connection with recent operations, although according to earlier information that traveller, who left Wargla for the south in November last, was entrusted rather with a scientific than a political mission, the task committed to him by the Minister of Public Instruction being the study of the geology, botany, and hydrography of the region, as well as of the state of religious affairs among the sects of the Algerian Sahara. It may be remarked that the name Tuat, which is the general Berber word for "oasis," and is sometimes used for the whole group of oases south of Algeria, including Insalah, is applied in the narrower sense to the line of oases running north and south from the neighbourhood of Gurara to about 26½° N., the most important lying a few miles to the east of the course of the Wed Mzaud. The population, which includes a diversity of ethnical elements (Berber, Arab, Negro, etc.), is very dense, the separate "ksur," or settlements, adjoining each other very closely, and numbering over 300. The soil of the district is formed in great part of recent alluvium, extending round the base of the cretaceous Tademait plateau, and to this fact it owes its fertility. The importance of the locality, however, depends in great measure on its central position among the surrounding countries, which has made it a great emporium of trade. To the French it is of value as forming an advanced outpost in the direction of Timbuktu, and thus facilitating communication across the desert with that much-sought goal.

Dr. Kandt's Surveys in the Lake Kivu Region.—The fourth number of the *Mitteilungen aus den Deutschen Schutzgebieten* for 1899 contains a short report by Dr. Kandt on his work around Lake Kivu, to which allusion was made by Mr. Sharp in his recent communication to the Society (*Journal*, vol. xiv. p. 662). A sketch-map is also given of the lake, which shows how incorrectly it has hitherto been shown on our maps. Dr. Kandt wrote from his zoological station on Lake Kivu in August last. In December, 1898, he had started up the valley of Rusizi, and on reaching its outflow from the lake, crossed to its right bank, and followed the western shore of Kivu through Bunyabungu, Itambi, and Uyungu, to Kumasa at its northern point. Thence he proceeded north through various independent districts to within two days' march of Lake Albert Edward, afterwards turning south-east along the floor of the great trough to Kissigali, a district of Ruanda. Thence following a former route along the foot of the Sabyin volcano, he struck Lake Kivu at Kumisenye, and followed its eastern shore southward to the Rusizi. The southern end of the lake is split into two gulfs by a peninsula, and at the extremity of this Dr. Kandt established his station. The axis of the lake is shown by him as running north-east and south-west, the greater part of it lying much farther east than has been supposed. The long narrow island of Kwijwi, continuing the line of the southern peninsula, runs in a straight line up the centre. North of Namyagira (the north-western of the Virunga group of peaks, according to Von Götzen), the remains of an old lake-bed extend to Lake Albert Edward, forming at the present day a swamp with four minor lakes. Dr. Kandt carefully surveyed the greater part of the region between Kivu and Albert Edward, discovering a great lava-plain in the south between the volcanoes and the plateau escarpment. He hoped to be able to complete his work by descending the Akanyaru to its junction with the Nyavarongo, and thence going north of the Mohasi to the Virunga volcanoes, and back to Kivu by their south side. He has paid special attention to ornithology, but was purposing in his next trip to study the botany of the eastern lake-shore and of the forests of the plateau-escarpment.

Pendulum Observations in German East Africa.—A German expedition for the purpose of gravity determinations and the fixing of positions by astronomical observations left Langenburg in May last, under the command of Lieut. Glauning and Dr. Kohlschütter, the latter of whom took part in the Anglo-German boundary delimitation. Letters from the neighbourhood of Lake Rukwa, describing the early stages of the expedition, are published in the *Mitteilungen aus den Deutschen Schutzgebieten* (1899, part 4). From the mouth of the Songwe the party proceeded north *viâ* Rungwe and the Ngurumbu pass, whence a descent was made to the Usafua plain. The new residence of Merere in the Usanga steppe was visited, and the journey continued westward across the Tangano range to the residence of Sultan Muambunyu (district Bungu or Wungu), on Lake Rukwa. Lieut. Glauning assigns a greater extent to the remnant of the lake than is allowed by Mr. Wallace, giving it a length of 80 kilometres (50 English miles), or even more; but this, perhaps, includes the swamp at the north end. He says that even in the south it has retreated almost 2 kilometres (over a mile) during the last ten years, though a greater difference is seen in the north, where it was shallower. Its dimensions do not change greatly in the rainy season. Dr. Fülleborn, who has navigated it in canoes, found the greatest depth to be from 7 to 10 feet. A pendulum station was established at Kamsamba between the lake and the southern escarpment, and here observations were made, while positions for three other stations were to be chosen on other sides of the lake. The expedition was afterwards to proceed to Tanganyika.

The Geology of the West Coast of the Victoria Nyanza.—A short paper by Captain Herrmann, in the *Mitteilungen aus den Deutschen Schutzgebieten* (1899, part 3), sums up clearly the chief structural features of the country west of the Victoria Nyanza. This region forms part of the great interlacustrine plateau, composed chiefly of quartzite and clay-slates, which rises to a considerable height above the granite and gneiss regions of German East Africa, its boundaries being marked on all sides by a steep drop of from 350 to 1350 feet. The lower layers (whose deposit, however, dates, in Captain Herrmann's opinion, from a period when the granite region to the south was already dry land) consist of a great variety of clay-slates, etc., from a snow-white kaolin to the hardest black roofing-slates, the separate layers being generally thin. Above this series originally lay the quartzite, in fewer but thicker layers, also varying greatly in structure and hardness, some being in homogeneous blocks, others showing a pillar-like structure. The period of the elevation of these formations was probably that which gave rise to the whole system of terraces, troughs, and volcanoes in this part of Africa. The movements of upheaval must have everywhere acted in the same direction, the structural lines always running from north-north-east to south-south-west. The force exerted varied, however, in intensity according to the distance from a central point, which seems to coincide with the volcano Virunga. It remained, however, the same within successive zones slightly curved round this centre. The result is a succession of blocks separated by troughs, of which Captain Herrmann defines five. The first from the east is formed by the islands off the west coast of the Victoria Nyanza, which are all connected beneath the water-level, but are separated from the mainland by a channel of equal depth throughout. Three other blocks, separated by river-valleys, swamps, or lines of lakes, occur before the Kagera is reached; while the fifth—Ruanda—lies to the west of that river. These main divisions have exercised an influence on the political partition of the country among the native tribes. Although the action of running water has, to some extent, modified the relief, the edges of the blocks are still so sharp, that this can have operated only from a geologically recent period. Captain Herrmann concludes by a reference to the three different changes of level—secular, periodic, and yearly—which affect the Victoria lake. The second seems to have a period of from eighteen to twenty-five years, and possibly coincides with fluctuations in the rainfall. In former times the present troughs, such as the Kagera valley, were arms of the lake; while, as the secular retreat of the water proceeds, that between the islands and the shore now covered by water will also form a valley, while the eastern edge of the islands will form the coast-line.

Moir's Lake in Northern Rhodesia.—Mr. Robert Codrington sends us the account of a recent visit to Moir's lake, by Mr. P. H. Selby, collector of the Loangwa district of Northern Rhodesia. The lake, which lies to the west of the Middle Loangwa, was first seen by Mr. Joseph Thomson, during his outward march in 1890 towards Lake Bangweulu. Mr. Selby reached it by climbing the escarpment of the Muchinga range and crossing the level plateau above, of which the lake is merely a flooded depression. The surface of the plateau is dotted here and there with huge monoliths, covered with lichen. The timber is low, the grass short, and strong-running streams occur every few miles. Some thirty or forty years ago the country, now entirely uninhabited, was densely populated with Wasenga, who retreated south-west owing to the depredations of the Angoni. The lake (known to the natives as Wemba) was apparently smaller than when visited by Thomson, as Mr. Selby says it is about 6 square miles in extent, whereas the former estimated it at 30. There are only two narrow strips of open water separated by a sandy belt covered with rushes, the rest of the lake being concealed by long thin grass growing from the bottom, while the ground all around is swampy. The average depth appears to be 2 or 3 feet. The water is fresh, and contains fish, but no hippo or crocodiles. In its neighbourhood there are only some forty or fifty huts of the poorest and wildest Wabisa.

AMERICA.

A Canadian Lake of Subterranean Inflow.—Mr. A. T. Drummond, in a recent letter to *Nature*, describes a curious lake in Canada specially characterized by its having an invisible inflow. The lake in question, named the Lake-on-the-Mountain, is situated on the top of a cliff about 180 feet in height, on the south side of the Bay of Quinte, an arm of Lake Ontario. It is described as a lake of clear fresh water, about 1½ mile long, with a width of about three-quarters of a mile. The source of the inflow is not, it seems, attributable to springs from any possibly higher grounds in the same country, but, in Mr. Drummond's opinion, rather to be sought in the Trenton limestone area 25 or 30 miles to the north-eastward of the Bay of Quinte. The dip of the rocks is favourable, and for the whole distance, and into the Laurentian area beyond, there is a steady rise towards the north until at about 50 miles away a height of nearly 400 feet above Lake Ontario is reached. A fair amount of rain fell in this higher country during the drought elsewhere. In order to ascertain their bearing on the origin of the inflow, Mr. Drummond this past summer took a series of depths and temperatures in the lake. Whilst a considerable part of its area was shallow, the lake was found to have, close alongside its southern boundary, a great rent in the bottom, nearly a mile long, one-third of a mile or more wide, and varying from 75 to 100 feet deep. This rent is probably due to a widened fault in the Trenton limestone here, and it is suggested that the same forces which gave rise to this fault may also account for a subterranean connection with higher ground many miles away. In Lake Ontario, at its outlet opposite Kingston, during August, the surface of the water ranged in temperature around 72° Fahr., and at a depth of 78 feet (the bottom) it was 56½° Fahr., the latter being very much colder than during last and some previous years. At the Lake-on-the-Mountain, whilst the temperature of the surface was 74¼° Fahr., at 30 feet depth it was 69¼° Fahr., at 45 feet 47° Fahr., at 60 feet 43° Fahr., and at 99 feet 42° Fahr. Thus, whilst during the first 30 feet there was not very much change in the temperature, between 30 feet and 45 feet there was a rapid fall of 22¼°, and between the latter depth and the bottom at 99 feet a further fall of only 5°.

Southern Chile.*—Mr. W. Anderson Smith spent some time in southern

* 'Temperate Chile, a progressive Spain.' By W. Anderson Smith. London: A. & C. Black. 1899.

Chile in the years 1896 and 1897, studying the conditions of the districts in which colonization is now being carried on, the portion of the central valley south of Talca, the island of Chiloe and the small islands near it, and the lower reaches of the Palena river. The first part of his book deals with the social, political, and economic conditions of the Republic as a whole, the second and more important part with the actual conditions of the southern lands. He deals mainly with the various aspects of natural history in a popular manner, and he has much to say as to the history of south Chilean colonization and the present condition of the European settlers and native Indians. The remarkable density of the forests in the humid region is vividly described. The great shell-fish industry along the coast, and the vast abundance and slight utilization of the fish which swarm in sea and river, are strongly insisted on. It would appear that Mr. Smith made his observations with the assistance, if not indeed on behalf, of the Chilean Government, but his book is a frank statement of facts and opinions quite uninfluenced by any official control.

Geological Researches in the Andes.—The recently issued volume of the *Revista del Museo de la Plata* for 1899 contains several reports on geological investigations lately made in the Andes between Argentina and Chili. One of these, by Dr. Carl Burckhardt, deals with that part of the range just north of 39° south, embracing the upper basin of the Biobio. The most remarkable feature here to be noticed is the ramification of the Cordillera into three chains, including between them two "Inter-Andine plateaux." The easternmost chain forms a zone of Jurassic-Cretaceous rocks with simple folds. This is followed towards the west by the plateau of Las Lajas, a zone free from folding, covered with neo-volcanic rocks. Next comes the chain of Pino Hachado, forming a zone of Mesozoic folds with old volcanic rocks, surmounted by basalt, which last has been ejected subsequently to the folding of the Cordillera. The fourth zone consists of the plateau of the Rio Aluminé, again free from folding, formed of granite, and covered with neo-volcanic lavas; while the last two zones constitute the chain of Lonquimay, consisting of Jurassic folds, associated in the east with granite, and further west with basalts with eruptive centres. From the evidences of glaciation visible in the basalt which covers the Pino Hachado chain, it follows that the main folding of the Andes was completed before the close of the glacial era. Dr. Burckhardt holds that the Pino Hachado chain is closely related orographically and geologically with that of Lonquimay, and that the two form together the Cordillera, properly so-called, of the region. An interesting note is also given relative to a probable change, which has occurred within comparatively recent times, in the position of the continental water-parting in this latitude. It now runs through the Paso del Arco, and is formed by glacial moraines. Where these are discontinuous the surface is quite level, and is occupied by a marsh. In the valley of the Arco, which runs to the Atlantic, there are to be seen the ancient deposits of a large river, the rocks composing them being not found in the neighbourhood. In the valley of the Biobio there is a system of alluvial terraces, which show that that river once flowed some 600 to 1000 feet higher than at present, while the material of which they are composed is analogous to the deposits on the Arco. Dr. Burckhardt therefore concludes that the Biobio once flowed to the Atlantic through the valley of the Arco. The same volume of the *Revista* contains the report by Dr. Leo Wehrli on a geological expedition to the region of Lake Nahuel-huapi, which supplies the means of comparing the structure of the Andes in that latitude (40°–41°), with that observed by Dr. Burckhardt, and also with the phenomena previously noted by the two observers in 35°–36°. The region of the Biobio presents, as might be expected, intermediate characters between the two others. In the south Dr. Wehrli found the groundwork of the range to be a vast granitic massif, while the folded sedimentary formations are represented only by two narrow belts.

AUSTRALASIA AND OCEANIC ISLANDS.

Soundings by the "Albatross" in the Pacific Ocean.*—A letter dated "Papeete Harbour, Tahiti Island, September 30, 1899," giving particulars of the work accomplished by the *Albatross* expedition up to that time, has been received by the U.S. Fish Commission from Prof. Alexander Agassiz, and is published in *Science* of December 8, 1899. The expedition left San Francisco on August 23. The first sounding was made in lat. 31° 10′ N., and long. 125° W., in 1955 fathoms, about 320 miles from Point Conception, the nearest land. At station No. 2 the depth had increased to 2368 fathoms, the nearest land, Guadeloupe island, being about 450 miles, and Point Conception nearly 500 miles distant. The depth gradually increased until it reached 3088 fathoms in lat. 16° 38′ N., long. 130° 14′ W., the deepest sounding thus far obtained. Off the Marquesas, in lat. 7° 58′ S., long. 139° 8′ W., the depth became 2287 fathoms. It then passed to 1929, 1802, and 1040 fathoms, in lat. 8° 41′ S., long. 139° 46′ W., Nukuhiva island being about 30 miles distant. Between Nukuhiva and Houa-Houna (Ua-Huka) islands, 830 fathoms were registered, and 5 miles south of Nukuhiva 687 fathoms. About 9 miles south of the latter island a depth of 1284 fathoms was obtained. It would appear from the soundings that this part of the Marquesas rises from a plateau having a depth of 2000 fathoms, about 50 miles in width. The soundings were extended by the Paumotus as far as Tahiti, and in all numbered seventy-two. The deep basin in the Central Pacific developed by the soundings between lat. 24° 30′ N., and lat. 6° 25′ S., varying in depth from nearly 3100 to a little less than 2500 fathoms, is pointed out as being probably the western extension of a deep basin indicated by two soundings on the charts, to the eastward of the line of the expedition, in longitudes 125° and 120° W., and latitudes 9° and 11° N., one of over 3100 fathoms, the other of more than 2550 fathoms. It was proposed to name this large depression Moser basin. Large hauls of red clay and manganese nodules were obtained from the bottom of this basin. The bottom temperatures of the Moser basin varied between 34°·6 at 2628 and 2740 fathoms, to 35°·2 at 2440 fathoms, and 35° at 2475 fathoms; about 120 miles from the Marquesas. At station No. 23, off the Marquesas, in 1802 fathoms, the temperature was 35°·5. The temperatures of the bottom between the Marquesas and Paumotus were 34°·9 at 1932 fathoms, 35° at 2456 fathoms and 2451 fathoms, and 35°·1 at 2527 fathoms. An extensive collection of surface animals was obtained, including many interesting forms. On the way to Tahiti a few days were devoted to an examination of the westernmost atolls of the Paumotus. Prof. Agassiz inclines to the opinion that these atolls have been formed in an area of elevation similar to that of Fiji. He points out, also, that the Paumotus are situated on a plateau similar to that upon which the Marquesas and Society islands are placed—this plateau having a depth of from 1200 to 1500 fathoms rising from the general oceanic basin which surrounds them, and which has a depth of from 2300 to 2500 fathoms. Furthermore, evidence of this elevation is found at the two extremities of the Paumotu plateau, at Makatea and the Gambier islands.

Journeys in the Gazelle Peninsula, New Britain.—Two short accounts of journeys in the mountainous districts of the Gazelle peninsula appear in the *Deutsches Kolonialblatt* for December 1 last. The first, by the Governor of German New Guinea, describes a visit to the Mission station St. Pauli among the Baining mountains, in the western part of the peninsula. The tract between the mountains and the coast contains a large area of very fertile soil, possibly suitable for cacao cultivation. A species of *Ficus* was also seen, which seemed to yield a good

* See *Geographical Journal*, vol. xiv. p. 215.

supply of caoutchouc. The strip immediately below the mountains is intersected with perennial streams, which sometimes disappear in the porous limestone. The path to the Mission station leads by the valley of the Malamga, clothed with splendid forest. The school at St. Pauli already has an average of twelve scholars, although the station is of quite recent date, the population of the neighbourhood sparse, and the country difficult to travel. The Bainings are an energetic and friendly disposed race, and good agriculturists. Their settlements are, as a rule, placed on the highest and steepest summits, one of which, 1000 feet higher than the station, was visited by the governor. The fertility of the soil among the mountains seems to vary greatly. The most characteristic forms of vegetation are luxuriant bamboos, wild bread-fruit trees, and the "gallip," a tall tree with spreading crown, producing edible nuts. The governor afterwards visited the northern parts of the peninsula, crossing over from Talili bay to Blanche bay, and following the path round the shores of the latter. There is one difficult spot where the mountains fall sheer to the sea, but the view over the bay is particularly fine. The second expedition was made by the Governor of Herbertshöhe to the Varzin mountains, to the south of Blanche bay. The way to the Catholic Mission station of St. Josephsthal leads first through cultivation, bush, and grass-land, and afterwards through high forest. The station lies in a fine position, and commands an extensive view over the Gazelle peninsula, which reveals the fact—confirmed by the excursions of the missionary, Pater Apunto, in the surrounding country—that the greater part of the peninsula is quite uninhabited. Several of the villages round the station were reached by steep paths, one of them leading through the dark ravine of a stream. The separate homesteads are widely scattered among the bush, and the huts are small and poor, not allowing a man to stand upright in them. From the Varzin mountains a comparatively level ridge runs north-west in the direction of Kabaira, with which place it would probably afford a good means of communication.

POLAR REGIONS.

Glacial Phenomena of Spitsbergen.—In a paper read before the Geological Society in June last, and printed in the fourth part of the *Quarterly Journal* of the Society for 1899, Mr. E. J. Garwood sums up the results of his observations on the glacial phenomena of Spitsbergen, made during his second visit with Sir Martin Conway. Some of the points were briefly touched upon by Mr. Garwood after the paper read by Sir Martin Conway before our Society; but they are now dealt with in greater detail, and throw valuable light on the phenomena of ice-sheets generally. Using the term "ice-sheet" in the sense of a covering of ice radiating from a watershed consisting of snow and ice, and not confined by visible barriers of rock, Mr. Garwood says that two such sheets exist in the part of Spitsbergen explored—one on each side of the depressed area connecting Dickson bay and Wijde bay; the radiating point and chief gathering-ground of each area lying somewhat north-west of its centre, with supplementary radiating points to the north and east. The peaks and ridges which protrude above the ice (*e.g.* Mount Chydenius and the Three Crowns) are in this view to be regarded as groups of "Nunatakkr." These ice-sheets seem to be the remnant of an ice-cap which once buried the country more deeply, the condition of things observable being probably almost identical with that which prevailed in our own country towards the close of the glacial epoch. The alpine-glacier stage has not yet been reached, the phenomena of valley-bound ground-ice with freely moving surface layers being still maintained, but the original central radiating point has been replaced by several decentralized points. Among the more particular features described are the ice-tunnels ascribed by Mr. Garwood to the arching up of ice-bridges on the closing of crevasses; the bringing up of englacial moraines to the surface by the obstruction caused by nunatakkr; and the englacial streams with their deposits, which sometimes take the form of "kames" at right angles to the direction of the valley. Mr. Garwood was unable to gain any data respecting the rate of movement of the ice-sheets, but thinks that in the case of glaciers near the coast the rate is not less than 15 or 20 feet in twenty-four hours. From observations made at the termination of the King's bay glacier, he considers that the discharge of icebergs is caused primarily by the action of the tides, occurring during each rise and fall of the water, or four times in twenty-four hours. The size of the larger bergs, even supposing that these represented a portion of the ice-front which had resisted one such rise or fall, would indicate a daily motion of 16 to 20 feet, without allowing for the smaller fragments constantly falling. The paper also touches upon the action of sea-ice, and rock-sculpturing above the snow-line.

The Wellman Polar Expedition.—A detailed account of the Wellman polar expedition of 1898–99, with a map and illustrations, appears in the December number of the *National Geographic Magazine*. An outline of the scope and character of the meteorological work of the expedition, by Mr. Evelyn B. Baldwin, is also published in the same number. The main facts of the expedition have already been given in the *Geographical Journal* (see *Journal*, vol. xiv., 1899, p. 326). On June 26, 1898, the party sailed from Tromsö, in the ice-protected steamer *Frithjof*, calling at Archangel. The most northerly point was reached on March 20, 1899, off the east coast of Rudolf Land, near the 82nd parallel of latitude, 565 miles from the Pole. Subsequently a party, led by the meteorologist Baldwin, explored the eastern limits of Franz Josef Land. A voyage was also made in the unexplored parts of Markham sound in the relief steamer *Capella*, and altogether some twenty new lands or islands were added to the map of that archipelago. Confirmatory evidence is given as to the non-existence of the Dove glacier of Payer. Wilczek Land is also said to differ in form and dimensions from the Austro-Hungarian explorers' maps. The results of the scientific work of the expedition to be published later include the observations of Mr. Baldwin on the *aurora borealis*; Mr. Harlan's report on the aurora, particularly from the point of view of its effect upon the magnetic needle, as also his general study of the physical conditions of Franz Josef Land; and a report by Dr. Edward Hofma, medical officer and naturalist of the expedition, concerning the fauna and flora of that region. The meteorological observations by Mr. Baldwin will also appear in a subsequent paper.

GENERAL.

The Teaching of Geography.—Miss Reynolds was awarded the Gilchrist Travelling Studentship in connection with the University of Wales in 1898, and selected as her subject of study the methods of teaching geography in Switzerland and the north of Italy. She has now published a very interesting report,* giving the result of her studies. The greater part of the report is occupied with Switzerland. The part which geography should play in education is first considered with reference to the views of Rousseau, Pestalozzi, and the Swiss geographical teachers of to-day. The methods of geographical teaching in the Swiss universities and schools are then described separately, and some account of the complicated cantonal educational legislation is given. Chapters on school journeys and excursions, map-making and apparatus complete the section. While the whole of the report is

* 'The Teaching of Geography in Switzerland and North Italy.' By Joan Berenice Reynolds, B.A. London: C. J. Clay & Sons. 1899.

useful and very helpful for the teachers of geography, special interest attaches to the chapters on school excursions, maps, and apparatus. The school excursion and the school journey are not exclusively geographical as practised in Switzerland, or in Germany, but they are entirely educational. Perhaps the most valuable of their lessons is the early training in travel. There is probably no luxury less fully enjoyed than ordinary tourist travel, simply because the tourist has no idea how to occupy his time or what to look at. The same effect is often to be traced in the more ambitious journeys of explorers. Miss Reynolds shows in great detail how school excursions are organized, and points out also in what particulars they often fall short of the ideal. It remains to be seen how such a method of training could be applied in this country in different social and educational conditions.

OBITUARY.

General Tillo.*

On January 11 (New Style), 1900, at half-past eight in the morning, after a short but painful illness, Lieut.-General A. A. Tillo, a Vice-President of the Imperial Russian Geographical Society, passed away.

The deceased, besides his purely military duties, was widely known and respected in the world of science for his great and successful researches. Having received an excellent training in geodesy at two military academies—that of the Artillery and Staff College—he lost no opportunity of acquiring knowledge, and while in Strassburg in 1879, in attendance on H.H. the Grand Duke George of Mecklenburg, for whom he acted as tutor, he seized the opportunity to attend a complete course of lectures on Jurisprudence at the University of that city. Having thoroughly mastered four languages (German, French, English and Italian), A. A. Tillo was able to develop his mental powers by study, and found time by his industrious habits to read through a mass of literature relating to various branches of science. He showed the wide range of his learning by his works, among which there were treatises on cartography, geodesy, hypsometry, terrestrial magnetism, meteorology, and lastly pure geography. Many of these are works of great importance, such as 'The Hypsometrical Map of Russia,' 'Essay on a Tabulation of Levellings of the Russian Empire,' 'The Aralo-Caspian Levelling,' 'Terrestrial Magnetism in the Orenburg Region,' 'Researches on Geographical Distribution and Secular Variations in the Dip and Deflection of the Magnetic Needle throughout European Russia,' 'The Distribution of Atmospheric Pressure in the Russian Empire and Asia on the Basis of Observations taken between 1836 and 1885,' 'Map of the River Basins of European Russia,' etc. The number of his separately published works reached one hundred, and there are others unpublished of great value. Of these the following are prepared for publication: 'Map of the River Basins of Asiatic Russia,' 'Area of the Russian Empire,' 'Lengths of the Rivers of Asiatic Russia,' etc.

Many of these works required the co-operation of a few assistants, and Tillo always knew how to inspire them with a love for their task and combine their labours with his own with the happiest result. His rare tact combined with his wide knowledge gave him great authority and influence, and it was due to these

* We are indebted to Lieut.-Colonel Jules Shokalsky, Secretary of the Physical Section of the Imperial Russian Geographical Society, for the following brief memoir of the late Lieut.-General A. A. Tillo.

that he achieved brilliant results in his yet unfinished work—'Expeditions to examine the Headwaters of the Principal Rivers of European Russia,' for which he had to make use of a number of fellow-workers in the various departments of science. Having collected a mass of materials bearing on various questions, Tillo never withheld or declined to impart information to others engaged on similar studies, a fact which the writer of this memoir can testify from his own personal experience. It was due to Tillo's initiative that the Geographical Society undertook a series of researches on magnetic anomalies in the government of Kursk, and collected rich materials for the hypsometry of Russia. With all his great erudition Tillo was conspicuous for his modesty, and knew how to listen to others and respect their opinions.

Geographical science and Russia have lost in him a foremost worker and a good man in the best sense of these words.

Dr. Paulitschke.

The well-known African traveller, Dr. Philipp Paulitschke, Imperial Councillor and Professor at Vienna University, died in that city on December 11, 1899. Born at Tschermagowitz, in Moravia, he made himself a name by his ethnographical researches in the Somal and Galla countries, in which he and his companion, Von Hardegger, were the first Europeans to penetrate south of Harrar as far as Bia Woraba. The most valuable monument of his active literary career is his 'Ethnographie Nordost-Afrikas,' in which work, aided by the linguistic researches of the deceased A. W. Schleicher, he treated in an exhaustive way both of the material and moral culture of the peoples of that part of the continent.

CORRESPONDENCE.

The Régime of the Okavango River.

I was interested to read in your last issue Major Gibbons's account of his travels in Barotseland, particularly that portion relating to the Magwegena spruit, which connects the Okavango river with the Kwando.

Major Gibbons speaks of this as merely forming an overflow of the Okavango "during two months of the year, becoming waterless during the dry season." But in this he is incorrect. It so happens that in August last—the height of the dry season—I was on the Magwegena myself. It was then flowing freely, and much of the country on both banks was flooded. And yet when Major Gibbons saw it in April or May it was dry.

It follows, therefore, that there is a double overflow each year from the Okavango into the Kwando; while curiously enough, as it is well known, the Kwando itself comes down twice annually in flood, at the same time as the Okavango is overflowing. Obviously, then, the same causes make both the Okavango and the Kwando rise, not only in the wet season, but also again in the dry.

Hitherto, I believe, the suggestion has held ground that the second rise in the Kwando may be caused by the accumulated rainfall at its source being held back by vegetable growths in the river-bed, so as not to reach the Linyanti marshes until some months after the local rainfalls have been carried off by the stream, and that thereby the second overflow at this point is caused. But now that we know that the Okavango also has this double rise, this theory is rendered less tenable, unless we are to understand that the upper reaches of both rivers are so exactly alike that the rainfall at their sources occupies just the same time in percolating through the vegetable growths which are said to obstruct their respective beds. At the same time I confess that no other feasible explanation occurs to me. The subject is, however, a very interesting one, and it is possible that, now that renewed attention is called to the facts, some of the Fellows of the Society who are acquainted with the upper portions of either river may be able to give us the benefit of their knowledge, with a view to clearing up what at present is somewhat of a mystery.

PERCY C. REID.

Feering Bury, Kelvedon, January 18, 1900.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By HUGH ROBERT MILL, D.Sc., *Librarian*, R.G.S.

THE following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Com. = Commerce.
C. Rd. = Comptes Rendus.
Erdk. = Erdkunde.
G. = Geography, Geographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. = Memoirs, Mémoires.
Met. = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. = Review, Revue.
S. = Society, Société, Selskab.
Sitzb. = Sitzungsbericht.
T. = Transactions.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Bulgaria. —

Trade of Bulgaria for the year 1898. Foreign Office, Annual No. 2357, 1899. Size 10 × 6½, pp. 58. *Price* 3d.

Europe. **Chisholm.**

Stanford's Compendium of Geography and Travel (New Issue), Europe. Vol. i. The Countries of the Mainland (excluding the North-West). By George G. Chisholm, B.SC. London: E. Stanford, 1899. Size 8 × 5½, pp. xx. and 736. *Maps and Illustrations. Price* 15s. *Presented by the Publisher.*

This is referred to in the *Journal*, p. 172.

Europe—Glacial Period. *Naturw. Wochenschrift* 14 (1899): 525–528, 537–543. **Weber.**

Versuch eines Ueberblicks über die Vegetation der Diluvialzeit in den mittleren Regionen Europas. Von Dr. C. A. Weber.

Europe—Historical. *Mém. A. Imp. Sci. St.-Pétersbourg* 8 (1899): 1–184. **Westberg.**

Ibrâhîm's-Ibn-Ja'kûb's. Reisebericht über die Slawenlande aus dem Jahre 965. Von Friedrich Westberg.

A critical study of the report of the journey of Ibrahim ibn Jakub through the country of the Slavs in A.D. 965, with notes as to the identification of the places mentioned by him.

Europe—Historical. *J. Manchester G.S.* 15 (1899): 24–37. **Howorth.**
The Changes in the Political Map of Europe during the Nineteenth Century, as illustrated by Copper Coins. By D. F. Howorth. *With Illustrations.*

Europe—Statistics. **Supan.**
Die Bevölkerung der Erde. Periodische Uebersicht über neue Arealberechnungen, Gebietsveränderungen, Zählungen und Schätzungen der Bevölkerung auf der gesamten Erdoberfläche. Herausgegeben von Alexander Supan. X. Europa.—Dr. A. Petermann's Mitteilungen. Ergänzungsheft Nr. 130. Gotha: Justus Perthes, 1899. Size 11 × 7½, pp. vi. and 83.

The area and population of all the countries of Europe at the census of 1891 and 1895, with occasional supplementary or later data. Maps are given of the change in the northern frontier of Greece and of the density of population in Russia.

France. *C. Rd.* 129 (1899): 1041–1043. **Martel.**
Sur de nouvelles recherches souterraines en Dévoluy (Hautes-Alpes) et sur le plus profond puits naturel connu (chourun Martin, 310^{m}). Note de M. E.-A. Martel.

France. *G.Z.* 5 (1899): 580-587, 618–630. **Auerbach.**
Ueber französische Länderkunde. Von Prof. B. Auerbach.

On the physical geography of France.

France. *Ann. G.* 8 (1899): 427–437. **Bigourdan.**
La Carte de France, d'après l'ouvrage du colonel Berthaut. Par M. G. Bigourdan. *With Maps.*

Historical studies of the survey of France from 1750 to 1898, with reproduced specimens of the various maps referred to.

France—Loire. **Joanne.**
Collection des Guides-Joanne. Itinéraire général de la France. Par Paul Joanne. La Loire. Paris: Hachette et C^{ie}, 1899. Size 6½ × 4½, pp. 48, xx., and 338. *Maps and Plans.*

France—Marseilles. *B.S.G. Marseille* 23 (1899): 7–30. **Masson.**
Marseille port colonial. Par M. Paul Masson. *With Diagrams.*

France—Mont Blanc. *C. Rd.* 129 (1899): 993–996. **Janssen.**
Note sur les travaux au mont Blanc en 1899. Par M. J. Janssen.

France—Morvan. *Ann. G.* 8 (1899): 405–426. **Martonne.**
Une excursion de géographie physique dans le Morvan et l'Auxois. Par M. E. de Martonne. *With Maps and Plates.*

France—Normandy. *C. Rd.* 129 (1899): 1043–1045. **Thoulet.**
Évaluation approchée de la dénudation du terrain crétacé des côtes normandes. Note de M. J. Thoulet.

Germany—Bavaria. *Sitzb. A. W. München* (1899): 197–222. **Weinschenk.**
Geologisches aus dem bayerischen Walde. Von Dr. E. Weinschenk. *With Maps and Illustrations.*

Germany—Elbe. *Deutsche Rundschau G.* 22 (1899): 24–32. **Henz.**
Das Delta der Elbe. Von W. Henz. *With Illustration.*

Germany—Prussia. **Schöne.**
Der Fläming. Von Dr. Emil Schöne. Wissenschaftliche Veröffentlichungen des Vereins für Erdkunde zu Leipzig. Vierter Band. Beiträge zur Geographie des mittleren Deutschland. Herausgegeben . . . von Friedrich Ratzel. Leipzig: Duncker & Humblot, 1899. Pp. 91–194. *Map and Illustrations.*

On the origin of the name Fläming as applied to the low bare ridge in the south of the North German plain on the borders of Anhalt.

Germany—Saxony. **Wohlrab.**
Das Vogtland, als orographisches Individuum. Eine Studie zur deutschen Landeskunde. Von Dr. Albert Wohlrab.—Forschungen zur deutschen Landes- und Volkskunde . . . herausgegeben von Dr. A. Kirchhoff. Zwölfter Band. Heft 2. Stuttgart: J. Engelhorn, 1899. Size 9½ × 6½, pp. 97-185. *Map and Illustrations.*

Germany—Thüringerwald. **Kändler.**
Kritik orometrischer Werte und Richtungsverhältnisse der Kamm- und Thalbildungen im Thüringerwald. Von Max Kändler.—Wissenschaftliche Veröffent-

lichungen des Vereins für Erdkunde zu Leipzig. Vierter Band. Beiträge zur Geographie des mittleren Deutschland. Herausgegeben . . . von Friedrich Ratzel. Leipzig: Duncker & Humblot, 1899. Pp. 281–382.

On the crests and valleys of the Thüringerwald, considered in relation to the orographical structure of the group.

Greek Temples. *P.R.S.* 65 (1899): 370–375. **Penrose.**

On the Orientation of Greek Temples, being the results of some observations taken in Greece and Sicily in the month of May, 1898. By F. C. Penrose.

Hungary. *Deutsche Rundschau G.* 21 (1899): 503–507. **Szirbusz.**

Die Trockenlegung des Ecsedermoores. Von Dr. Géza Szirbusz. *With Map.*

On the draining and reclamation of a great marsh near Nagy-Károly in Hungary.

Italy. **Deecke.**

Italien. Von Prof. Dr. W. Deecke.—Bibliothek der Länderkunde, herausgegeben von Dr. Alfred Kirchhoff und Dr. Rudolf Fitzner. Dritter und vierter Band. Berlin: A. Schall [1898]. Size 10½ × 7, pp. xii. and 514. *Maps, Plans, and Illustrations. Price* 14 *m.*

A complete geographical description of Italy, based on geological structure, and including all the conditions of which modern geographical description takes account. The Maltese island group is included, although Corsica, which has certainly an equal claim to be included in Italy, is left out of account.

Italy—Malaria. *Atti R. A. Lincei, Rendiconti* 8, 2 Sem. (1899): 193–203. **Grassi.**

Osservazioni sul rapporto della seconda spedizione malarica in Italia, presieduta dal Prof Koch, composta oltre che dallo stesso Koch, dal Prof. Frosch, dal dottor Ollwig e coadiuvata dal Prof. Gosio. Nota del Socio B. Grassi.

Italy—Roads. *B.S.G. Italiana* 12 (1899): 481–489. **Rosetti.**

Tre vie romane della Romagna: Emilia, Flaminia e Popilia, nota del E. Rosetti.

Portugal. *J. Manchester G.S.* 15 (1899): 75–122. **Newby.**

Portugal, the Portuguese, and the Vasco da Gama Celebration, 1898. By John R. Newby. *With Sketch-map and Illustrations.*

Russia. *P. Philosoph. S. Glasgow* 30 (1899): 192–222. **Mavor.**

From the Baltic to the Caspian. A Voyage across Russia. By Sam. Mavor. *With Map and Illustrations.*

Russia—Canals. *Ann. G.* 8 (1899): 469–471. **Legras.**

Le système Marie. Par M. J. Legras. *With Map.*

The Marie system of inland waterways leads from the Volga, starting at Rybinsk, up the Cheksna, and thence by canal past the White Lake, and skirting the southern shore of Lakes Onega and Ladoga to the Neva. A shorter system of canals runs from Rybinsk up the Mologa river, and down the Tykva to join the Neva canal on Lake Ladoga.

Russia—Finland. *Fennia* 17 (1899). ———

Atlas de Finlande. Texte. Publié par la Société de Géographie de Finlande. *With Diagrams and Illustrations.*

The explanatory text accompanying the special Atlas of Finland published by the Finnish Geographical Society. See review, p. 145.

Russia—Northern. **Pearson.**

'Beyond Petsora Eastward.' Two Summer Voyages to Novaya Zemlya and the Islands of Barents Sea. By Henry J. Pearson. With Appendices on the Botany and Geology, by Colonel H. W. Feilden. London: R. H. Porter, 1899. Size 9½ × 7½, pp. xiv. and 336. *Maps and Illustrations. Price* 22*s.* 6*d. net. Presented by the Author.*

Mr. Pearson has collected the narrative of two voyages to the borders of the arctic regions in 1895 and 1897, and the various monographs which have since been presented to different learned societies on the natural history collections. The whole forms a handsome volume illustrated by a large number of excellent photographs of the scenery, people, fauna, and flora of the extreme north of European Russia. The Russian names have not been transliterated in accordance with a definite system, and several forms of the same word occur. An unusual feature (which it would be well for other authors to follow) is the inclusion of numerous sketch-plans of parts of the districts traversed, so that the reader has the greatest facility in following the descriptions. A general chart is also given.

Switzerland. *Jahrb. Schweizer Alpenclub* **34** (1899): 225–252. **Bähler.**
Das Pommat und die deutsche Sprachgemeinde Bosco im Tessin. Von Dr. A. Bähler. *With Illustrations.*

On the distribution of languages in Ticino.

Switzerland. *Jahrb. Schweizer Alpenclub* 34 (1899): 265–274. **Mercanton.**
Les débâcles au glacier de Crête-Sèche. Par Paul L. Mercanton. *With Illustrations.*

Switzerland. *Jahrb. Schweizer Alpenclub* **34** (1899): 253–264. **Stoffel.**
Wege und Stege der Landschaft Avers. Von S. Stoffel. *With Illustrations.*

United Kingdom—England. *J.S. Arts* **48** (1899): 6–20. **Barry.**
Opening Address. By Sir John Wolfe Barry, K.C.B., etc. *With Plans and Sections.*

On providing means of crossing two currents of traffic at right angles by means of subways, applicable to the busiest centres of London.

United Kingdom—England. *Geolog. Mag.* **6** (1899): 501–505. **Dawkins.**
On the South-Eastern Coalfield. By Prof. W. Boyd Dawkins.

The boring at Ropersole, in the Weald of Kent, establishes the fact that the Dover coalfield extends northwards for a distance of eight miles and beyond in the direction of Canterbury. The coalfield does not extend as far to the south-west as Brabourne, where strata believed to be of Devonian age have been found by boring. The upper surface of the coal-measures is found at Dover at a depth of 1100 feet, and at Ropersole at 1181 feet.

United Kingdom—England—Devon. **Peek.**
Rousdon Observatory, Devon. Vol. xv. Meteorological Observations for the Year 1898, made under the superintendence of Sir Cuthbert E. Peek, Bart. London, 1899. Size 11 × 9, pp. 40. *Plate. Presented by Sir Cuthbert Peck.*

United Kingdom—England and Wales. *P.R.I.* **16** (1899): 679–697. **Mansergh.**
The Bringing of Water to Birmingham from the Welsh Mountains. By James Mansergh. *With Illustrations.*

Particulars of the Elan drainage area near the sources of the Wye and Severn, which is to be utilized for the supply of water to Birmingham. A sketch-map is given of the water-supplies of Manchester, Liverpool, Stockton, and Birmingham, and special maps of the Elan area, with pictures of the works under construction.

United Kingdom—Radcliffe Observations. **Stone and Rambaut.**
Astronomical and Meteorological Observations made at the Radcliffe Observatory, Oxford, in the Years 1890–1891, under the Superintendence of the late Edward James Stone, M.A., etc. Edited by Arthur A. Rambaut, M.A., etc. Vol. xlvii. Oxford: J. Parker & Co., 1899. Size 10½ × 6½, pp. xxvi., 240, xii., and 68. *Presented by the Radcliffe Trustees.*

United Kingdom—Scotland. *Geolog. Mag.* **6** (1899): 472–479, 510–520. **Lapworth.**
The Survey Memoir on the Scottish Uplands. By Prof. C. Lapworth.

United Kingdom—Scotland—Skye. *Geolog. Mag.* **6** (1899): 485–491. **Harker.**
Notes on Subaërial Erosion in the Isle of Skye. By Alfred Harker.

A study of the erosion of the tertiary volcanic rocks in the island of Skye.

ASIA.

Asia—Railways. *Fortnightly Rev.* **66** (1899): 914–925. **Long.**
Russian Railway Policy in Asia. By R. E. C. Long. *With Map.*

A sketch of various Russian plans for an Asiatic railway system, including the projected line from Saratov, passing between the Caspian and Aral seas to Charjui, and thus uniting the Transcaspian and European railway systems.

Ceylon. *J.R. Colonial I.* **31** (1899): 9–44. **Ferguson.**
Ceylon in 1899. By John Ferguson.

Ceylon—Colombo. *J.S. Arts* **48** (1899): 73–95. **Ferguson.**
Old and New Colombo. By John Ferguson.

China. *Rev. Française* **24** (1899): 651–658. **Schotter.**
Le Kouytchéou. Par Aloys Schotter.

China—Chekiang. *B.S.G. Italiana* 12 (1899): 408–418. **Vannutelli.**

Una escursione nel Ce-Kiang, lettera del socio ten. di vascello L. Vannutelli. *With Map and Illustrations.*

A trip from Ningpo in the early part of 1899.

China—Kiungchow. **Butler.**

Trade of Kiungchow for the Year 1898. Foreign Office, Annual No. 2348, 1899. Size 10 × 6, pp. 14. *Price* 1*d.*

China—Yangtse Valley. **Bishop.**

The Yangtze Valley and Beyond. An account of Journeys in China, chiefly in the Province of Sze Chuan and among the Man-tze of the Somo Territory. By Mrs. J. F. Bishop. London: John Murray, 1899. Size 9½ × 6½, pp. xvi. and 558. *Map and Illustrations. Price* 21*s. Two copies, one presented by the Author, the other by the Publisher.*

A full record of Mrs. Bishop's journey up the Yangtse in 1896, of which a summary description was given in the *Journal* for July, 1897, vol. x. p. 19. See notice, p. 149.

China—Yangtse. **Scidmore.**

Cruising up the Yangtsze. By Eliza Ruhamah Scidmore. From the *Century Magazine*, September, 1899, pp. 668–679. *Illustrations.*

Chinese Empire—Mongolia. *B.S.G. Paris* 20 (1899): 308–329. **Klementz.**

Voyages de Dmitri Klementz en Mongolie occidentale, de 1885 à 1897. *With Map.*

Hong Kong. **Blake.**

Hong Kong. Report for 1898. Colonial Reports, Annual No. 282, 1899. Size 9½ × 6, pp. 34. *Price* 2½*d.*

India. **Durand.**

The Making of a Frontier. Five Years' Experiences and Adventures in Gilgit, Hunza, Nagar, Chitral, and the Eastern Hindu-Kush. By Colonel Algernon Durand, C.B. London: John Murray, 1899. Size 9 × 6, pp. xvi. and 298. *Map, Portrait, and Illustrations. Price* 16*s. Presented by the Publisher.*

A history of the formation of the Gilgit frontier, of value, as the author claims, not for the revelation of facts from official sources, but for the absence of such inaccuracies as an outsider might fall into in discussing facts already accessible to the public.

India. *J. Manchester G.S.* 15 (1899): 159–173. **Hatch.**

Our Indian Empire: with Personal Reminiscences of a Tour from Charing Cross to the North-West Frontier. By E. F. G. Hatch, M.P. *With Map and Illustrations.*

India—Archæology. *Nouv. Archives Miss. Sci.* 9 (1899): 521–558. **Foucher.**

Rapport sur une mission d'études archéologiques et religieuses dans l'Inde. Par M. A. Foucher.

The mission lasted from November, 1895, to October, 1897. The journey included a short stay in Ceylon, a visit to Southern India and Madras, then to Calcutta, Benares, Lucknow, Lahore, and a longer sojourn in Kashmir. After this the Swat valley was visited, and the journey concluded at Bombay.

India—Madras. ——

Report on the Madras Observatory for 1898–99. Size 13 × 8½, pp. 8. *Diagram.*

India—Madras. *P.I. Civil Engineers* 137 (1899): 2–71. **Jones.**

The Waterworks of the Madras Presidency. By J. A. Jones. *With Map and Plans.*

India—North-West Frontier. ——

A Dictionary of the Pathan Tribes on the North-West Frontier of India, compiled under the orders of the Quarter-Master-General in India, in the Intelligence Branch. Calcutta, 1899. Size 6½ × 4½, pp. 240. *Map. Presented by the Indian Government.*

This little book gives in compact form the names and tribal relations of about 2500 tribes, clans, divisions, subdivisions, sections, and minor fractions of the Pathan people, each class mentioned being a portion of that mentioned before, and comprising several of that which follows: *e.g.* "the Dadu Khel are a minor fraction of the Dreplara section of the Khusrogi subdivision of the Nasruddin division of the Zakha Khel clan of the Afridi tribe."

India—North-West Frontier. **Foucher.**

Tour du Monde 5 (1899): 469, 481, 493, 541, 553.

Sur La Frontière Indo-Afghane. Par M. A. Foucher. *With Map and Illustrations.*

The author went up to the British outposts in order to study the ancient monuments in the Afridi country.

India—Rajputana States. **Adams.**

The Western Rajputana States. A medico-topographical and general account of Marwar, Sirohi, Jaisalmir. By Lieut.-Colonel Archibald Adams. London: Junior Army and Navy Stores, 1899. Size 9½ × 6½, pp. xii. and 456. *Illustrations. Presented by the Author.*

The various states of Western Rajputana are described with regard to their geographical position, geology, climate, flora, fauna, and political organization. Portraits are given of a number of the ruling princes and of many of the interesting buildings. Perhaps the most valuable part of the work, as forming the subject of the author's professional studies, is the discussion of the sanitary, hygienic, and medical conditions of the several states. This forms the essential part of the description, the other data being intended to give it completeness and a more general interest to the public. The book is written by official direction, and published by the Marwar Darbar, *i.e.* the government of Jodhpore, the chief of the states described.

India—Standard Time. *P. Asiatic S. Bengal* (1899): 62–66. ——

Letter to H.E. the Viceroy on the introduction of a standard time for India.

A summary of the arguments for the introduction in India of standard time based on the meridian of Greenwich.

India—Tide Tables. **Crosthwait and Roberts.**

Tide-Tables for the Indian Ports for the Year 1900 (also January, 1901). Part i.—Western Ports. (Suez to Pámban Pass.) Part ii.—Eastern and Burma Ports. (Galle to Port Blair.) By Lieut. H. L. Crosthwait and E. Roberts. Size 6½ × 4¼, pp. 1204.

India—Time. *P. Asiatic S. Bengal* (1899): 49–55. **Oldham.**

On Time in India: a suggestion for its improvement. By R. D. Oldham.

Arguments for introducing standard time in India, based on Greenwich meridian.

Indo-China. *B.S. Bretonne G.* 18 (1899): 102–115. ——

Sur l'origine des races de l'Indo-Chine française. *With Map.*

Malay Archipelago—Celebes. **Koperberg.**

Tijds. K. Ned. Aard. Genoots. Amsterdam 16 (1899): 589–592.

Het Meer "Danau" in Bolaäng Mongondo. Door M. Koperberg.

Malay Archipelago—Celebes. **Kruijt.**

Tijds. K. Ned. Aard. Genoots. Amsterdam 16 (1899): 593–618.

Het stroomgebied van de Tomasa-rivier. Door Alb. C. Kruijt. *With Map.*

Malay Archipelago—Siauw. **Dinter.**

Tijds. Ind. Taal-, Land- en Volkenk. 41 (1899): 324–390.

Eenige geographische en ethnographische aanteekeningen betreffende het eiland Sidoe. Door B. C. A. J. van Dinter. *With Map.*

Malay Archipelago—Sumatra. **Kroesen.**

Tijds. Ind. Taal-, Land- en Volkenk. 41 (1899): 253–285.

Nota omtrent de Bataklanden (speciaal Simeloengoen). Door J. A. Kroesen.

On the Battak country in Sumatra.

Malay Archipelago—Sumatra. **Kroesen.**

Tijds. Ind. Taal-, Land- en Volkenk. 41 (1899): 211–252.

Rapport betreffende de aanvaarding van de onderwerping aan het Nederlandsch oppergezag van het landschap Tanah Djawa. Door J. A. Kroesen.

Malay States. ——

Straits Settlements. Reports on the Federated Malay States for 1898. London: Eyre & Spottiswoode, 1899. Size 13½ × 8½, p. 78. *Price* 8½*d.*

Russia—Central Asia—Railway. *B.S.G. Marseille* 22 (1898): 295–314. **Gourdet.**

Le Chemin de fer dans l'Asie centrale. Par M. Paul Gourdet.

The author, who holds a public appointment in the town of Vyerni, gives an account of the Trans-Caspian railway and its extension to Tashkent, referring also to the part the railway is destined to take in the development of the country.

Russia—Caucasus. *B.S.G. Com. Havre* 16 (1899): 263–285, 323–339, 419–439. **Baye.**
Au sud de la chaîne du Caucase (souvenirs de voyage). Par Le Baron De Baye. *With Illustrations.*

The illustrations are excellent.

Russia—Transcaucasia. **Rossmässler.**
Deutsche Rundschau G. 21 (1899): 507–511, 541–551.
Reiseerinnerungen aus den Karabagh 'schen Bergen. Von F. Rossmässler.

Russia—Siberia. *Scottish G. Mag.* 15 (1899): 583–595. ———
The Tian-Shan: its Vertical Relief, Hydrography, etc.

An abstract of Dr. Max Friederichsen's work, "Morphologie des Tien-Schan."

Turkey—Asia Minor. *Deutsche G. Blätter* 22 (1899): 153–169. **Grothe.**
Deutsche Kulturmission in Kleinasien. Von Dr. L. H. Grothe.

On the great future which German initiative is to bring to Asia-Minor.

Turkey—Syria. *Nouv. Archives Miss. Sci.* 9 (1899): 265–511. **Parisot.**
Rapport sur une mission scientifique en Turquie d'Asie. Par J. Parisot.

This journey was made with the object of studying the Syrian language and Asiatic music, and to make a collection of Maronite, Syrian, and Chaldean songs. The studies were made in the neighbourhood of Damascus, in the Lebanon, at Beirut, etc. The music of a large number of Maronite, Arab, Syrian, Chaldean, and Jewish chants and songs is reproduced.

Turkey—Syria. **Thomas.**
Two Years in Palestine and Syria. By Margaret Thomas. With Sixteen Illustrations reproduced in Colours in facsimile of the Original Paintings by the Author. London: J. C. Nimmo. 1900 [1899]. Size 9 × 6, pp. xiv. and 344. *Price* 12*s.* 6*d.* *Presented by the Publisher.*

The main feature of this account of a sojourn in Palestine (1895–97) is the novelty of reproducing the author's very effective paintings by means of the "three-colour" process. The result is striking and vivid.

AFRICA.

Africa—Missionary Researches. **Maples.**
Journals and Papers of Chauncy Maples, D.D., F.R.G.S., late Bishop of Likoma, Lake Nyasa, Africa. Edited by Ellen Maples. London: Longmans & Co., 1899. Size 8 × 5½, pp. 278. *Portrait and Map. Price* 6*s.* 6*d.* *Presented by the Publishers.*

This book consists of a series of extracts from the writings of the late Bishop Maples, of a varied nature. There are descriptions of journeys with notes on the wild life of the country, records of mission work, sermons, essays, and articles contributed to different publications. The descriptive parts are admirably graphic.

Algeria. *B.S.G. Paris* 20 (1899): 285–303. **Huguet.**
Dans le Sud algérien. Par le Dr. J. Huguet. *With Maps and Plans.*

Algeria—Constantine. **Monségur.**
Rev. G. 44 (1899): 415; 45 (1899): 46, 124, 252, 321, 426.
Étude sur la province de Constantine. Par le Commandant A. Monségur. *With Maps and Plan.*

Algeria—Railways. *Questions Dipl. et Colon.* 8 (1899): 129–156. **Bernard.**
Les Chemins de fer en Algérie. Par Augustin Bernard. *With Maps.*

On the existing and projected railways of Algeria.

Algeria—Sahara. *Globus* 76 (1899): 202–208. **Huguet and Pettier.**
El Golea, der südlichste Stützpunkt der Franzosen in der algerischen Sahara. Nach Huguet und Pettier. *With Illustrations.*

Congo. *B.S.R.G. d'Anvers* 23 (1899): 224–238. **Buls**
Du Stanley-Pool au Stanley-Falls. Conférence. Par M. Ch. Buls.

Notes of a lecture describing a voyage along the Congo on the occasion of the opening of the Congo railway.

Congo State. *Rev. Scientifique* 12 (1899): 742–750, 784–788. **Lancaster.**
Le climat du Congo. Par M. A. Lancaster. *With Map and Diagrams.*

Congo State. **Thonner.**

Dans la grande forêt de l'Afrique Centrale. Mon Voyage au Congo et à la Mongala en 1896. Par Franz Thonner. Bruxelles: Oscar Schepens & Cie., 1899. Size 10½ × 7, pp. x. and 116. *Maps and Plates. Presented by the Publishers.*

This is a translation from the German original dealing with a journey through the great equatorial forests of the Congo and Mongala. The main feature of the book is the series of eighty-seven full-page collotype reproductions of photographs of scenery, dwellings, and people.

German West Africa—Kamerun. *Deutsches Kolonialblatt* 10 (1899): 510–513. **Plehn.**

Ueber die Gründung der Station am Mgoko und Bereisung der Flüsse Ngoko, Bumba und Dscha.

Ivory Coast. *Nouv. Archives Miss. Sci.* 9 (1899): 157–264. **Eysséric.**

Rapport sur une mission Scientifique à la Côte d'Ivoire. Par M. J. Eysséric. *With Maps and Illustrations.*

A journey up the Bandama river and in the Baule country in 1896–97. Particulars are given of the surveys and the fixing of astronomical points. A series of small maps in colours shows the geology, forests, languages, and density of population.

Nigeria. ——

Correspondence relating to the Benin Territories Expedition, 1899. London: Eyre & Spottiswoode, 1899. Size 13½ × 8½, pp. 22. *Price* 2½*d.*

Somaliland. *A travers le Monde, Tour du Monde* 5 (1899): 369–371. **Goedorp.**

Chez les Somalis. Par Victor Goedorp. *With Illustrations.*

On a journey inland from Obok.

South Africa. **Bryce.**

Impressions of South Africa. By James Bryce. With Three Maps. Third Edition, revised throughout, with a new prefatory chapter, and with the Transvaal Conventions of 1881 and 1884. London: Macmillan & Co., 1899. Size 8 × 5½, pp. lxiv. and 500. *Price* 6*s. Presented by the Publishers.*

Mr. Bryce has added an introductory chapter, giving a brief review of the events in South Africa during the last two years, but without entering into a minute history of the political difficulties which led to the war, concerning which there are still serious differences of opinion. The work has been brought up to date throughout.

South-West Africa. **Möller.**

Resa i Afrika genom Angola, Ovampo och Damaraland. Af P. Möller. Stockholm: W. Billes, 1899. Size 9½ × 6½, pp. 226. *Map and Illustrations. Presented by the Publisher.*

Captain Möller landed at Mossamedes, and, after some journeys in the interior of Angola, turned southward in 16° E. and traversed the centre of Ovampoland and Damaraland, finally leaving the country at Walfisch bay.

Transvaal. *Rev. Française* 24 (1899): 625–650. **Demanche.**

La Question du Transvaal. La rupture avec l'Angleterre. La guerre de l'indépendance (1880–1881). L'incursion de Jameson (1895–1896). Forces anglaises et boers. Par G. Demanche. *With Map.*

Transvaal. **Fitzpatrick.**

The Transvaal from Within. A Private Record of Public Affairs. By J. P. Fitzpatrick. London: W. Heinermann, 1899. Size 9 × 6, pp. xiv. and 452. *Price* 10*s.*

This is a history of the events in the Transvaal during the Reform agitation at Johannesburg, the Jameson raid, and subsequently down to the present year, written by one of the active participators.

Tunis. *Nouv. Archives Miss. Sci.* 9 (1899): 103–156. **Blanchet.**

Mission archéologique dans le centre et le Sud de la Tunisie (avril—août 1895). Par M. Paul Blanchet. *With Plans.*

Describes many ruins, and records inscriptions of the Roman period.

Uganda. *Blackwood's Mag.* 166 (1899): 631–643. **Malcolm.**

On Service in the Uganda Protectorate. By Captain Neill Malcolm.

Refers to the incidents of the march to the relief of the Sudanese garrison at Fowers in March, 1898, and describes the incidents of daily life amongst the Indian troops and Swahili porters in Uganda.

NORTH AMERICA.

Alaska. **Filippi.**

Dottore Filippo de Filippi. La Spedizione di sua altezza reale il Principe Luigi Amedeo di Savoia, Duca degli Abruzzi, al Monte Sant' Elia (Alaska), 1897. Illustrata da Vittorio Sella. Milano: Ulrico Hoepli, 1900. Size 11½ × 8, pp. xviii. and 284. *Maps and Illustrations. Presented by the Publisher.*

The official account of the Duke of the Abruzzi's expedition to Mount St. Elias, illustrated by the fine photographs of Signor Vittorio Sella. The book describes the journey by Seattle to Yakutat, the encampments and climbs on Mount St. Elias, with particulars of the various glaciers and peaks, and the return journey. Appendices deal with equipment, meteorology, hygiene, natural history collections, and bibliography. There is a general map of North-Western North America, and also a special map of the mountain.

Alaska. *B. American G.S.* 31 (1899): 344–355. **Gannett.**

The Harriman Alaska Expedition. By Henry Gannett. *With Map.*

A summary of this paper appears in the *Journal* for January, 1900.

Canada—New Brunswick. **Bailey.**

The Mineral Resources of the Province of New Brunswick. By L. W. Bailey. (Geological Survey of Canada, Part M, Annual Report, vol. x.) Ottawa, 1899. Size 10 × 6½, pp. 128. *Map and Illustrations. Presented by the Geographical Survey of Canada.*

A careful study of all the existing evidence as to the value of the minerals in New Brunswick, with a map showing the distribution of economic minerals in the province.

Canada—Ontario. **McInnes.**

Report on the Geology of the Area covered by the Seine River and Lake Shebandowan Map-Sheets, comprising portions of Rainy River and Thunder Bay Districts, Ontario. By William McInnes, B.A. (Geological Survey of Canada, Part H, Annual Report, vol. x.) Ottawa, 1899. Size 10 × 6½, pp. 66. *Maps (separate) and Illustrations. Presented by the Geographical Survey of Canada.*

Canada and Alaska—Boundary. ———

Treaty Series, No. 19, 1899. Exchange of Notes between the United Kingdom and the United States of America, providing for the establishment of a Provisional Boundary between the Dominion of Canada and the territory of Alaska in the region about the head of Lynn Canal. October 20, 1899. London: Eyre & Spottiswoode, 1899. Size 9½ × 6, pp. 4. *Price ½d.*

The text of the *modus vivendi* as to the Alaskan frontier.

United States—Colorado. **Spurr.**

Monographs of the United States Geological Survey. Vol. xxxi. Geology of the Aspen Mining District, Colorado, with Atlas. By Josiah Edward Spurr. Washington, 1898. Size 12 × 9½; Atlas, 21½ × 19; pp. xxxvi. and 260. *Illustrations. Presented by the U.S. Geological Survey.*

United States—East Coast. **Hills.**

Sailing directions for the East Coast of the United States. Compiled by Captain E. H. Hills. London: J. D. Potter, 1899. Size 9½ × 6½, pp. xx. and 888. *Index Chart. Price 3s. 6d. Presented by the Hydrographer, Admiralty.*

United States—Lake Superior Region. *P.I. Civil Engineers* 137 (1899): 72–130. **Head.**

The Lake Superior Iron-Ore Mines, and their Influence upon the Production of Iron and Steel. By J. Head and A. P. Head. *With Map and Plans.*

United States—Massachusetts. **Emerson.**

Monographs of the United States Geological Survey. Vol. xxix. Geology of Old Hampshire County, Massachusetts, comprising Franklin, Hampshire, and Hampden Counties. By Benjamin Kendall Emerson. Washington, 1898. Size 12 × 9½, pp. xx. and 790. *Maps and Illustrations. Presented by the U. S. Geological Survey.*

This includes the description of the greater part of the drainage area of the Connecticut river, which is situated in Massachusetts.

CENTRAL AND SOUTH AMERICA.

American Republics. ———

Monthly Bulletin of the Bureau of American Republics. October, 1899. Washington, 1899. Size 9½ × 6, pp. 437–584.

Andes. *Rev. Museo La Plata* 9 (1899): 197–220. **Burckhardt.**

Rapport préliminaire sur une Expédition géologique dans la région andine, située entre Las Lajas (Argentine) et Curacautin (Chili). Por Carl Burckhardt. *With Maps and Illustrations.*

The expedition here described took place in the early part of 1898, the part surveyed being the part of the Cordillera situated near 39° S., between the source of the Biobio and Valdivia. See notice, p. 181.

Andes. *Alpine J.* 19 (1899): 565–578. **Vines.**

The Ascent of Aconcagua and Tupungato. By Stuart Vines.

Andes. *Rev. Museo La Plata* 9 (1899): 221–242. **Wehrli.**

Rapport préliminaire sur mon Expédition géologique dans la Cordillère argentino-chilienne, du 40° et 41° latitude sud (région du Nahuel-Huapi). Par Dr. Leo Wehrli. *With Maps and Profile.*

Andes. *Rev. Museo La Plata* 9 (1899): 243–252. **Wehrli.**

Avis géologique sur la question du Divortium aquarum interoceanicum dans la region du lac Lacar. Par Dr. Leo Wehrli. *With Map and Illustrations.*

Argentine Republic. *An. S. Ci. Argentina* 48 (1899): 333–335.

La determinación de la posición geográfica de San Rafael (provincia de Mendoza).

Argentine Republic. *Rev. Museo La Plata* 9 (1899): 1–78. **Delachaux.**

Limites occidentales de la República Argentina.—El articulo del Dr. Juan Steffen "La cuestion de limite chileno-argentina," con especial consideración de la Patagonia.—Exámen critico por Enrique S. Delachaux.

A critical study from the Argentine point of view of Dr. Steffen's article on the boundary between Chile and Argentina, in Patagonia, published in the *Zeitschrift* of the Berlin Geographical Society for 1897.

Chile.

Temperate Chile. A Progressive Spain. By W. Anderson Smith. London: A. & C. Black, 1899. Size 9 × 6, pp. x. and 400. *Map and Frontispiece.* 10*s.* 6*d.* *Presented by the Publishers.*

The record of a recent visit to Southern Chile for the purpose of inspecting and reporting on the country and its adaptability for immigration. See notice, p.

Guatemala.

A Glimpse at Guatemala, and Some Notes on the Ancient Monuments of Central America. By Anne Cary Maudslay and Alfred Percival Maudslay. With Maps, Plans, Photographs, and other Illustrations. London: John Murray, 1899. Size 12 × 9½, pp. xviii. and 290. *Price £4 4s.* *Presented by the Authors.*

A gracefully written and superbly illustrated book of travel, full of observations on all aspects of nature as well as on the ancient buildings, the study of which was the main object of the journey.

Guatemala.

Biologia Centrali-Americana; or, Contributions to the Knowledge of the Fauna and Flora of Mexico and Central America. Edited by F. Ducane Godman. Archæology. By A. P. Maudslay. [Part xi. September, 1899.] (V... London: R. H. Porter, and Dulau & Co. Size 13 × 10½. *Pl... separate.*

Nicaragua.

Tangweera. Life and Adventures among Gentle Savages. By C. ... London: E. Arnold, 1899. Size 9 × 6, pp. xii. and 318. *Illustrations.* *Presented by the Publisher.*

The record of life in the forests of the Mosquito coast about forty years ago, written out from notes taken at the time. The chapters abound with descriptions of wild nature, and of the unspoiled Mosquito Indians.

Porto Rico.

Puerto Rico: its Conditions and Possibilities. By William Dinwiddie. London and New York: Harper & Bros., 1899. Size 8½ × 5½, pp. 294. *Price* 10*s.* 6*d.*

A description of Porto Rico, based on a special visit of inquiry of two months immediately after the Spanish evacuation. It deals with the resources and trade of the island.

AUSTRALASIA AND PACIFIC ISLANDS.

Australia—Handbook. ———

The Australian Handbook (incorporating New Zealand, Fiji, and New Guinea). Shippers, Importers and Professional Directory & Business Guide for 1899. London, etc.: Gordon & Gotch. Size 10 × 6½, pp. 640. *Maps, Plans, and Illustrations.*

Ellice Islands. ———

Australian Museum, Sydney. Memoir III. The Atoll of Funafuti, Ellice Group; its Zoology, Botany, Ethnology, and General Structure, based on collections made by Mr. Charles Hedley of the Australian Museum, Sydney, N.S.W. Parts 8 and 9. Sydney, 1899. Size 10 × 6. *Illustrations. Presented by the Australian Museum, Sydney.*

Fiji. **Allardyce.**

Fiji. Annual Report for 1898. Colonial Reports, Annual No. 268, 1899. Size 10 × 6, pp. 24. *Price* 1½*d.*

Kerguelen Island. *P.R.S. Victoria* 11 (1899): 209-213. **Hogg.**

A Contribution to the Petrology of Kerguelen Island. By Evelyn G. Hogg.

The rocks described were obtained in 1898 by Mr. Robert Hall, who was on board a whaling vessel which touched at Howe island, Greenland harbour, Royal sound, and "Cat's Ears."

New South Wales. ———

Annual Report of the Department of Mines and Agriculture, New South Wales, for the Year 1898. Sydney, 1899. Size 13½ × 8½, pp. 204. *Plans, etc.*

New South Wales—Copper. **Carne.**

The Copper-Mining Industry and the Distribution of Copper Ores in New South Wales. By J. E. Carne. New South Wales. Department of Mines and Agriculture. Geological Survey: Mineral Resources. No. 6. Sydney, 1899. Size 10 × 6½, pp. 198. *Map and Plates. Price* 2*s.* 6*d. Presented by the Geological Survey, New South Wales.*

A complete history of copper-mining in New South Wales, with full particulars of the present state of the industry, which has entered on a period of renewed prosperity since 1894.

New Zealand. *G.Z.* 5 (1899): 609–618. **Jung.**

Die wirtschaftlichen Verhältnisse Neuseelands. Von Dr. Emil Jung.

On the economic conditions of New Zealand.

POLAR REGIONS.

Antarctic. *Verh. Ges. Erdk. Berlin* **26** (1899): 320–322. ———

Das Expeditionsschiff für die geplante deutsche Südpolar-Forschung.

Antarctic. *Petermanns M.* **45** (1899): 240-241. **Borchgrevink.**

Borchgrevinks antarktische Expedition auf dem "Southern Cross."

Antarctic. *Naturw. Wochenschrift* 14 (1899): 477–483. **Drygalski.**

Ueber die wissenschaftliche, praktische und nationale Bedeutung der Deutschen Südpolar-Expedition. Von Prof. Dr. Erich von Drygalski. *With Map.*

Antarctic. *Meteorolog. Z.* 16 (1899): 472-473, 474-475. **Hann.**

Vorläufige Ergebnisse der meteorologischen Beobachtungen der belgischen antarktischen Expedition. Von J. Hann.

Antarctic Exploration. **Buchanan.**

On the Physical and Chemical Work of an Antarctic Expedition. By J. Y. Buchanan, F.R.S. (From the *Geographical Journal* for November, 1899.) Size 10 × 6½, pp. 8.

Arctic. *Rev. Scientifique* **12** (1899): 711–718. **Rabot.**

Un précurseur de Nansen au XVIe siècle. Par M. Ch. Rabot.

On the voyages of Barents.

Arctic—Whaling. **Lindeman.**
Abhandlungen des Deutschen Seefischerei-Vereins. Herausgegeben vom Deutschen Seefischerei-Verein. Band IV.: Die gegenwärtige Eismeer-Fischerei und der Walfang. Von Dr. Phil. M. Lindeman. Berlin: Otto Salle, 1899. Size 13½ × 11, pp. viii. and 134. *Presented by the Author.*

A treatise on sea-fisheries in arctic waters, with special reference to whaling.

East Greenland. *Petermanns M.* 45 (1899): 241–243. **Nathorst.**
Die schwedische Expedition nach Ostgrönland 1899. Von Prof. A. G. Nathorst.

North-West Passage. ——
The Story of the North-West Passage, as told by the Early Explorers. London: T. Nelson & Sons, 1899. Size 6½ × 4½, pp. 80. *Map and Illustrations. Price 4d. Presented by the Publishers.*

A series of quotations from Hakluyt and Purchas, with occasional notes, giving an account of the early search for the North-West Passage in a form adapted for use as a Reader in elementary schools. The illustrations (so far as they are reproductions of contemporary woodcuts) are good.

MATHEMATICAL GEOGRAPHY.

Contour-Maps. *Globus* 76 (1899): 281–283. **Kahle.**
Zur Entnahme von Höhen aus Karten mit Höhenlinien. Von P. Kahle.

On the method of reading and utilizing contour-maps.

Geodesy. ——
Jahresbericht des Direktors des königlichen Geodätischen Instituts für die Zeit von April 1898 bis April 1899. Potsdam, 1899. Size 9½ × 6½, pp. 26.

Navigation. ——
Navigation Made Easy. A great improvement over the old Mercator or Mid-Latitude Method. Kirby's Great Circle Navigator. The True Natural Course Indicator for quick and accurate shaping of courses under all Circumstances. 1899. Size 9 × 7½, pp. 8. *Illustrations.*

Description of an instrument by which the great-circle course between any two points can be obtained by taking account of the ship's position at the time.

Position at Sea. *Nautical Mag.* 68 (1899): 759–767. **Goodwin.**
Raper's Approximate Solution of the Double Altitude. By H. B. Goodwin.

Position at Sea. *Nautical Mag.* 68 (1899): 724–742. **Plumstead.**
Notes on Lunars, Sumners, and Double Altitudes. By E. Plumstead.

Prime Meridian. *Mouvement G.* 16 (1899): 457–460. ——
L'adoption du méridien initial de Greenwich par la France.

Notes on the various prime meridians which have been employed at different times.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Climates. **Manson.**
The Evolution of Climates. By Marsden Manson. (From the *American Geologist*, vol. xxiv., August, September, and October, 1899.) Size 9½ × 6, pp. [58]. *Map. Presented by the Author.*

Forests and Water Supply. *Meteorolog. Z.* 16 (1899): 469–472. **Bühler, etc.**
Untersuchungen über den Einfluss des Waldes auf den Stand der Gewässer.

On the suggestions of Bühler, Ebermayer, Hoppe, and Müttrich for a scheme of investigation of the influence of forests on the rainfall and drainage of a district.

Glaciers. **Richter.**
Commission Internationale des Glaciers. Les variations périodiques des Glaciers. Quatrième Rapport, 1898, rédigé par E. Richter. (Extrait des *Archives des Sciences physiques et naturelles*, t. viii., 1899.) Genève: Georg & C^{ie}., 1899. Size 10 × 6½, pp. [32]. *Presented by the Publishers.*

Mountains. **Gukassian.**
Ueber den Parallelismus der Gebirgsrichtungen mit besonderer Berücksichtigung der Hauptrichtungen des hercynischen Systems. Von A. Gukassian.—Wissen-

schaftliche Veröffentlichungen des Vereins für Erdkunde zu Leipzig. Vierter Band. Beiträge zur Geographie des mittleren Deutschland, Herausgegeben . . . von Friedrich Ratzel. Leipzig: Duncker & Humblot, 1899. Size 10 × 6½, pp. 195–279.

On the direction of mountain chains.

Oceanography— *J. Geology* 7 (1899): 585–618. **Tolman.**

The Carbon Dioxide of the Ocean and its Relations to the Carbon Dioxide of the Atmosphere. By C. F. Tolman, jun.

Oceanography ——

Conférence Internationale pour l'exploration de la mer, réunie à Stockholm, 1899. Stockholm, 1899. Size 9 × 8, pp. lvi. and 28. *Maps.*

A summary of this official report was given in the *Journal* for December, 1899, vol. xiv. p. 646.

Oceanography. *Geolog. Mag.* 6 (1899): 559–566. **Spencer.**

Mr. Hudleston "On the Eastern Margin of the North Atlantic Basin." By Prof. J. W. Spencer.

A critical paper on the continental margins of Europe, with remarks on the methods of expressing and representing depths on maps. The argument is confused by a misprint, "isobar" for "isobath."

Oceanography. *C. Rd.* 129 (1899): 891–893. **Thoulet.**

Sur une expérience relative aux courants sous-marins. Note de M. J. Thoulet.

The experiments consisted in the use of a number of floats coupled together in pairs by lines of different lengths, the lower bottle of each pair being loaded so as to keep the line stretched.

Terrestrial Magnetism. **Pochettino.**

Atti R.A. Lincei Rendiconti 8, 2 Sem. (1899): 204–212.

Se e come la forza magnetica terrestre varii coll' altezza sul livello del mare. Nota di A. Pochettino.

Volcanic Islands. **Grosser.**

Geologische Betrachtungen auf vulkanischen Inseln. Von Paul Grosser.—Sonder-Abdruck aus den Verhandlungen des naturhistorischen Vereins der preuss. Rheinlande, Westfalens und des Regierungsbezirks Osnabrück. 56 Jahrgang, 1899. Size 8½ × 5½, pp. 50–68. *Presented by the Author.*

On the volcanic islands visited during a voyage round the world.

Zoogeography. *A travers le Monde, Tour du Monde* 5 (1899): 325–326. ——

Migrations d'Animaux. L'Invasion du Hamster en France. *With Map.*

GENERAL.

Ballooning. *B.S.G. Italiana* 12 (1899): 561-572. **Roncagli.**

La Spedizione Andrée e la nautica nell' aria. Nota di G. Roncagli.

Bibliography. ——

Catalogue No. 3 of Second-hand Books and Manuscripts. Being a Collection of rare volumes relating chiefly to Spanish America. For sale at affixed prices. By W. W. Blake, Gante 8, City of Mexico. Mexico, 1899. Size 9 × 5½, pp. 156. *Presented by the Publishers.*

This catalogue contains a large number of works on America.

British Colonies. ——

Combined Circulars on Canada, the Australasian and South African Colonies. Issued by the Emigrants' Information Office. January, 1900. Size 8½ × 5½, pp. 18, 46, and 16. *Sketch-Maps.*

Commercial Geography—Indiarubber. *B.S. d'Études colon.* 6 (1899): 165–261. **Morris.**

Plantes produisant le caoutchouc du commerce. Par D. Morris, traduction de L. Pynaert. *With Map and Illustrations. Also separate copy.*

Educational. *Petermanns M.* 45 (1899): 235–238. ——

Der geographische Unterricht an den deutschen Hochschulen im Wintersemester 1899–1900.

The programme of the German University courses in geography for the winter session.

Educational. *J.R. Colonial I.* 31 (1899): 45-50. **Andrews.**
The Empire and Geographical Teaching. By Arthur W. Andrews.

Educational—Methods. *J. School G.* 3 (1899): 337-351. **Reilly.**
Geography in Model Department, Normal School, Trenton, N.J. By Susan A. Reilly.

On work in practical geography for junior classes.

Geographical Congress. *Naturw. Wochenschrift* 14 (1899): 489-495. ——
VII. Internationaler Geographen-Congress Berlin, 28 September bis 4 Oktober 1899.

This report, continued in subsequent numbers, reprints all the abstracts of papers read at the Berlin Congress in the language in which they were presented.

Geographical Congress. *Verh. Ges. Erdk. Berlin* 26 (1899): 364-391. ——
Bericht über die feierliche Eröffnung des Siebenten Internationalen Geographen-Kongresses.

Geographical Congress. *Questions Dipl. et Colon.* 8 (1899): 267-275. **Bernard.**
Le Congrès international de Géographie de Berlin. Par Augustin Bernard.

A good summary of the work of the Congress at Berlin in 1899, but marred by some words out of harmony with the cosmopolitan spirit of such a gathering; words which are quoted without any expression of disapproval.

Geographical Progress. **Jüttner and Paulitschke.**
Deutsche Rundschau G. 21 (1899): 552-564.
Fortschritte der geographischen Forschungen und Reisen im Jahre 1898. 3. Amerika. Von Dr. J. M. Jüttner. 4. Afrika. Von Dr. Ph. Paulitschke.

Mountaineering. **Zurbriggen.**
From the Alps to the Andes, being the Autobiography of a Mountain Guide. By Mattias Zurbriggen. London: T. Fisher Unwin, 1899. Size 9 × 6, pp. xv. and 270. *Illustrations. Price 10s. 6d. Presented by the Publishers.*

The famous Alpine guide who writes this narrative of his life's excursions has had a remarkably wide, in fact a unique, experience of mountains, not only in his alpine home, but in the Himalayas, the New Zealand Alps, and the Andes. Zurbriggen can boast of more high climbs than any other man, for he accompanied Sir Martin Conway in the Karakorum and Mr. Fitz Gerald on Aconcagua. It is interesting to note the matter-of-fact way in which this professional climber recounts his remarkable achievements.

Peace-Conference. ——
Miscellaneous, No. 1 (1899). Correspondence respecting the Peace Conference held at the Hague in 1899. London: Eyre & Spottiswoode, 1899. Size 13½ × 8½, pp. vi. and 356. *Price 2s. 10½d.*

Royal Navy. **Clowes.**
The Royal Navy, a History from the Earliest Times to the Present. By Wm. Laird Clowes, assisted by Sir Clements Markham, K.C.B., Captain A. T. Mahan, U.S.N., H. W. Wilson, Theodore Roosevelt, E. Fraser, etc. Vols. i.–iv. London: Low & Co., 1897–1899. Size 11 × 8, pp. (vol. i.) xxiv. and 698; (vol. ii.) xiv. and 594; (vol. iii.) xx. and 610; (vol. iv.) xiv. and 624. *Portraits, Maps, Charts, and Illustrations. Price £5.*

Sir Clements Markham contributes the chapters on exploration by naval officers.

Travels. **Oertel.**
Die Naturschilderung bei den Deutschen Geographischen Reisebeschreibern des 18. Jahrhunderts. Inaugural-Dissertation zur Erlangung der Philosophischen Doktorwürde bei der Philosophischen Fakultät der Universität zu Leipzig, eingereicht von Karl Otto Oertel. Size 9 × 6, pp. 92. *Presented by Prof. Ratzel.*

On the German travellers and writers of descriptive geographical works of the eighteenth century, from Johann Peter Kolb to Alexander von Humboldt.

NEW MAPS.

By J. COLES, *Map Curator*, R.G.S.

EUROPE.

Austria-Hungary. **Artaria.**

Artaria's Eisenbahn- und Post-Communications-Karte von Oesterreich-Ungarn. Verlag von Artaria & Co., Wien, 1900. Mit Stationsverzeichnis. Scale 1 : 1,700,000 or 18·8 stat. miles to an inch. *Price* 1 *fl.*

England and Wales. **Ordnance Survey.**

Publications issued since December 8, 1899.

6-inch—County Maps:—

ENGLAND AND WALES (revision): — **Cheshire**, 3 N.E., 13 N.E., 21 N.E., N.W., S.E., 30 N.W., 30A N.E., 53 S.E., 59 N.E. **Derby**, 20 S.W., 28 N.W., N.E., S.W., 29 N.W., N.E., S.E. **Nottinghamshire**, 13 S.W. **Surrey**, 5 complete, 6 N.W., S.W., N.E., S.E., 7 S.W., S.E., 16 N.W., S.W., S.E., 17 N.W., S.W., S.E., 17 N.W., N.E., S.W., 18 complete, 19 N.W., S.W., S.E., 27 complete, 28 complete, 29 N.W., N.E., S.E., 30 complete, 31 complete, 32 S.W., S.E., 40 complete, 41 complete, 42 complete, 43 N.W., S.W., S.E., 44 N.W., N.E., 45 complete, 46 N.W., S.W., S.E., 54 complete, 55 complete, 56 complete, 57 N.W., S.W., S.E., 58 N.E., S.W., 59 N.W., N.E., S.W., 67 complete, N.W., S.W., 69 complete, 70 N.W., S.W., N.E., S.E., 71 N.W., N.E., 78 N.W., N.E., S.E., 79 complete, 80 N.W., N.E., 82 N.E., 83 N.W. **Westmorland**, 5 S.E., 6 N.W., N.E., 8 N.E., S.W., S.E., 9 S.E., N.E., S.W., 11 S.W., 12 S.E., 13 N.W., S.E., 14 S.W., 15 N.E., 16 N.E., 20 N.E., 24 S.E., 26 N.E., S.W., 29 S.E., 32 N.W., N.E., 47 S.W. 1*s. each.*

25-inch—Parish Maps:—

ENGLAND AND WALES (revision):—**Berkshire**, IV. 4, 12; XIX. 1, 9; XXV. 1, 5, 12, 14, 15, 16; XXVIII. 12; XXXIV. 1, 5, 7, 13, 14, 15, 16; XXXV. 10, 14, 15, 16; XXXVII. 1, 2, 6, 7, 8; XLV. 9; XLIX. 4; L. 1. **Bucks**, XVII. 4; XVIII. 5, 7, 10, 11, 14, 15, 16; XIX. 10, 11, 13, 14, 15, 16; XX. 9, 10, 13, 14; XXI. 4, 8, 11, 12, 16; XXII. 1, 7; XXXIII. 11; XXIV. 8, 12, 13; XXVI. 4, 8; XXVIII. 15, 16; XXX. 7. **Cumberland**, XLVIII. 5, 10, 11, 12, 13, 14, 15, 16; XLIX. 9, 10, 13; LIV. 13; LV. 6, 7, 8, 10, 11, 12; LVI. 5, 13; LVIII. 2, 3, 4, 7, 8. **Derbyshire**, XXXVIII. 1. **Denbighshire**, IV. 4; V. 1; VIII. 5; XIII. 1, 4, 14; XVII. 3, 8; XVIII. 1, 3, 4, 5, 15, 16; XIX. 1, 2, 3, 4, 8, 9, 10, 11, 12, 13, 14; XXVI. 2, 3, 4, 6, 7, 8, 10, 11, 13 and 14, 15, 16; XXVII. 13; XXVIII. 6, 10, 12; XXXIII. 3, 4, 8, 12, 16; XXXIV. 5, 9; XXXV. 10; XXXIX. 1, 11, 14; XL. 1, 11, 12; XLI. 15; XLII. 1, 5, 16; XLIII. 8, 16; XLIV. 2, 3, 5, 6, 7, 9, 10, 11, 13, 14, 15; XLV. 4; XLVI. 1. **Glamorganshire**, X. 7, 8; XI. 13; XXVII. 10, 15; XXXV. 1, 2, 3, 5, 6, 9, 14, 15; XLI. 1. **Nottinghamshire**, X. complete, 16 sheets; XI. 1, 5, 9, 13; XV. 2, 9; XVI. 1; XIX. 2, 3, 4, 7, 9, 10, 11, 12, 13, 14, 15, 16. **Oxfordshire**, XIV. 15, 16; XVII. 4; XIX. 4, 7, 8, 11, 12; XX. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 15, 16; XXI. 1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16; XXII. 6, 7, 9, 10, 11, 12, 13, 14, 15, 16; XXIII. 4, 6, 8, 11, 12, 14, 16; XXV. 4; XXVI. 2, 7, 8, 11, 12 XXVII. 1, 2, 3, 4, 5; XXVIII. 4, 8; XXXIII. 11; XXXIX. 4; LV. 12. **Staffordshire**, X. 11; XII. 9; XVII. 1, 9, 12; XIX. 1, 2, 3, 5, 6, 7, 9. **Wiltshire**, II. 15 V. 7, 8, 11; IX. 5, 6, 7, 10, 11; XVII. 9; XXIV. 1, 5, 9, 13, 14. 3*s. each.*

(*E. Stanford, Agent.*)

Germany. **Königl. Preuss. Landes-Aufnahme.**

Karte des Deutschen Reiches. Herausgegeben von der Kartogr. Abtheilung der Königl. Preuss. Landes-Aufnahme, 1899. Scale 1 : 100,000 or 1·6 stat. mile to an inch. Sheets: 306, Burgsteinfurt; 331, Warendorf; 662, Fussen. *Price* 1·50 *marks each sheet.*

Germany. **Langhans.**

Verteilung der landwirtschaftlichen und industriellen Bevölkerung im Deutschen Reiche nach der Berufszählung von 1895. Scale 1 : 5,000,000 or 79 stat. miles to an inch. Paul Langhans. Gotha: Justus Perthes, 1899. *Petermanns Geographische Mitteilungen*, Jahrgang 1899, Tafel 18. *Presented by the Publisher.*

This map, which has been issued by the Buenos Aires and Pacific Railway Company, shows the present state of railway enterprise in Argentina. The lines belonging to the Government and the different railway companies are distinguished by the manner in which they are drawn, and the gauges on which they are constructed are also indicated.

West Indies. **Service géographique de l'Armée.**

Amerique. Scale 1,000,000 or 15·8 stat. miles to an inch. Sheets: Haïti and Porto-Rico. Service géographique de l'Armée, Paris.

GENERAL.

World. **Meyer.**

Meyer's Hand-atlas. Zweite, neubearbeitete und vermehrte Auflage mit 112 Kartenblättern, 9 Textbeilagen und Register aller auf den Karten verzeichneten Namen. Parts 37 and 38 (in one). Leipzig und Wien. Verlag des Bibliographischen Instituts, 1899. *Price 60 pf. each issue.*

CHARTS.

United States Charts. **U.S. Hydrographic Office.**

Pilot Charts of the North Pacific Ocean for December, 1899, and January, 1900, and of the North Atlantic Ocean for December, 1899. Published at the Hydrographic Office, Washington, D.C. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Abyssinia, etc. **Wellby.**

One hundred and sixty-two Photographs taken by Captain M. S. Wellby during his journey through Somaliland, Southern Abyssinia, etc., 1899. *Presented by Captain M. S. Wellby.*

The views and scenes are well chosen, and these photographs form a valuable addition to the Society's collection. The following is a list of the titles:—

(1) British Residency at Zeila; (2) Trees at Hargeisa; (3) Somali Khafila crossing plain near Jig Jigga; (4) Harrar, looking from the west; (5) Arrival of M. Legarde, French representative, at Ras Makonnen's palace at Harrar; (6) Captain Harrington's camp at Kalubi; (7) Raskonnen's soldiers outside Captain Harrington's tent; (8) Ras Makonnen leaving Captain Harrington's tent; (9) Valley of Tyalanko; (10) Ras Makonnen's camp at Shola; (11, 12) Villagers bringing dergo to Ras Makonnen; (13) Captain Harrington's and Ras Makonnen's camp at Tullo; (14) An Abyssinian house at Kuni; (15) Hair-dressing in the British agent's camp; (16) M. Legarde and his doolies crossing the bridge over the Hawash river; (17) My canvas boat on the Hawash river; (18) Loading up by the Hawash river; (19) Captain Harrington's mid-day halt at Dobi; (20) Captain Harrington on his road to Addis Abbaba; (21) St. George's church at Addis Abbaba; (22, 22A, B) King Menelik's camp on his way to Tigre; (23) King Menelik's artillery firing a salute in honour of receiving the Queen's message through phonograph; (24, 25) The Russian representative, M. Vlassof and his escort; (26A) The French representative, M. Legarde; (27) Queen Taitu's advanced guard approaching King Menelik's camp; (28) Queen Taitu and her lady attendants on the march; (29) Queen Taitu's rear-guard; (30, 31) King Menelik's camp; (32) McKelvey, family and home; (33) Market day at Addis Abbaba; (34) Horse market at Addis Abbaba; (35) Abyssinians partaking of their favourite food, raw meat; (36) Church of St. Raguel at Entoto; (37) H. B. M.'s agent, Captain Harrington and his escort; (38) Captain Harrington's camp at Addis Abbaba; (39) Madame Vlassof's Cossack orderly; (40) Curagunas building British agency at Addis Abbaba; (41) King Menelik's palace; (42) The ardarash or reception hall in process of construction; (43) Residency of M. Legarde; (44) Shahzad Mir and his pony; (45) My dog "Lady;" (46) The Russian residency at Addis Abbaba, showing M. Legarde and M. and Madame Vlassof; (47, 48) Market day at Walamo; (49) View of Walamo valley north of Damota hill; (50) House at Walamo; (51) Paying Walamo natives for supplies; (52) Shawm-players of Galla chief of Baroda; (53) View of Lake Abai; (54) Post of Fitarawri Imani in Gamo; (55) My camp in Gamo; (56) Fitarawri (General) pays me a visit; (57) My men saluting Fitarawri Imani; (58) A house in Gamo; (59) My caravan descending hill in Gamo; (60) Lake Tukurabai; (61) Hills of Gamo; (62) Fitarawri Degafi

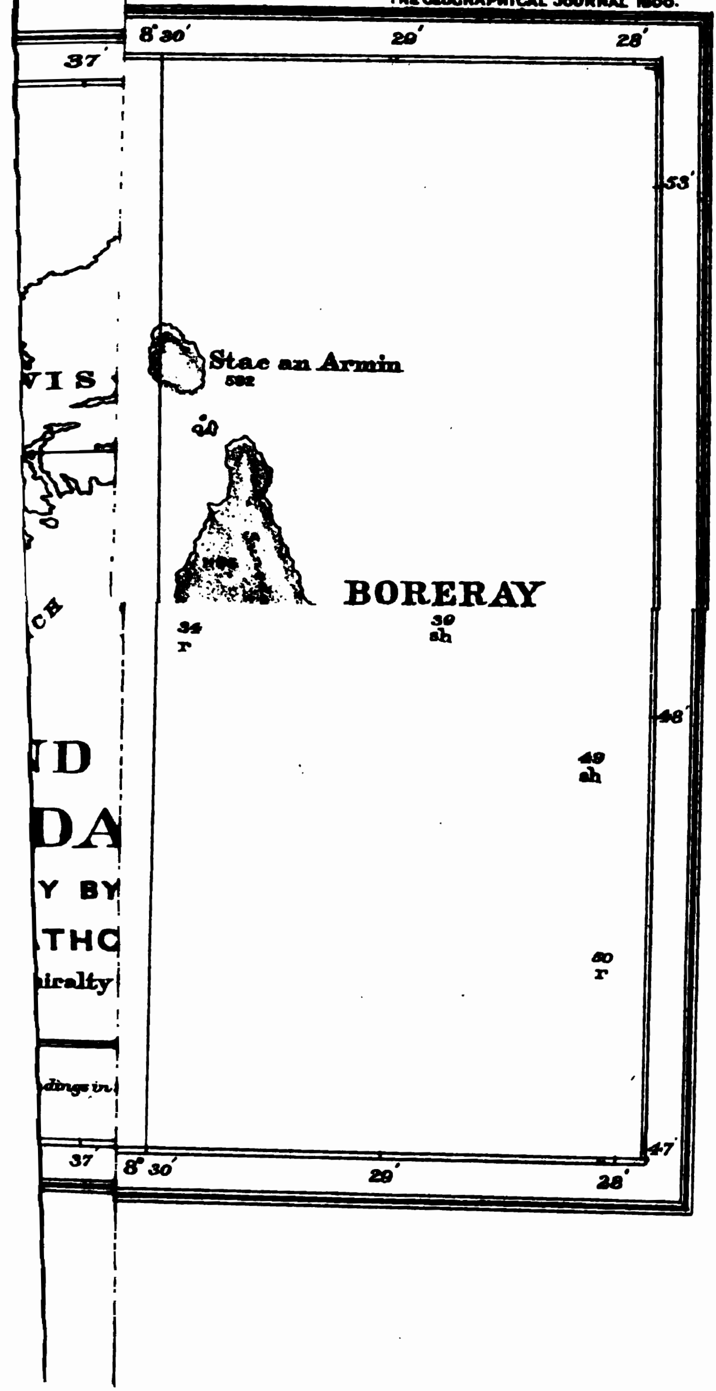
pays me a visit; (63, 64) Hills of Gamo; (65) Katama of Fitarawri Degafi; (66) Lake towards the north; (67) Hill called Algvodi; (68) Valley looking south-west from camp; (69) Glimpse of south end of camp; (70) Camp and distant hills; (71) South end of lake; (72) View of lake; (73) Caravan crossing shallow river; (74) View of a bit of Stefani with corner of Hammer Koki from the north; (75, 76) View of Rudolf shore and waves; (77–79) Elephants; (80) Shore of Lake Rudolf; (81) View of bay; (82) Oryx; (83) View of bay; (84) Herd of Oryx; (85) Rhinoceros with young one; (86) Rhinoceros youngster; (87) My "Lady" to the rescue retrieving duck; (88) Gallopa natives; (89) Natives of Gallopa who refused to leave me; (90, 91) View across Lake Rudolf; (92) View with bird of prey; (93) Dome palms, across lake; (94) Curious hills; (95) Remarkable accumulation of camel-bones, Lake Rudolf; (96) Some of our cattle loaded; (97) Top of pass before meeting Turkana; (98) Turkana giant points out country to Shazad Mir; (99) Two Turkana men; (100) Members of the Abba tribe; (101) Members of the Loka tribe; (102) We find water below river-bed; (103) Kaisuki; (104) Stream with bamboos and Boma guides; (105) View across valley to the east; (106) My Morelli guide; (107) Difficult crossing; (108) Boat crossing Ruzi; (109, 110) Donkeys crossing; (111–113) Camels crossing; (114) Village of Nyuro; (115) Crossing the other animals; (116–118) Crossing another river; (119) Junction of the Ruzi and other river; (120) Shilluk village; (121, 122) Camels being pulled across river; (123) Bringing rope back; (124) Lifting camel into the river; (125) Birds of prey in plain; (126) Pulling donkeys across river; (127) Nuers; (128, 129) Our native boat on the Sobat; (130) Nyuak village; (131) Loading up after crossing stream; (132) Dinka village; (133) Dinka men fishing; (134) Sheikhs Munyan and Shilluks; (135, 136) Crossing last river; (137) A Shilluk boat; (138) Group of Shilluks; (139) Fort Sobat; (140) H.M.S. *Fokh* with Captain Escomb, R.N.; (141) Fashoda fort; (142) Shiek Dugl's camp; (143) Gebelain hills; (144) Bringing wood by boat; (145) Mahomed Hassan, my Somali boy; (146) Nuers and Nyuaks; (147) Dervish fort; (148) Gorge above Wad Hamed Nile; (149) Nile; (150) Palace at Khartum; (151) The Atbara bridge; (152) Resident's house at Atbara; (153) Native craft, Nile; (154) Sirdar's house at Omdurman; (155, 156) Colonel Lewis's pony; (157) Colonel Lewis; (158) Sudanese regiment; (159) Farewell to Omdurman; (160) My dog at Suez; (161) Shahzad Mir at Suez; (162) Last of my dogs at Alexandria.

Angola. **Moraes and Ferreira.**

Thirty-eight Photographs of St. Paul de Loanda, Angola Railway, and surrounding country, by J. Moraes and J. A. M. Ferreira, St. Paul de Loanda, 1898–99.

(1, 2) "English House" stores, Loanda; (3) Office of the "English House," Loanda; (4) Loanda Coaling Company's stores, on island facing Loanda; (5) Loanda Coaling Company's stores and pier; (6) Empreja Nacional (Portuguese Steamship Co.) coaling depôt; (7) Loanda city; (8) Civil and military hospital, Loanda; (9) Bull ring, Loanda; (10) Penedo fortress, entering Loanda harbour; (11) Harbour master's office and stores, Loanda; (12) Governor-General's palace, Loanda; (13) Main street of Loanda; (14) Novo Redondo, Angola; (15) River Bengo, Cabiri, Angola; (16) Royal Trans-African Railway: Loanda station; (17) Public Works, Loanda; (18) Upper city, Loanda; (19) Government offices, Loanda; (20) Stores and terminus of the Royal Trans-African Railway, Loanda; (21) Fortress of S. Michael commanding Loanda harbour; (22) Public gardens, Loanda; (23) Loanda Gas Company's works; (24) Barracks of the 2nd Rifles (Ultramarine), Loanda; (25) Naval station and headquarters, South Atlantic Division, on the island facing Loanda; (26) Royal Trans-African Railway: upper city station, Loanda; (27) Royal Trans-African Railway: Zenza station; (28) Statue of Salvador Correia; (29) Loanda observatory; (30) Church of "Our Lady" on the island in front of Loanda; (31) Sé Cathedral, Loanda; (32) Island in front of Loanda, showing Loanda Coaling Company's store; (33) Praca de D. Pedro V., Loanda; (34, 35) Loanda Coaling Company's depôt, Nazareth, Loanda; (36) The "English House," Loanda; (37, 38) Coffee and cane plantation, Monte Bello, Casengo, Angola.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.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The

Geographical Journal.

No. 3. MARCH, 1900. Vol. XV.

A FRAGMENT OF THE GEOGRAPHY OF ENGLAND.

SOUTH WEST SUSSEX.*

By HUGH ROBERT MILL, D.Sc., F.R.S.E.

Introductory.—In 1896 I proposed a scheme for a geographical description of the United Kingdom, based on the maps of the Ordnance Survey, and consisting of a separate memoir for every sheet of the map on the scale of 1 inch to a mile.† I was requested by the Royal Geographical Society to prepare a specimen memoir, and, by the advice of Sir John Farquharson, then Director-General of the Ordnance Survey, chose Sheet No. 317 of the new one-inch map of England as a fairly typical example. In order to complete the strip of coastal plain in this sheet to the sea, No. 332 was also considered, these two being, in fact, united in the special edition of the map printed in colours. The original proposal was to discuss and arrange the facts recorded by the various Government Survey and Statistical Departments, so as to bring out the regional distribution of all obtainable data regarding the country, and to indicate the influence of the forms of the land-surface upon that distribution. It was proposed to supplement the data already existing in a published form by obtaining new information, or even by making special investigations on the spot. Each memoir was to be comprehensive, authoritative, and brief, and every group of memoirs when completed for a natural region was to be summarized, so as to give a general description of the whole, and ultimately combined and condensed to form a handbook of the geography of the British islands as a whole. The question of the staff required for the production of the memoirs was not dealt with. The

* Read at the Royal Geographical Society, February 5, 1900.

† *Geographical Journal*, vol. vii. (1896), p. 345.

attempt to fill up the skeleton-plan of a memoir according to the original design has naturally brought various practical difficulties into relief, and the work done upon it, being merely an incident in other work of greater immediate urgency, is neither so complete nor so satisfactory as it ought to be. However, it has shown that the execution of the scheme is possible, and I believe that the following specimen memoir will allow the desirability of carrying out the original suggestion to be fairly considered, and decided upon one way or the other.

The treatment of maps and the study of the district on the spot is easy, and need not be further referred to: but the treatment of unmapped statistics is extremely laborious, and in the following memoir very incomplete. For instance, with regard to most statistics, the mean of a series of years should be worked out; but I have been able only to take the figures of a single year as a specimen. So also I have been unable to obtain the highest accuracy possible in the measurements on the maps, from want of time to repeat the work according to different methods. On this subject, however, a special report has been made.

If the importance of cartographical representation could be brought home to the various government statistical departments, it would lead to an immense increase in the value of their work, and enormously facilitate reference to it. If the census returns, the agricultural returns, and the Registrar-General's reports, to take a few examples, were mapped even on the scale of 10 miles to an inch, the conditions and resources of the country could readily become known to any student; as things are it would require a lifetime to obtain correct ideas of the general condition of the country in any one particular.

Two important matters on which stress was laid in the original plan have had to be almost ignored. One is the distribution of disease and causes of death, for which ample data exist; the other is the treatment of historical and archæological subjects. These are so important, the number of persons interested in them is relatively so large, and the literature is so extensive, that I fear they must be treated separately. Only the largest features and the most generally accepted facts can be included in a short summary.

While presenting this work, I have to acknowledge the greatest possible help from several Government departments and individuals, amongst whom it is a pleasure to mention and to thank Colonel Sir John Farquharson and Colonel D. A. Johnston, the successive Directors-General of the Ordnance Survey; Sir Archibald Geikie, Director-General of the Geological Survey and the staff of the office in Jermyn Street, especially Messrs. Clement Reid and Lamplugh; Major Craigie, of the Board of Agriculture; Mr. G. J. Symons, for his rainfall statistics; Mr. B. V. Darbishire, for help with measuring areas on the contoured maps; and Mr. J. Vincent Elsden, Storrington, for the use of his excellent photographs.

I may add that the plan of carrying on the work suggested in 1896 still appears to be sound, and the practical experiment has confirmed my belief in its importance and its practicability. As to its ultimate object, it may be allowable to quote from the earlier paper:—

"In my opinion the important practical point is that, in the prospect of increasing agricultural depression, and in prevision of the certainty of the ultimate recovery in the value of land in the British Islands when the fields of America, Russia, and India cease to yield a paying return at low prices, it is absolutely essential to have a trustworthy account of the actual conditions and resources of our own country. The account would in some degree correspond to Sir John Sinclair's 'Statistical Account of Scotland' of a century ago; but would, of course, have the advantage of a more systematic plan and far more numerous and more exact data. It will not be so very many decades before waterfalls will rival coal-mines in industrial value, and the tidal bore in an estuary will determine a centre of dense population. The study of the country in the light of scientific geography will then be a vital necessity, and it is our duty as geographers to see that we hand on our science as an efficient implement for the needs of a later age.

"I have little doubt that in the coming century the generalizations of geography will find a multiplicity of applications in economic, political, and social life, which will be of the utmost national importance. Even now we recognize instances, economic, political, and social, where ignorance or neglect of geographical principles has led to results which may fairly be called national misfortunes. I feel sure that some such scheme as that set forth in this paper will provide in its elaboration the means for greatly advancing geography and perfecting its theory; and on its completion will form a mass of geographical information which will retain a permanent value."

Memoir to Sheets 317 and 332.

Position.—Taking the position to the nearest minute of latitude, the region covered by Sheets 317 and 332 of the Ordnance Survey 1 : 63,360 map (1 mile to 1 inch) extends from 51° to 50° 43′ N., and from 0° 26′ to 0° 50′ W. The central parallel is 50° 51′, a position corresponding to a longest day of 16 hours 26 min. and a shortest day of 7 hours 52 min. The length of a degree of longitude on this parallel is 43·714, and that of a degree of latitude 69·126 statute miles. The northern slope of the Downs is the only part of the district which is turned away from the direct rays of the sun.

Configuration.—The area covered by Sheets 317 and 332 includes three sharply contrasted natural regions, the dividing lines of which run east and west: (1) the plain or flat valley through which the river West Rother flows eastward to the Arun, on the north; (2) the elevated land of the South Downs; and (3) the coastal plain. The two plains are united by the gorge of the Arun, which cuts across the line of the Downs from north to south; and further west there is an easy pass across the Downs leading from Cocking to Chichester formed by two valleys. These depressions cut the ridge of hills into three distinct parts. The general features are brought out by the sketch-map, Fig. 6.

The mean altitude of the land is 150 feet above sea-level, for an area of 270 square miles. The mean depth of the sea below low-tide level is 46 feet for an area of 162 square miles. The areas of land lying between given limits of height, and of water lying between given limits of depth, are in square miles, acres, and percentage of the whole area of land or sea respectively:—

TABLE I.—AREAS OF LAND AT DIFFERENT ELEVATIONS.

Elevation.	Square miles.	Acres.	Per cent. of land.
Above 800 feet	0·05	32	0·02
700–800 "	1·7	1,088	0·63
600–700 "	4·25	2,720	1·50
500–600 "	9·5	6,080	3·52
400–500 "	15·5	9,920	5·73
300–400 "	20·0	12,800	7·40
200–300 "	9·0	5,760	3·33
100–200 "	66·0	42,240	24·44
50–100 "	43·0	27,520	16·03
0–50 "	101·0	64,640	37·40
Total	270·0	172,800	100·00

TABLE II.—AREAS OF SEA AT DIFFERENT DEPTHS.

Depth.	Square miles.	Per cent. of sea.
Beach covered at high water ...	5·0	3·09
Low-tide mark to 25 feet	32·0	19·75
" 25–50 "	61·0	37·66
" 50–75 "	42·5	26·23
" 75–100 "	20·0	12·34
Over 100 "	1·5	0·93
Total	162·0	100·00

These tables show that, while there are 101 square miles of land along the coast less than 50 feet above sea-level, there are 98 square miles of sea along the coast with a less depth than 50 feet. When the small area of land below 50 feet north of the Downs is deducted, there appears to be just as much land as there is sea-bed within 50 feet of sea-level. More than three-quarters of the land lies at less elevations than 200 feet. It is to be particularly noticed that there is a smaller area of land between 200 and 300 feet than in any other hundred feet interval of height until 600 feet is reached.

The contour-line of 50 feet, which forms the upper limit of the land below 50 feet in elevation, runs nearly from west to east across the southern part of Sheet 317 (Sheet 332 having no land at so high a level); but at the place where the Arun crosses the South Downs, the contour line runs northward, bounding the low land on each side of the river. The land below 50 feet is thus divided into the *coastal plain*, entirely south of lat. 50° 51′ and the *river plain*, which has a less regular form and much smaller area. The surface of the river plain is entirely covered with alluvium deposited by the stream in its meanderings. The coastal plain is mainly composed of Tertiary strata like those of the London basin, consisting of various sands and clays, although Chalk occurs in the east; but the whole is covered for the most part with drift composed of later gravels and brick-earth. Above the level of 50 feet these formations thin away rapidly, until about the elevation of 150 feet the solid Chalk of the South Downs appears at the surface. The Downs are composed entirely of Chalk, but the valleys which penetrate them from the south are carpeted with valley gravels. From the coastal plain the land rises comparatively gently (with a mean gradient above 300 feet of about 1 in 17) to the nearly flat summit; but towards the north the slope is much more abrupt (averaging, down to 300 feet, 1 in 3), plunging down to the plain of the Rother. This steep slope stops at an elevation of about 300 feet (near the transverse valley of the Arun not until a lower level), and here the Chalk ends, and the Rother valley is composed of a narrow terrace of the Upper Greensand, which at

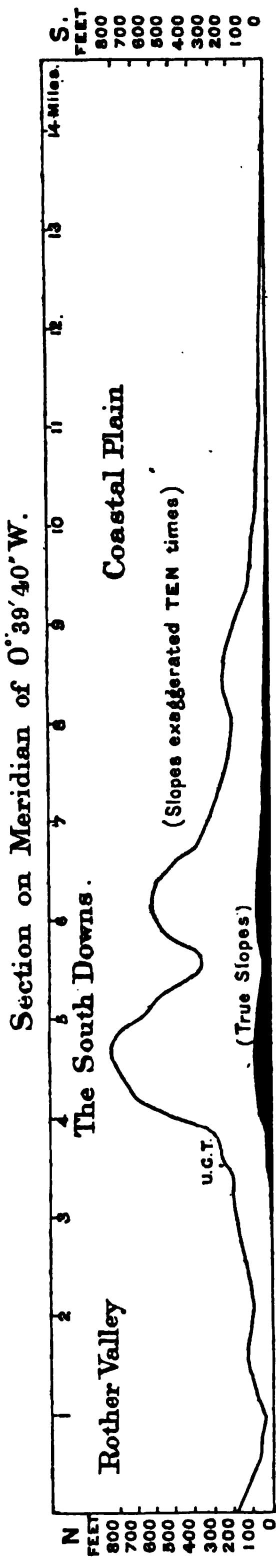

FIG. 1.—SECTION ACROSS DISTRICT FROM NORTH TO SOUTH—THE BLACK PORTION SHOWS TRUE SLOPES.

200 feet stops abruptly and gives place to wide parallel belts of Gault clay and various strata of the Lower Greensand, each successive belt emerging from under the foregoing. The surface is broken and irregular in contrast to the smoothness of the coastal plain and the rounded forms of the Downs, and after sinking to the level of 50 feet or under in the river bed, it rises again to the north to heights of over 400 feet, the harder Weald Clay with included Horsham stone occupying the north-

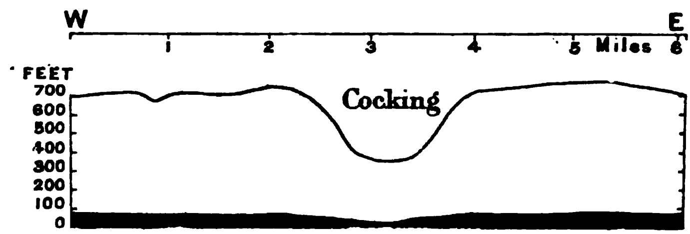

FIG. 2.—SECTION ALONG RIDGE OF DOWNS ACROSS COCKING PASS.

eastern corner of the sheet. The sketch-map, Fig. 7, shows the main geological divisions. Fig. 1 shows the profile of the country from north to south both on a true scale and with the vertical scale exaggerated ten times. Figs. 2 and 3 show sections along the crest of the Downs across the valleys. Fig. 2 is a typical geological section along the same line as Fig. 1, showing how the successive beds crop out, and how the abrupt escarpment of the Chalk Downs facing the north is formed by the weathering away of the steep edge of the gently sloping stratum, the smooth and only slightly undulated outline of the slope contrasting with the deep valleys and long spurs which diversify the gentler declivity to the south.

The areas of the different geological formations, and the percentage they cover of the whole area of the land included in the sheets, are given below:—

TABLE III.—AREA OF GEOLOGICAL FORMATIONS.

Formation.	Area, square miles.	Area, acres.	Percentage of area.
Alluvium	22	14,080	8·1
Tertiaries and drift	92	58,880	34·1
Chalk	79	50,560	29·3
Upper Greensand	7	4,480	2·6
Gault	15	9,600	5·5
Lower Greensands	48	30,720	17·8
Weald Clay...	7	4,480	2·6
Total	270	172,800	100·0

This table shows the preponderance of soil formed from drift and

Tertiary sands or clays like those of the London basin, and the insignificant area of the Upper Greensand which, as will be shown presently, plays a very remarkable part in determining the distribution of the population north of the Chalk escarpment.

The Coastal Plain.—The declivity of the Downs on the southern side, although broken by valleys and spurs, becomes increasingly gradual as the Chalk dips below the overlying Tertiary formations,

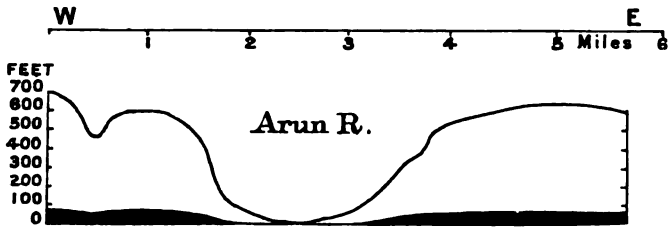

FIG. 3.—SECTION ALONG RIDGE OF DOWNS ACROSS ARUN GORGE.

FIG. 4.—GEOLOGICAL SECTION FROM NORTH TO SOUTH.
(SHOWING STRATA OUT OF WHICH THE SCENERY IS CARVED).

i.e. from 300 feet down to 50 feet. Below this level the slope is very slight indeed, the actual coast-line being formed for the most part by beds of clay, mounds of shingle, or drifted sand from 10 to 25 feet high. Inland, however, there are several considerable depressions. The gravel ridge at Selsey Bill, which forms the site of Selsey, is cut off from the mainland by a narrow marshy depression in part below sea-level, through which a little channel practically unites the sea at Pagham with the sea at Bracklesham Bay. Formerly this was a broad tidal marsh difficult to cross, emphasizing the isolation of the peninsula of Selsey. The bed of the disused Chichester and Arundel canal runs west and east from the tidal Chichester channel to the Arun river at an elevation of about 20 feet, somewhat higher land occurring to the south. The clays of the Tertiary formations and the overlying drift form excellent soil and are highly cultivated, while the lowlying marsh lands yield pasture. Throughout the whole coastal plain the underlying Chalk has been reached in borings for wells, in some places more than 300 feet below the surface. East of the Arun the Chalk is covered with drift only, and comes to the surface at several places. The Chalk foundations of the coastal plain have been formed by the erosion of somewhat disturbed strata, and the drift laid down upon them by the action of sea-ice coming from the south.*

The coast-line formed by a gravel beach, above which a low clay cliff rises at some places, is undergoing great erosion. Off Selsey Bill a line of banks covered by less than 25 feet of water, traces out an earlier coast-line running parallel to the present shore and about 5 miles distant from it. Along the coast to the eastward the depth of 25 feet is reached everywhere within $1\frac{1}{4}$ mile of the low-water line. Below the shingle slope a broad beach of fine sand is laid bare at low water, the tide retiring for a mile or more at some points.

Historical evidence of the submergence of the old cathedral of Selsey amply confirms the deductions as to erosion which may be drawn from the map, and the rate at which the coast is now being eaten back is estimated at from 6 to 8 feet per annum opposite Bracklesham Farm, and from 10 to 13 feet opposite Cockham Manor Farm.† At Pagham the old tidal harbour of 750 acres in extent was reclaimed in 1875–77, the sea being kept out by the great accumulation of shingle, and the land-water allowed to escape by a sluice.

The tides along the coast rise $16\frac{1}{2}$ feet at springs and $12\frac{1}{2}$ feet at neaps. An exceptionally high tide, especially if a strong south-westerly wind is also blowing, is apt to wash away the shingle beach and leave the land behind exposed to inundation. Between the embanked promenade at Bognor and the sandhills at the mouth of the Arun there are several places where the land is below high-tide level, and artificial banks have been built to keep the sea from the fields. At Felpham and Middleton much damage has been done by storms, the old churchyard of the latter parish having been washed away. The parish of Climping, at the mouth of the Arun, west of the river, includes about 80 acres, formerly part of the old parish of Cudlawe, or Cudlow, the greater part of which has been washed away, the site of the parish church being now occupied by 2 fathoms of water.‡

Along almost the whole shore included in the sheet, groynes of timber, or even of solid masonry and cement, have been erected at close intervals, running down the beach at right angles to high-water mark. Their object is to prevent the shingle and sand from being washed along the shore from west to east, and to cause accumulations against the weather side of the obstructions and so to pile up a defensive wall. The number of old groynes to be seen almost buried in the sand, shows that this method of combating the loss of land by erosion is a sound one (see photograph, Fig. 5).

The streams of the coastal plain are small and indefinite. River-

* 'Memoir on Sheet 332 of the Geological Survey,' by Clement Reid.

† Report on Coast Erosion. 'British Association Reports,' 1895, p. 374.

‡ Kelly's 'Directory of Sussex.' 1899.

FIG. 5.—THE BEACH AT LITTLEHAMPTON, SHOWING GROYNES.
(From a photograph by Frith and Co., Reigate.)

action produces no change or indentation in the coast-line. The Arun is the one important river in the area, and it flows into the sea directly, without an estuary. The width between the western breakwater and the low eastern wall which define its mouth is 120 feet. At low water there is a depth of only 2 feet of water all across the river at some places in Littlehampton, but above the town a depth of from 4 to 5 feet is found as far as Arundel. At high-water springs the depth at Littlehampton is 17 feet, and at Arundel from 15 to 16 feet; the rise at Arundel being 10 feet at springs and 7 feet at neaps. The river is embanked against floods on both sides all the way from Littlehampton to Arundel.

*Dangers to Navigation off the Coast.**—The 5-fathom line south of Selsey Bill runs 3½ miles from the shore, with no channel deeper than 3¼ fathoms within it. The dangers to navigation, known by the general name of the "Owers," are defined by a line of narrow shoals running due south from Medmerry Farm for 3½ miles, known as the Streets, the Brake or Cross Ledge, and the Boulder bank. These have less than 2 feet of water over them at ordinary low water of spring tide. A reef of rock, the Mixon, marked by a beacon, lies one mile south of Selsey Bill, and at low water of spring tides it is connected with the shore and with the Streets by dry sand, although a large pool of water over 2 fathoms deep and three-quarters of a mile in diameter is enclosed opposite the road at Selsey beach.

The Pullar bank runs east from the Boulder bank, and is continued by the Middle Ground, forming a series of shoals extending 4 miles to the eastward, and coming to within 2 feet of the surface in places at low water. A channel, the Swash or Swashway, leads through between the Middle Ground and the group of shallow banks lying farther east, known as West Head, East Borough Head, and the Outer Owers. The Outer Owers falls off abruptly into deep water, especially at the Elbow, its southern point, and the Owers lightship is anchored 1½ mile south of the shallowest part in 18 fathoms. Between the line of shoals from the Boulder to the Owers and the edge of low water at the Mixon, there is a stretch of water over 4 fathoms, and in places over 6 fathoms deep, the western part of which is called the Looe Stream, which leads with a very narrow channel between the Boulder and the Street shoals. In the east the Looe Stream merges into the Park, the area of water between 4 and 8 fathoms deep in Pagham bay forming the anchorage east of Selsey and south of Bognor. It is a fine anchorage ground, being composed of stiff clay under a thin layer of gravel, but it is dangerous in southerly or easterly winds. Both the Swashway and the Looe Stream are dangerous channels, on account of the tidal streams and the absence of clear leading marks for navigation. Chichester cathedral

* From the Admiralty Chart and 'Sailing Directions.'

spire and the little churches and large windmills on the coast are almost the only marks which exist. The regular course for vessels navigating the English Channel passes about 4 miles south of the Owers lightship, and does not come within $8\frac{1}{2}$ miles of land in any part of the coast included in the sheet, the general rule laid down in the 'Sailing Directions' being to keep to seaward of the 10-fathom line. Hence only the distant topmasts of the Channel shipping can be seen by an observer on the shore.

The contrast between the three headlands of Selsey Bill, Beachy Head, and Dungeness, which look not dissimilar on a political map of England, is remarkable: the Tertiary clays and sands eaten away to form Selsey Bill shoal the sea for miles; the lofty chalk cliff of Beachy Head has been cut back, leaving deep water in the sea; while the gravel banks of Dungeness have been built out by the action of the currents until they have reached deep water, and the largest vessels can come close up to the shore.

The South Downs.—Measured between the contour-lines of 300 feet on the north and south, the South Downs form a great sheet of Chalk 4 miles wide in the western half, 3 miles wide in the eastern, and stretching east and west across the whole breadth of the sheet. The geological section (Fig. 4) distinguishes between the steep and uniform escarpment facing the north and the long dip-slope emerging from its covering of Tertiary deposits which faces the south. The uniform northern slope, which presents a bold and almost mountainous aspect when viewed from the plain, trends from the west slightly south of east as far as Barlavington, where it turns at right angles and runs south nearly 2 miles to Cold Harbour Farm, the steep slope facing eastward, and there it turns again at right angles and runs east by south to the edge of the sheet. This rectangular intrusion of the plain into the Downs may be called, for convenience, the Bignor embayment. A similar abrupt turn to the north occurs 24 miles farther east, and the structure is probably to be explained by a fold in the strata. The three parts into which the portion of the Downs included in this sheet is divided by north and south valleys are all deeply carved into valleys and combes, between which rise broad rounded summits, characteristically capped with trees. In all three parts the culminating altitudes form a nearly level undulating strip of land immediately overlooking the northern escarpment. In all, also, there is the absence of running water characteristic of the Chalk. There are neither streams nor springs, and during rain the porous soil rapidly soaks up the moisture. The origin of the dry Chalk valleys is ascribed by Mr. Clement Reid to the end of the Glacial Period, when the whole mass of the Chalk was frozen into hard and impervious rock in which the torrents resulting from the melting of the higher snow cut out the valleys.

The valley of the Lavant on the west, if we define it by the 300-foot contour-line, carries its head within a mile of the plain to the north, and forms a natural line of communication between south and north. The portion of the Downs to the west included in the sheet is hollowed on its southward slope into a series of long valleys converging southward on that of the Lavant.

The central portion of the Downs, between the valley of the Lavant and the flat-bottomed trench which the Arun has cut across the Chalk, measures 9 miles in length. It contains in Duncton Down the highest point (837 feet) in this sheet, and within 20 feet of the culminating point of the South Downs. No large valley runs eastward from the Downs to the trench of the Arun, but a very remarkable dry valley (which may be called the Dean valley) runs westward, commencing at an elevation of 420 feet, under the shadow of Duncton Down, and running for 5 miles until it enters the Lavant valley at an elevation of 200 feet. A tongue of drift from the coastal plain runs up this valley for a considerable distance, carrying a strip of fertile ground into the very heart of the Chalk country. To the south the Dean valley is bordered by a fairly uniform ridge of down (500 to 750 feet high), from which only short valleys descend to it; but from the north it receives longer and deeper lateral valleys. The southern ridge is itself deeply cut into broad south-sloping valleys, or combes, separated by bold ridges. The southern extremities of these ridges occasionally form small isolated hills, and the southern slope, as a whole, is the most varied and picturesque of the Chalk scenery. The covering of soil over the greater part of the Downs is so thin that when the turf is cut the white Chalk gleams through, and on the unfenced uplands the boundaries between the pasturage of neighbouring farms is marked by cutting a shallow trench into the Chalk.

The eastern portion of the Downs included in the sheet forms nearly half of the block of heights, measuring 9 miles in length, which lies between the deep-cut valleys of the Arun and the Adur. It is in every way similar to the other portions; steep and uniform to the north, where it rises over the plain, and cut into long valleys, ridges, and nearly isolated rounded hills on the south.

The Rother-Arun Valley.—The portion of the broad valley lying north of the South Downs which falls within this sheet belongs almost entirely to the drainage area of the Arun. The eastern edge of the sheet coincides almost exactly with the watershed between the Arun and the Adur, about 2 miles of one upper tributary and 1 mile of another flowing eastward being alone included.

The geological structure is very simple, consisting of the outcrops of the gently dipping strata appearing one from beneath the other as one goes from south to north, and forming a series of belts, running on the whole from west by north to east by south, parallel to the strike of the Chalk escarpment. Close at the base of the escarpment the Upper

Greensand forms a sort of terrace between the altitudes of 300 and 200 feet in the west, where at Elsted it is a mile wide, but gradually diminishing in breadth to less than a quarter of a mile at Graffham, where the Chalk begins to descend lower, and the level of the Upper Greensand sinks to between 200 and 100 feet, and expands to a mile in width, corresponding to its diminished slope, in the Bignor embayment. Where it emerges from under the Arun alluvium the Upper Greensand terrace on the eastern block of the Downs is from a half to a quarter of a mile wide, and gradually rises eastward from 50 to 250 feet in average elevation. This Greensand terrace forms everywhere a porous sandy soil, in which water is readily found by sinking wells, as it is prevented from percolating away by the impervious stratum of Gault clay which underlies it. At the outcrop of the Upper Greensand along the northern edge of the Chalk escarpment there is a row of natural springs formed by the escape of the water which has percolated through the porous strata of the Chalk. A number of small streams accordingly take their rise on the Upper Greensand terrace, and flow out over the clay and Lower Greensand, the whole valley being richly supplied with clear running brooks, in contrast to the sluggish ditches of the coastal plain and the waterless stretches of the Downs. The belt of Gault averages a mile in width on the west of the Arun, except in the Bignor embayment, where the general lowering of the surface has exposed it to a much greater extent; but along the eastern block of the Downs it is less than half a mile wide.

The centre of the valley and the northern slope is occupied by various beds of the Lower Greensands, which in the north reach elevations of 400 feet, and are deeply carved into picturesque hills and dales. The Folkestone beds, which come out from under the Gault, form a soil so unproductive that the belt forms an almost unbroken succession of commons, warrens, and parks between the cultivated lands of the Gault on the south and those of the Sandgate and Hythe beds on the north, through which the river flows.

In the north-eastern corner of the sheet the Lower Greensands form a distinct escarpment, though not so high nor so sharply defined as that of the Chalk, overlooking the Weald Clay, which comes up from beneath them. This is part of the great curved escarpment, bounding the central Weald, of which Hindhead and Leith Hill are the most prominent features on the west and north of the curve. The crest of the southern part of the Lower Greensand escarpment runs just to the north of the district shown in Sheet 317.

Speaking generally, the Rother valley slopes downwards gently to the east, at an average gradient of 1 in 700, as far as the Arun; while east of the Arun a short and relatively steep slope to the west, averaging 1 in 132, leads down to the river from its watershed with the Adur.

The Rivers and Streams of the District.—The area of the standing and

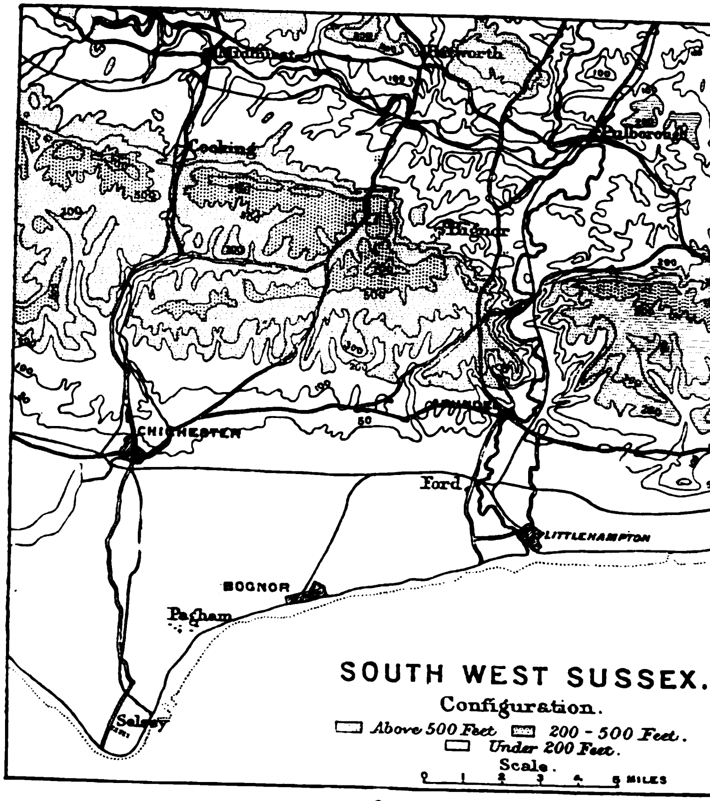
Petworth
Pulborough
Cocking
Bignor
CHICHESTER
Ford
LITTLEHAMPTON
BOGNOR
Pagham
Selsey
SOUTH WEST SUSSEX.
Configuration.
Above 500 Feet
200 - 500 Feet.
Under 200 Feet.
Scale.
0 1 2 3 4 5 MILES

FIG. 6.


Midhurst
Petworth
Pulborough
Cocking
Bignor
ARUNDEL
CHICHESTER
Ford
LITTLEHAMPTON
BOGNOR
Pagham
Selsey
SOUTH WEST SUSSEX.
Geology.
Alluvium
Drift and
Tertiaries
Chalk
U. Greensand
Gault
L. Greensand
Wealden
Scale.
0 1 2 3 4 5 MILES.

FIG. 7.


Midhurst
Petworth
Pulborough
Cocking
Bignor
ARUNDEL
CHICHESTER
Ford
LITTLEHAMPTON
BOGNOR
Pagham
Selsey
SOUTH WEST SUSSEX.
Rainfall.
25 - 30 inches
30 - 35 "
35 - 40 "
0 1 2 3 4 5 MILES

FIG. 8.

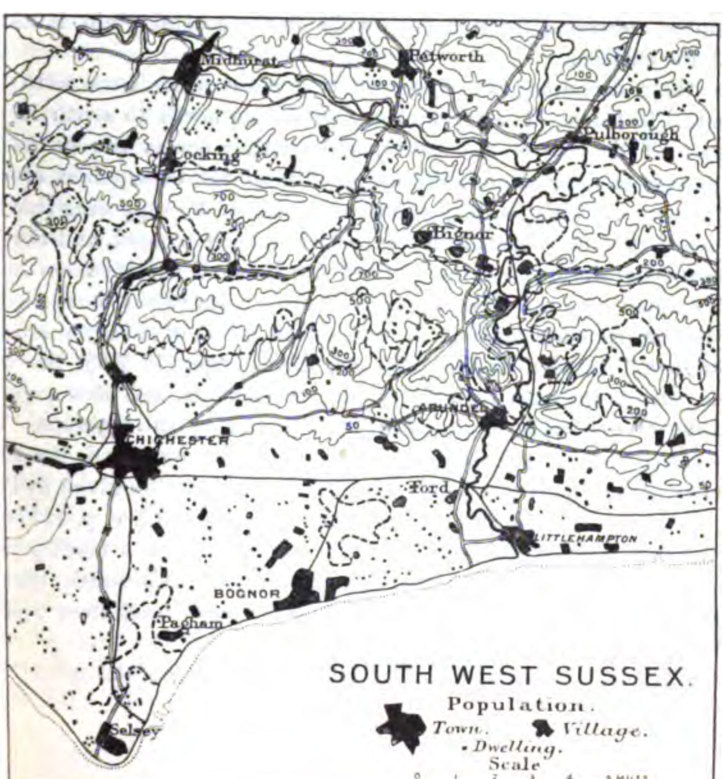
Midhurst
Petworth
Pulborough
Cocking
Bignor
ARUNDEL
CHICHESTER
Ford
LITTLEHAMPTON
BOGNOR
Pagham
Selsey
SOUTH WEST SUSSEX.
Population.
Town. Village.
Dwelling.
Scale
0 1 2 3 4 5 MILES

FIG. 9.

running water represented on the land of the two sheets is estimated approximately at 414 acres, or about two-thirds of a square mile, forming 0·25 per cent. of the land. There are no lakes, only a few artificial ponds in the parks or at the villages, and the only river of any importance is the Arun, a typical river of the Weald.

The valleys of the Downs are typically waterless. The Tertiary and Drift deposits which cover the Chalk in the Lavant valley allow of the formation of a small stream, the Lavant, which flows towards the estuary of Chichester Channel in wet weather, but is reduced to a chain of pools in drought.* Chichester Channel is remarkable as a narrow tidal estuary which, while bearing every resemblance to the mouth of a large river, receives no river at all at the present day.

The streams rising on the Tertiary and Drift deposits which clothe the southern slopes of the Downs are mere brooks of a few miles in length, with ill-defined courses, often connected one with another by ditches cut in lines from east to west to drain the land, and flowing sluggishly across the flat plain to the sea.

The Arun and its tributaries drain an area of 112 square miles on the sheets under consideration, if the watershed be drawn along the crest of the northern ridge of the Downs, and round the source of each of the small tributaries coming in from the southern slopes. This will, however, include a greater area than actually drains to the river, as most of the rain falling on the Chalk slopes percolates into the mass of rock, and, unless recovered through deep wells on the coastal plain, is lost to use on the surface.

In their direction the rivers show a close accordance with the geological features. The main stream runs from north to south in the direction of the dip of the strata, and cutting across the successive escarpments at right angles, the steep cliffs of the escarpment always look up-stream. This might possibly be explained by supposing that the river began to flow before the lower rocks had been exposed, and that its course was determined by the original dip-slope of the Wealden dome. On this hypothesis the river was able to deepen its valley more rapidly than the escarpments could be formed by the action of subaerial erosion.

But it will be seen that the Rother, which comes in from the west to join the Arun, runs parallel to the escarpments, and this suggests that that stream has been guided in its direction by the outcrops. The fact that the long tributary comes in from the west and the short tributaries from the east is noticeable, and the explanation given by Prof. Davis for some English rivers (*Geographical Journal*, vol. v. p. 127) may apply. It is further noticeable that the Rother receives a much greater number of tributaries on its right side (coming from the south) than on the left (coming from the north). Ten streams at least, over 2 miles

* The name *lavant* is applied in Sussex to a periodical stream.

in length, come in from the south, and only five from the north, although those from the north are longer. The explanation seems to be that springs at the base of the Chalk are more numerous than on the dip-slopes of the Lower Greensands, which form the northern versant, and the rainfall also is heavier.

In the following table the lengths of the rivers are given only to the edge of the sheet, except for the upper part of the Rother, three short windings of which are taken from the sheet to the north for the sake of completeness. It is to be remembered that a greater length of both rivers is found on other sheets.

TABLE IV.—LENGTHS OF RIVERS.

River.	Distance in direct line. Miles.	Length by windings. Miles.	Ratio length to distance.	Length for navigation. Miles.	Point to which navigable by barges.
Arun	14·25	25·25	1·8	20·0	All the way
Rother	14·0	19·6	1·4	12·0	Midhurst

Where the Arun enters the sheet the surface of the water cannot be more than 10 feet above the Ordnance datum level, as a bridge crossing the river has the bench-mark of 21 feet, and is probably not less than 11 feet above the water. The river plain, measured between the contour-lines of 50 feet, is half a mile wide at this point, but contracts to less than a quarter of a mile in the gorge cutting across the Lower Greensand escarpment, just before the Rother joins and the river turns eastward below the ridge on which Pulborough stands. Here the first of the great windings of the river traverses a flat expanse of reclaimed or marshy ground, which a very moderate blocking of the gorge through the Chalk would convert into a lake of about 4 miles diameter. The greater part of this area is covered with alluvial deposits, formed as the river changed its course on the nearly level ground, and it is liable to be flooded in winter.

The gorge through the Chalk averages three-quarters of a mile in width between the contours of 50 feet, although at one point, at Houghton, this is reduced to less than half a mile, and heights of 200 feet on opposite sides of the valley are less than a mile apart. The river traverses its flat gorge in windings which carry it three times against the solid Chalk on the left side and twice on the right, so that it cuts white cliffs along its course. The cutting is most marked south of Houghton, where the river runs close under the chalk cliff for $1\frac{1}{2}$ mile, forming a semicircular sweep with a radius of half a mile from North Stoke as a centre. Into the concavity of every winding a fan-shaped terrace of valley gravel projects from the opposite side of the valley, uncovered by the alluvium which carpets the bottom. The sharp loops of the river have been connected

by artificial channels to shorten the distance for barge navigation, thus forestalling the natural process of river change. On emerging from the Downs at Arundel, the river flows in gentle curves southward across the coastal plain to the sea.

The canal cutting off the large curve of the Arun near Watersfield had a lock $11\frac{1}{2}$ miles by the barge channels from the sea; and another lock was built at Pillingham, 4 miles higher, where barges left the river and entered the canal that led to the Wey at Guildford, and so to the Thames. This canal is no longer in use. The influence of the tide is felt as high as Pillingham lock on the Arun, $23\frac{1}{2}$ miles from the sea by the windings, and $13\frac{1}{4}$ in a direct line. On the Rother it is felt as far as Hardham Mill only.

Roads and Railways.—The roads of the district show only a limited relation to the natural features, which indeed are only in two cases pronounced enough to exercise much determining influence. One case is the steep escarpment of the Downs which limits the number of convenient crossing-places from north to south; the other is the marshy valley of the Arun, which practically closed that opening to high-roads.

The coastal plain is traversed by roads in every direction, most of them designed for local purposes, and serving to connect the farmhouses with the chief centre of the parish. Hence it is rarely that a road runs more than a mile without a turn at right angles, and a journey by road along the coast involves many abrupt turns and *détours.* The chief high-road from west to east runs through Chichester and Arundel, rising in its highest points, at several places, over 100 feet. Chichester, from its historic position, forms the natural centre of roads, the existing system being derived from that of the Romans. The surface of the roads in the south is usually good, being formed of flint, broken small, and marine gravel.

The roads across the Downs usually follow either valleys or spurs. At least nine well-made roads penetrate the Downs from the south, but only four emerge on the north. The Downs, however, are traversed in every direction by cart-roads and paths, the wheel-ruts showing the white of the Chalk through the general covering of turf.

The plan of Chichester is formed by two main streets crossing at right angles. The street running east and west is part of the South Coast high-road which runs from Southampton to Brighton, through Chichester and Arundel. The second, running from south to north, is part of the road which comes from Selsey Bill, and continues northward up the Lavant valley to the culminating point at 321 feet; and then, descending steeply, leaves the Downs at Cocking, crosses the plain by Cocking Causeway to Midhurst, and continues northward to Haslemere and Guildford. A branch from this road runs up the Dean valley through the very heart of the Downs to Up Waltham, where it joins the diagonal road which, starting north-eastward from Chichester, on the site of the ancient Roman Stane Street, diverges northward at 200 feet near Seabeach, and crosses the southern ridge of the Downs at 502 feet. From Up Waltham it continues up the valley, crosses the main ridge of the Downs at 495 feet, and descends steeply to the plain at Barlavington, whence it runs northward to Petworth and on to Guildford.

The third road crossing the Downs may be viewed as the continuation of that from Bognor; it leaves the Chichester-Arundel high-road at Westergate, and runs up the steep and picturesque valley known as Rewell Hill, where, at an elevation of 322 feet, it meets the fine highway from Arundel, which has come up on the back of a long spur. The two roads cross; one descends the steep eastward escarpment to Houghton, crosses the Arun where its valley is narrowest, descending to a level of 13 feet, and running eastward along the base of the Chalk escarpment through Storrington to Steyning. The second road proceeds northwards, crosses the ridge of the Downs at 420 feet, and descends very steeply to Bury, whence it runs north to Fittleworth; but where it crosses the line of Stane Street a branch runs north-eastward by the old Roman way through Pulborough, absolutely straight to Five Oaks, where it branches to the passes through the North Downs at Guildford and Dorking. Stane Street only remains visible in parts, but it is interesting to notice that the line by which it must have descended the escarpment of the Downs in its straight course to Pulborough is the easiest gradient possible, passing obliquely down the face of the southern side of the Bignor embayment. East of the Arun, the valley running north-eastward on the west of Highdown Hill, carries a high-road through the village of Angmering at an easy gradient.

It is important to notice that no high-road runs through the flat valley of the Arun from south to north; the villages along the river were thus isolated from one another more effectually than they would have been by hills. It is also noticeable that the chain of villages on the Upper Greensand terrace, at the foot of the Chalk escarpment, is not linked together by a continuous high-road. There is a winding road at the level of about 250 feet from Cocking through the Upper Greensand villages westward, and a rough road about the same level from Graffham eastward. The main east-to-west road runs north of the Rother through Pulborough, Petworth, and Midhurst, at levels between 100 and 200 feet for the most part; but there are numerous irregular cross-roads. This road crosses the Arun at Stopham, where the bridge was built in 1309 replacing the former Estover ferry. The name of Stopham house was formerly La Forde, or Ford Place, indicating the ancient importance of this point as a crossing-place. The main east-and-west road leads to Steyning, and to Winchester and Salisbury respectively.

The railways of the district exemplify the effect of superior engineering skill in overcoming the difficulties which kept the old road-makers away from the river-valleys. The South Coast railway from Brighton to

Southampton runs straight across the coastal plain from east to west past Arundel and Chichester, at a nearly uniform level of 30 feet above the sea, thus corresponding fairly with the high-road. The flatness of the plain is exemplified by the absolutely straight line of the railway. Branches run off southward to Littlehampton and Bognor. A steam tramway or light railway, 8 miles in length, runs from Chichester through the Hundred of Manhood to Selsey beach. It was opened in 1897. North of the Downs a single line runs from Pulborough up the easy gradient of the Rother valley to Midhurst, roughly parallel to the high-road, and another railway continues this line westward to Petersfield. From Midhurst the Pulborough line turns southward, jostling the high-road past Cocking and down the Lavant valley to Chichester. It passes under the highest part of the ridge by a tunnel half a mile long. The main line connecting the district with London is that which comes through the gap in the North Downs at Dorking and follows the line of Stane Street to Pulborough, thence striking straight down the centre of the flat gorge of the Arun to Ford Junction, where it joins the South Coast line. Between Pulborough and Ford it crosses the river or its windings no less than twelve times in 10 miles.

Climate.—There are no fully equipped meteorological stations reporting either to the Meteorological Office or to the Royal Meteorological Society, on the land portion of the two sheets (except Bognor, recently established), but at the Owers lightship daily observations of the temperature of the sea are made and reported to the Meteorological Office. Rainfall, however, is or has been observed at twenty-seven places for Mr. Symons's observing system, and the results are published in his 'British Rainfall' for each year. Those sending returns in 1898 were—

Place.	Feet above sea-level.	Mean rain-fall. Ins.	Place.	Feet above sea-level.	Mean rain-fall. Ins.
Bognor	—	27	Patching	130	—
„ (Lidsey Lodge)... ...	—	27	Arundel (High Street)	30	29
Littlehampton (Surrey House)	20	27	West Stoke (Rectory)	176	29
Yapton	24	26	Eartham House	240	(32)
„ (Drove Farm)... ...	14	27	Forest Side Vicarage	341	—
Angmering	44	27	Watergate	240	—
Chichester (Sewage Works) ...	10	—	West Dean Park	190	36
„ (Westgate Meadow)	40	28	Chilgrove...	284	33
„ (Oaklands)	80	28	Petworth Park	182	31
Clapham (Rectory)	150	29	Repton (Lynch Farm)	160	38
Patching	180	29	Midhurst (St. Ann's)	120	30

The distribution of rainfall was deduced from the mean rainfalls calculated by Mr. Symons in the manner thus described :

"Inasmuch as it is not infrequent to have several years in succession considerably above or below the average, it is not safe to trust to a short average; ten or fifteen years is the very shortest period, and twenty or

twenty-five years is desirable. But when dealing with a large area it is rarely possible to obtain records of twenty or twenty-five synchronous years; therefore one has to find the longest period for which several synchronous records exist, and to utilize observations for short periods by differentiation from the long ones, so that eventually one obtains strictly comparable results.

"In this case the eighteen years 1881–98 have been adopted, there being nine stations at which the records are perfect for the whole of those years. Take, for example, Littlehampton: the mean of the eighteen years is 27·28 inches, and as, on the map, the amounts are given to the nearest inch, the amount of twenty-seven is placed over Littlehampton. To take one other example, illustrating the use of a record covering only two years: at Beechwood House, Lavington, observations were made for only the years 1872 and 1873, and the mean of those two years was 45·08 inches; but those were very wet years, 14½ per cent. above the average, and therefore the 45·08 inches represents a true mean of 39·40 inches, and 39 inches is entered upon the map."

Taken altogether, the driest month of the year is April, and the wettest time occurs in October and November. The whole of the low coastal plain up to the level of 100 feet has a rainfall under 30 inches, the places with least rainfall being those lying nearest the sea. The southern slope of the Downs and the whole of the valley north of the Downs have an average rainfall of from 30 to 35 inches; but the crest of the Downs and the narrow belt immediately at the base of the escarpment (the Upper Greensand terrace) have a higher rainfall, closely approaching 40 inches.

The fact that the rainiest part of the region is the slope of the South Downs which is sheltered from the sea and from the prevailing south-westerly winds is curious, but may be explained by the cooling of the rain-bearing wind when raised to the highest point by passing over the Downs. This view is confirmed by the relatively low rainfall at Cocking, where the Downs are interrupted by a valley. The interesting district just north of the Arun gorge, between Amberley and Pulborough, which would throw much light on the causes of the distribution of the rainfall, is unfortunately without a rain-gauge, and the curves shown on the map (Fig. 8) are dotted at that point.

The total rainfall of the whole district averages about 32 inches, which corresponds to 3232 tons per acre; and the average distribution on the three natural regions may be estimated as—

	Average inches.	Tons per acre.	Area, sq. miles.
Coastal plain	27·5	2777	110
Chalk Downs	36	3636	80
Rother and Arun valley	34	3434	80

The average rainfall over the drainage area of the Arun, within these sheets, may be estimated at 34·5 inches, an annual contribution of

250,000,000 tons of water, if percolation and evaporation are not considered.

Although there are no meteorological observations taken in the district, the general climate is known by comparison of data in the neighbouring regions. From the monthly climate maps of the British Islands published by Dr. Buchan,* and from the Physical Atlas of Bartholomew, the following data are obtained: The mean temperature reduced to sea-level for the whole area lies between 50° and 51° Fahr., probably about 50°·7, and the annual range between the mean temperature of the warmest month and that of the coldest is 23°. The district lies in the sunniest belt of the British Islands, and has probably nearly 1600 hours of bright sunshine in the year, out of 4435 hours which the sun is above the horizon. The local climates must vary considerably, on account of differences of altitude and of exposure to sunlight and wind, taken together with the differences in rainfall. On the summit of the Downs at 700 feet or more, the temperature must be nearly 2°·5 lower at all times of year than at sea-level on account of altitude.

The south coast of England has the highest atmospheric pressure in the islands at all seasons. The prevailing winds are from some point between west and south-west, a fact shown clearly by the general slope of the trees on the coastal plain and on the crest of the Downs. The district lies in one of the minor storm tracks crossing the British Islands, and, especially in winter, is often traversed by the centres of cyclonic disturbances moving from south-west towards north-east.

The following are the mean monthly temperatures and pressures for the district reduced to sea-level:—

	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Temp. ° F.	39·5	41·7	43·0	48·5	53·8	60·0	62·5	62·8	58·5	51·0	45·7	41·3
Barom. inch.	29·99	30·01	29·93	29·95	29·99	30·02	29·99	29·97	29·99	29·92	29·95	29·98

The mean barometric pressure for the year is 29·975 inches.

(To be continued.)

A JOURNEY FROM FORT JAMESON TO OLD CHITAMBO AND THE TANGANYIKA PLATEAU.†

By ROBERT CODRINGTON, Deputy Administrator, Northern Rhodesia.

I LEFT Fort Jameson, the headquarters of the British South Africa Company's Administration in North-Eastern Rhodesia, on April 25, 1899, and, accompanied by Mr. G. M. E. Leyer, travelled to the Loangwa river, which we crossed in lat. 13° 13′. The river at this point was only 350 yards wide and about 4 feet deep, but it was evident, from

* *Journal* Scottish Meteorological Society, Third Series, No. xiii. (not dated, 1898 ?).

† Map, p. 308.

the country on both sides, that, when in flood, it is at this point at least a mile wide. From Fort Jameson, which is 3857 feet above the level of the sea, we travelled through an uninhabited forest country, with plentiful water, to Msoro, where there is a trading-station of the North Charterland Exploration Company in charge of a half-caste Portuguese. There are a large number of Senga villages in the immediate neighbourhood, and a small trade is carried on in ivory and wax. Thence we travelled through a sparsely inhabited forest country to the Loangwa river, which at the point where we crossed it, at the junction of the Kapamba river, is 1609 feet above sea-level. We camped on the east bank in the village of Sunda. I had with me a folding boat made by Theo. Smith, Medley, Oxford. It weighed 200 lbs. complete, and required at least twenty porters, in reliefs, to keep up with the caravan for any length of time; but it was very easily stretched and folded up again, was capable of holding a large number of men or loads without any danger of capsizing, and proved most useful and serviceable throughout our journey. This boat we used for the first time in crossing the Loangwa.

Leaving the Loangwa on May 1, on the 3rd we climbed the Muchinga range, ascending 3460 feet to Hoste's deserted camp, which is 5072 feet above the sea. It was found impossible to induce any of the Wa-Bisa people in the villages through which we passed to carry any of our loads, the heaviest of which, with the exception of the boat, was under 35 lbs. The villagers invariably crowded round our camp, but as soon as the subject of work was mentioned, although good pay was offered and the people were almost without a rag of clothing, the assembly at once melted away, and in one case at least the entire population slept in the bush, regardless of cold or wild beasts, rather than have to listen to such horrible suggestions. Luckily we were provided with good gangs of Yaos from Blantyre, and Angoni from Fort Jameson, who, although only engaged to come with us as far as the Loangwa, agreed readily enough to stay with us as long as we required them.

From Hoste's camp we travelled through an uninhabited country, well wooded, well watered by numerous running streams, and of an unvarying altitude of about 5000 feet, to Serenje, about 12 miles to the east of which is a swampy piece of water presumably that marked on the map as Moir's lake.* No open water was observed, and as my companion had not yet recovered from a severe attack of malarial fever from which he had suffered on the Shire river, I purposely avoided all swamps, and took no steps to see for myself of what this particular one consisted. From Serenje we travelled through a level country with open plains alternating with light forest trees and occasional stony kopjes; water everywhere plentiful and good, but the population very

* See *ante*, p. 179.

...scattered. On May 8 we crossed the Lehombo river, and ... the 9th. This river, which rises in the Irumi hills and flows ...e Luapula, was, at the points where we crossed it, a deep swift ... On the evening of May 9 we arrived at the present village of ...mbo. Chitambo, who is an intelligent man about thirty years of ... handed me, immediately on my arrival, a very interesting docu-...nt, a copy of which is attached. It appears, from conversation with ...itambo, that his father died later in the same year as Livingstone, and was buried under the same tree, after which the village was abandoned.

On the morning of May 10, we travelled 13½ miles east-south-east from Chitambo's present village, and reached the site of old Chitambo, on the Lulimala stream. The trees have long since grown up all over the site of the old village, and, except for a small clearing and a low fence round it, there was nothing to distinguish the Livingstone tree, which was of a variety common to all the high country of British Central Africa. The inscription is, however, very well and deeply cut, the bark having been removed for the purpose, and shows that the boys who carved it took a great deal of pains to make the inscription as permanent as possible. The bark has grown over part of the "E" in Livingstone, and over part of the "3" in 1873. Borers were fast destroying the lettering, which is, however, still distinct with the exception of the last two lines, in which the first letters of the names of the followers have disappeared. The inscription now reads as follows :—

DR. LIVINGSTONE,
MAY 4, 1873,
. . . ZA MNIASERE,
. . . CHOPERE.

The tree itself was hollow, and the rot was eating through into the inscription, and would soon have destroyed it completely. The inscription was, therefore, not cut out a day too soon, as its existence was threatened by rot from one side and borers from the other, and any violent storm would have endangered the whole tree. There was also a risk of the inscription being carried away by private persons for the sake of speculation, one scheme of this sort, at least, being frustrated by my action.

Having taken steps to preserve the inscription from damage, I immediately cut down the tree, and sawed it off above and below the inscription. When this was done, its weight was so great that it was impossible for two men to lift it; and as there were several hundred miles of land transport to be accomplished before it could reach the ocean, I was obliged to take steps to bring it down to a reasonable weight. For three days my boys were engaged in carefully adzing out the inside of the section, until as much had been cut away as was consistent with the necessity of leaving a sound and durable piece of timber. Carefully packed with a quantity of naphthaline to destroy the borers, the section was sewn in canvas and slung on a strong pole; but it was a very heavy and inconvenient load, weighing about 200 lbs., and required at least twenty-five carriers; had it not been for our folding boat, I doubt if we should have got it across the large rivers which flowed between us and the Tanganyika plateau.

I had brought with me from Fort Jameson one of the iron poles of the Trans-Continental Telegraph, and this I firmly planted in the very heart of the tree-stump, where it will serve to mark the exact spot for many years if necessary, until some more elaborate monument is erected. The lonely spot where Livingstone died twenty-six years ago appears to me to be appropriately marked by this symbol of European occupation, bringing with it the blessings of peace and the safety of life and property to the wretched people amongst whom his last days were spent. A large clearing was made and a strong fence built round the tree-stump on May 14. Everything being completed, we left old Chitambo and travelled 3½ miles to the Lulimala river, which we crossed in the folding boat, assisted by a few canoes from the large village on the river-bank. That night we reached the village of Kalonga, on the Lokulu river, which was 350 yards wide, a strong deep stream.

In all published maps of this country the swamps to the south-east of Lake Bangweolo are marked in a rather exaggerated manner. Our path passed through a succession of open plains fringed with thick and sometimes large forest trees, in which water was generally to be found, but never in any large quantity. The rivers which intersect the plains are wide and deep, and become choked and lost in grass and reeds, only narrow waterways for canoes remaining to connect them with the open water of Bangweolo, here called Bemba.

On May 16 we arrived on the bank of the Lotikila river, down which we paddled 1½ mile, until the river spread out into a lake about a mile wide and 5 miles long, surrounded by swamp and with no navigable outlet. Crossing this, we travelled 8 miles to the Munekase river, 75 yards wide, swift and deep, with high banks; thence 11 miles to the Lolingela river, 1000 yards wide; and thence 4½ miles to the Chambezi river, where I camped on the bank opposite the village of Kabinga, which is situated on an island. The present chief Kabinga remembered Livingstone, and says he was with him when he died.

On May 19 I went in my boat 7 miles down the Chambezi, to where a large river, which I took to be the Lolingela, runs in from the south and the Chambezi turns northwards. There was no sign of the Chambezi becoming choked with weeds and grass, but all native information pointed to the fact that there is no open water into the Chambezi, but only waterways for canoes. The Chambezi is a very large river. At Kabinga's it is 2 miles wide and 19 feet deep, and I found this depth and width to prevail at least 7 miles lower down. The altitude of my camp at Kabinga's was 3791 feet.

Leaving Kabinga's on May 21, I travelled 26 miles up the Chambezi, and found the average width to be about a mile and a half, and the depth about 15 feet. There are a great many islands, and the banks are steep and well wooded. The population is considerable, but is scattered on the islands in the river and backwaters. There are practically no paths, canoes being the universal means of communication from village to village. The people who belong to the Ba-Bisa and Ba-Lala tribes have been driven to this mode of life by the raids of the Arabs and Awemba, but, having now life and property secured to them by the presence in the Awemba country of the British South Africa Company's Administration, they are likely to return to the mainland and the fertile banks and deltas of the rivers.

We arrived at Kasama, the Administration station in the Awemba country, on May 25. The Awemba, who inhabit the country which lies to the south of the Tanganyika plateau, have for many years past raided their neighbours, and, having allied themselves with the Arab slavers and coast men, were considered strongly opposed to the influence of any Administrative authority over them; and although they were not openly hostile to Europeans, they were somewhat jealous of their entry into their country. However, last November the paramount chief died, having been attended in his last days by Bishop Dupont of the White Fathers of the Algerian Mission, whose principal station in Rhodesia was on the border of the Awemba country. On Mwamba's death there was great commotion. The chief's compound was broken into and looted by his servants, the various claimants to the chieftainship called their followers together and made ready to assert their claims, whilst the bishop found himself surrounded by the majority of the people, who looked to him for protection from the rival claimants, and from the usual human sacrifices. Soon after the representative of the British South Africa Company's Administration, hearing of what was going on, arrived at Mwamba's village, and his presence was gladly welcomed by the people, who were still apprehensive regarding what would happen at the burial of Mwamba, and which of the rival claimants would obtain the chieftainship. A son of Mwamba's was without doubt the rightful heir, and this man Kalonganjofu was acceptable to the vast majority of the people, and received the tacit support of the Administration. It was from the first evident that with the death of Mwamba the integrity of the Awemba kingdom was at an end. The people were heartily sick of the cruelties and oppression of their chiefs, who, being unable any longer to raid far afield by reason of the European occupation taking place around them, were inclined to practise on their own people, for the most trivial offences, the barbarities formerly reserved for the punishment of dangerous criminals and the captured and

by artificial channels to shorten the distance for barge navigation, thus forestalling the natural process of river change. On emerging from the Downs at Arundel, the river flows in gentle curves southward across the coastal plain to the sea.

The canal cutting off the large curve of the Arun near Watersfield had a lock $11\frac{1}{2}$ miles by the barge channels from the sea; and another lock was built at Pillingham, 4 miles higher, where barges left the river and entered the canal that led to the Wey at Guildford, and so to the Thames. This canal is no longer in use. The influence of the tide is felt as high as Pillingham lock on the Arun, $23\frac{1}{2}$ miles from the sea by the windings, and $13\frac{1}{4}$ in a direct line. On the Rother it is felt as far as Hardham Mill only.

Roads and Railways.—The roads of the district show only a limited relation to the natural features, which indeed are only in two cases pronounced enough to exercise much determining influence. One case is the steep escarpment of the Downs which limits the number of convenient crossing-places from north to south; the other is the marshy valley of the Arun, which practically closed that opening to high-roads.

The coastal plain is traversed by roads in every direction, most of them designed for local purposes, and serving to connect the farmhouses with the chief centre of the parish. Hence it is rarely that a road runs more than a mile without a turn at right angles, and a journey by road along the coast involves many abrupt turns and *détours*. The chief high-road from west to east runs through Chichester and Arundel, rising in its highest points, at several places, over 100 feet. Chichester, from its historic position, forms the natural centre of roads, the existing system being derived from that of the Romans. The surface of the roads in the south is usually good, being formed of flint, broken small, and marine gravel.

The roads across the Downs usually follow either valleys or spurs. At least nine well-made roads penetrate the Downs from the south, but only four emerge on the north. The Downs, however, are traversed in every direction by cart-roads and paths, the wheel-ruts showing the white of the Chalk through the general covering of turf.

The plan of Chichester is formed by two main streets crossing at right angles. The street running east and west is part of the South Coast high-road which runs from Southampton to Brighton, through Chichester and Arundel. The second, running from south to north, is part of the road which comes from Selsey Bill, and continues northward up the Lavant valley to the culminating point at 321 feet; and then, descending steeply, leaves the Downs at Cocking, crosses the plain by Cocking Causeway to Midhurst, and continues northward to Haslemere and Guildford. A branch from this road runs up the Dean valley through the very heart of the Downs to Up Waltham, where it joins the diagonal road which, starting north-eastward from Chichester,

Southampton runs straight across the coastal plain from east to west past Arundel and Chichester, at a nearly uniform level of 30 feet above the sea, thus corresponding fairly with the high-road. The flatness of the plain is exemplified by the absolutely straight line of the railway. Branches run off southward to Littlehampton and Bognor. A steam tramway or light railway, 8 miles in length, runs from Chichester through the Hundred of Manhood to Selsey beach. It was opened in 1897. North of the Downs a single line runs from Pulborough up the easy gradient of the Rother valley to Midhurst, roughly parallel to the high-road, and another railway continues this line westward to Petersfield. From Midhurst the Pulborough line turns southward, jostling the high-road past Cocking and down the Lavant valley to Chichester. It passes under the highest part of the ridge by a tunnel half a mile long. The main line connecting the district with London is that which comes through the gap in the North Downs at Dorking and follows the line of Stane Street to Pulborough, thence striking straight down the centre of the flat gorge of the Arun to Ford Junction, where it joins the South Coast line. Between Pulborough and Ford it crosses the river or its windings no less than twelve times in 10 miles.

Climate.—There are no fully equipped meteorological stations reporting either to the Meteorological Office or to the Royal Meteorological Society, on the land portion of the two sheets (except Bognor, recently established), but at the Owers lightship daily observations of the temperature of the sea are made and reported to the Meteorological Office. Rainfall, however, is or has been observed at twenty-seven places for Mr. Symons's observing system, and the results are published in his 'British Rainfall' for each year. Those sending returns in 1898 were—

Place.	Feet above sea-level.	Mean rainfall. Ins.	Place.	Feet above sea-level.	Mean rainfall. Ins.
Bognor	—	27	Patching	130	—
„ (Lidsey Lodge)... ...	—	27	Arundel (High Street)	30	29
Littlehampton (Surrey House)	20	27	West Stoke (Rectory)	176	29
Yapton	24	26	Eartham House	240	(32)
„ (Drove Farm)... ...	14	27	Forest Side Vicarage	341	—
Angmering	44	27	Watergate	240	—
Chichester (Sewage Works) ...	10	—	West Dean Park	190	36
„ (Westgate Meadow)	40	28	Chilgrove...	284	33
„ (Oaklands)	80	28	Petworth Park	182	31
Clapham (Rectory)	150	29	Repton (Lynch Farm)	160	38
Patching	180	29	Midhurst (St. Ann's)	120	30

The distribution of rainfall was deduced from the mean rainfalls calculated by Mr. Symons in the manner thus described :

"Inasmuch as it is not infrequent to have several years in succession considerably above or below the average, it is not safe to trust to a short average; ten or fifteen years is the very shortest period, and twenty or

on the site of the ancient Roman Stane Street, diverges northward at 200 feet near Seabeach, and crosses the southern ridge of the Downs at 502 feet. From Up Waltham it continues up the valley, crosses the main ridge of the Downs at 495 feet, and descends steeply to the plain at Barlavington, whence it runs northward to Petworth and on to Guildford.

The third road crossing the Downs may be viewed as the continuation of that from Bognor; it leaves the Chichester-Arundel high-road at Westergate, and runs up the steep and picturesque valley known as Rewell Hill, where, at an elevation of 322 feet, it meets the fine highway from Arundel, which has come up on the back of a long spur. The two roads cross; one descends the steep eastward escarpment to Houghton, crosses the Arun where its valley is narrowest, descending to a level of 13 feet, and running eastward along the base of the Chalk escarpment through Storrington to Steyning. The second road proceeds northwards, crosses the ridge of the Downs at 420 feet, and descends very steeply to Bury, whence it runs north to Fittleworth; but where it crosses the line of Stane Street a branch runs north-eastward by the old Roman way through Pulborough, absolutely straight to Five Oaks, where it branches to the passes through the North Downs at Guildford and Dorking. Stane Street only remains visible in parts, but it is interesting to notice that the line by which it must have descended the escarpment of the Downs in its straight course to Pulborough is the easiest gradient possible, passing obliquely down the face of the southern side of the Bignor embayment. East of the Arun, the valley running north-eastward on the west of Highdown Hill, carries a high-road through the village of Angmering at an easy gradient.

It is important to notice that no high-road runs through the flat valley of the Arun from south to north; the villages along the river were thus isolated from one another more effectually than they would have been by hills. It is also noticeable that the chain of villages on the Upper Greensand terrace, at the foot of the Chalk escarpment, is not linked together by a continuous high-road. There is a winding road at the level of about 250 feet from Cocking through the Upper Greensand villages westward, and a rough road about the same level from Graffham eastward. The main east-to-west road runs north of the Rother through Pulborough, Petworth, and Midhurst, at levels between 100 and 200 feet for the most part; but there are numerous irregular cross-roads. This road crosses the Arun at Stopham, where the bridge was built in 1309 replacing the former Estover ferry. The name of Stopham house was formerly La Forde, or Ford Place, indicating the ancient importance of the point as a crossing-place. The main east-and-west road leads to Steyning and to Winchester and Salisbury respectively.

The railways of the district exemplify the effect of superior engineering skill in overcoming the difficulties which kept the old road-makers away from the river-valleys. The South Coast railway from Brighton to

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"Inasmuch as it is not infrequent to have several years in succession considerably above or below the average, it is not safe to trust to a short average; ten or fifteen years is the very shortest period, and twenty or

introduction there by natural causes. Mr. Willcocks says, "The Bahr-el-Jebel should be selected for the first operations, as it is not in the middle of the swamp, and because numerous streams flow into it from the west. As near to the first *sudd* as possible there should be begun immediately willow plantations on as extended a scale as money would permit. These would supply the stakes for staking across deep overflows, and the cuttings for planting in shallows. . . . Once the willow plantations were established, the alignment of the Bahr-el-Jebel should be fixed

ON THE BANKS OF THE BAHI-EZ-ZEBAF.

upon, and taking 300 metres as a suitable final width for the river, the staking, matting, and planting of cuttings should proceed southwards. Once the rows of willows and poplars took root, they would begin at once to form banks to the river, and the water, being confined to a single channel, would itself begin to clear its course of weeds."* The

* Baker (1862) found a current of from 1¾ to 2½ miles an hour in the open channel, above the mouth of the Bahr-el-Ghazal.

suggestions include the treatment of side rivers at their entrance, and the means for reclaiming the foreshore in the whole unhealthy region from Fashoda to Abba. Apart from the local advantages (including

COMPOSITION OF THE "SUDD" ON ZERAF RIVER.

the provision of plentiful fuel, and the elimination by the willows of unwholesome matter from the water), the proposed operations would, it is pointed out, have a valuable result in increasing enormously the summer discharge of the Nile in Egypt.

MILITARY GEOGRAPHY.*

By Colonel Sir T. H. HOLDICH, K.C.I.E., C.B., R.E.

SETTING the widest possible definition to the term "Military Geography," Mr. Maguire's book deals with the relations that exist between the geography of the World at large—the form and disposition of its seas and continents—to those strategical developments which have shaped the World's history in the past, and may shape it again in the future. Consequently, it is rather an epitome of historical examples to illustrate various phases of continental strategy than a geographical treatise. Not

* 'Outlines of Military Geography.' By T. Miller Maguire, LL.D. Cambridge University Press. 1899.

much is said of the influence of such geographical details as are comprehended under the term "topography" on the course of strategical combinations; and nothing whatever of the means whereby such geographical knowledge may be attained as is essential to strategical schemes. Assuming that we know the World's geography sufficiently well to be aware, not only of the existence of such large features as ranges of mountains, rivers, and open seas, but of the nature of the passes and fords and harbours which must inevitably decide how we are to make use of them, this is all very well. Otherwise, it appears to leave something to be desired in a geographical text-book; for there are certainly vast spaces of which our geographical knowledge can hardly be said to be equal to the most elementary requirements of military operations.

There is not a word too much in the opening chapters about the necessity for military geographical study, for certainly an astonishing apathy on the subject still exists in England. Sherman's words, in his letter to Ewing, quoted by Mr. Maguire, "Every day I feel more and more in need of an atlas," might well be taken as the text of a sermon on our requirements in the matter of maps. A want of map information has lately been rather too distinctly prominent.

The leading principles which govern the application of the art of strategy to the initial plan of a campaign, the enormous range of these considerations which must affect the plan and the difficulties of placing a well-armed and well-equipped army corps in the field, are all excellently well illustrated by historical examples; but the general deduction that all the leading principles of strategy are the same to-day as they ever were in past ages seems to require something more than historical example to justify it. For it would certainly appear to the non-instructed mind that the gradually widening disproportion between the advantages of defensive and offensive warfare, by closing certain lines of attack that have hitherto been considered open, and by altering the conditions under which armies should be manœuvred to the field of battle, would affect the principles of strategy considerably. In the chapter on the Command of the Sea, we find that our leading naval authorities are also of opinion that new naval appliances have in no way affected the strategy of naval warfare "any more than rifles and breech-loaders have affected strategy on land." But we venture to doubt whether the analogy between sea and land warfare is quite sound. An open flat sea presents no such variety of topographical conditions as may affect the application of modern artillery fire and render certain strategical movements unadvisable that were readily practicable formerly. Increase of range on the high seas would only appear to widen the circle of naval tactics.

Although the author well illustrates the importance of naval stations to England in the World's wide geography, the real moral of his teaching may be found in the words, "No elaboration of defensive positions, no coast defences, however strong, give command of the sea, though they are both valuable and necessary. Command of the sea depends on a sea-going fleet as much as success in a land campaign depends on the field army." Well-chosen examples are given showing the complete mastery of strategy and control of all the avenues of communication throughout the world which have been maintained at certain periods of English history. His sea chapters are most interesting and instructive. If they have a fault, it is only that they are too short and too much condensed.

A chapter on the strategic relations of Europe with other countries naturally introduces a useful summary of the present relations between England and Russia in Asia. As there is only a periodic ebb and flow of public interest in Asiatic affairs, Mr. Maguire does well to point out, with reference to the great Siberian railway project, now so near its accomplishment, that "no territorial advance of Russia in the present century is comparable in importance to the step which has just been taken, after long and careful preparation." It places Russia within striking distance of Pekin, a fact which is duly emphasized; but little is said about the effect of such a railway in introducing a new European power to the Pacific.

It is those chapters in the book which deal with routes and lines of invasion, either hypothetical or historical, which appear to be of the greatest value to the student of military geography, not only because history is apt to repeat itself, but because it is in this connection that value of geographical knowledge can be most forcibly illustrated. Naturally the English student turns to India as the one vulnerable point in the British Empire, and there is very much about India in the pages of this book which he cannot do better than study most attentively. There are, perhaps, one or two minor suggestions made which might be considered as open to question. One of them occurs in page 236, where, with special reference to the political advantage of facing a northern enemy at Kandahar, the reason given is that it is in the highest degree unadvisable that India should see us fighting with Europeans. "Over that tremendous transaction," in the words of Sir R. Temple, "it is best that there should be a veil." Why? There was no veil drawn when the English fought for empire with the French, and both fought in line with native troops. Sedition and "unrest" would arise amongst certain sections of the civil population in India, whether we fought at Kandahar or on the Indus; amongst our military allies in India it would be a matter of the purest indifference where they fought. There are, doubtless, many strong reasons for defending India from outside our borders; but the hope of concealing anything from India is hardly one of them.

Very much useful information on the subject of railways is condensed into a comparatively short space. The question of the proposed connection between Burma and China is entered into at some length, but to us it appears to be hardly so important as a question of strategical geography as that of the connection between Kandahar and Herat—on which subject the book is silent.

In one of the historical illustrations which Mr. Maguire introduces when treating of lines of approach, there appears to have arisen a slight geographical confusion. Alexander's route from Kandahar to Central Asia is given as passing by either the Bamian or Panjshir river, Aornus, Baktra (? Baktria), the passage of the Oxus at the modern Kylil (? Kilif), Maracanda (Samarkand), to the Jaxartes, and thence back again to Baktria. It is, of course, dangerous to assume any certainty in the compilation of a route from old world records, but the balance of probabilities seems largely in favour of that route crossing the Hindu Kush by the Kaoshán (the Hindu Kush pass *par excellence*), where it is known that Alexander was in the immediate neighbourhood of colonies of Greek origin, which might have helped him. Having crossed the Hindu Kush, it is difficult to account for Aornos, unless there exists any record of two distinct places of that name. The rock of Aornos, for the possession of which so gallant a fight was made, is undoubtedly Mahaban, overlooking the Indus from its right bank south of Buner. Old Greek names closely connected with the story of Aornos still survive there. After the return to Baktria we read that "he then conducted an expedition to Bokhara, making the passage of the Indian Caucasus." This is difficult to understand. He would only have to recross the Oxus to enter the Bokhara region from Baktria. The "Indian Caucasus" may possibly refer to the next movement, viz. his march from the Choaspes (Kunar) to India. This is, in fact, the one instructive point in the strategic plan of his operations towards India. He struck at India from Kabul; as did Babar; as did Nadir Shah; as did most of the invaders of India, who used the Kabul river route twenty times for the once that any more southern route was utilized. But the chief Kabul road to India was not then by the Khaibar; and it is a notable point in the strategy of these early conquerors that they reduced the hill tribes of Kunar, Bajaor, and Swat, who threatened the flank of their communications, before turning south into the flat plains of the Punjab. Surely the methods employed by these ancient warriors of safeguarding their line of communications by wiping off the face of the earth any people who might possibly interfere with them—a method which is hardly permissible in these days—points to some difference in the "leading principles" of strategy in early ages compared with those of the present?

There was one occasion when Western India was conquered by an enemy approaching from the west, which has unaccountably escaped the notice of most of our military historians. The Arabs invaded Sind in the early years of the eighth century; occupied the Indus valley; stamped out the remnants of Greek influence, and imposed a dynasty (or succession of dynasties) on Multan which lasted for three centuries. They entered by a route which is not at all coincident with that followed by Alexander in his disastrous retreat to Persia. The latter is not well shown in the illustrative map at p. 288, for it fails to give point to one of Alexander's great strategical blunders, viz. that of attempting to make his army a base of supply for his fleet. Another blunder was his selection of a route the geography of which was unknown to him. As far as Makran he had had Greek pioneers to guide him, but here he made geographical assumptions, which, like all such assumptions, led to certain grief.

Mr. Maguire's book is a most useful work of reference both to the military student and the public at large. It is packed full of "wise saws and modern" (as well as ancient) "instances" from end to end of its 350 pages, and it possesses an excellent index. If we echo Sherman's cry for an atlas in further and fuller illustration of the geographical references, it is with the admission that it would be quite impossible to introduce anything like complete map illustration of so comprehensive a strategical survey within reasonable limits of space.

NARRATIVE OF A JOURNEY TO THE LAKES RAKAS-TAL AND MANASAROWAR, IN WESTERN TIBET, UNDERTAKEN IN SEPTEMBER, 1848.*

By Lieut.-General Sir RICHARD STRACHEY, R.E., G.C.S.I., F.R.S.

September 8. *Halt at Tisum.*—The thermometer, which at 6 a.m. stood at 30°·8, rose by nine o'clock to 54°, and at ten o'clock to 67°, after which the wind got up, and it became rather cloudy. It may be conceived that a change in the temperature of the air such as this, of 36° in four hours, was rather unpleasant. Inside the small black yak-hair tents used by the Tibetans, however, the change is still greater than this, and I have seen a difference of 42 degrees between 5 a.m. and 1.30, and that at an elevation of 18,400 feet.

As W. was still unwell, we halted to-day to give him a rest, and I went out in the afternoon to do something in the way of survey. I started off nearly south from *Tisum*, on the plain between the *Chaldu* and *Chirchun* rivers, and at a distance of about 4 miles came to a slight rising ground, from which I got a sight of the great snowy mass south of the *Manasarowar* lake, marked in our map as *Gurla*, the summits of which range from 21,800 to 25,000 feet. It was a good deal covered up in clouds, but still enough could be made out to see that it was a grand mountain. The Juharis called it *Mandhata*, after the name of a personage in the *Mahabarat*, but I don't think they could produce any authority for doing so. From

* Continued from p. 170. Map, p. 204.

the place where I stood, looking to the north, snowy peaks were seen in only two or three directions, and those were very distant, possibly none of them being within 150 miles. To the south-west was the *Balch* range, with very little snow upon it; everything beyond it was quite concealed by clouds. The plain, over which I looked for some 10 miles, appeared of a uniform pale brownish-yellow tint; the hills that rose from it inclined to shades of red, and the effect was anything but cheerful. The only sign of animal-life that I observed in this desert was a large cricket, *Gryllus*, with blue wings, that took short flights, making a peculiar quick, sharp chirrup as he went. Early in the morning, however, wolves had been heard, apparently hunting somewhere near our tents, and a young hare was run down in the course of the day by two of our men. During my absence, Winterbottom, in examining closely the herbage near our tent, found one or two novelties, and among them a curious little leguminous plant, with a remarkable four-cornered and winged prickly pod, which proves to be a new genus near *Eversmannia*. Mr. Bentham named it after me—*Stracheya Tibetica*, the real discoverer, W., having positively declined to allow his name to be perpetuated in such a way. Among the other new plants here met with may be mentioned the following: *Alyssum canescens*, * *Stellaria graminea*, * *Potentilla anserina*, *Saussurea glanduligera*, *Crepis glomerata*, *Parnassia ovata*, *Scopolia prœalta*, * *Salsola kali*; and a few grasses—*Stipa purpurea*, *orientalis*, and *sibirica*, *Festuca valesiaca*, *nitidula*, and *sibirica*, *Elymus sibiricus*.

A little excitement was produced at our camp early in the day by the report of the approach of a party of travellers. They turned out to be only some Juhari Bhotiyas returning home from *Kyunglung*, at which place our friend of *Topidhunga* had arrived, and had reported our intended visit to *Hundes*. But there had been no definite knowledge of our actual presence in Tibet. The chief civil authority of the place, the *Kharpun*, they told us, viewed the report with much philosophy; the entrance of foreigners into Tibet was notoriously prohibited, and what more was wanted to satisfy the Justice Shallow of *Kyunglung* that our threatened invasion was impossible? We took the opportunity of sending back letters to Kumaon by these Bhotiyas.

At night, 9 p.m., the thermometer was at 36°·5.

September 9. *Tisum to the Satlaj*, 15 *miles.*—The morning was cloudy; at 6 a.m. the thermometer was at 40°·5, and it rose nearly to 50° at 8 a.m. Our route lay down the *Jankum* river to the grazing or encamping ground called *Shib-chilam*, the ravine gradually getting deeper as we went on, till at that place, where the *Chirchun* river joins it, the bank is some 800 feet high, forming a steep cliff cut up into singular shapes, looking like ruins of towers and Gothic buildings. The deposits of gravel and sand, of which the plain was composed, might here be seen resting nearly horizontally on schist or shale, black and very rotten, that dipped at a highish angle to the north-west. These rocks are cretaceous, or possibly nummulitic. Between the two rivers, *Jankum* and *Chirchun*, on a tongue of land which hardly rose 100 feet above the water, were the remains of a village which had once existed here. Close by, also, the high-road from *Daba* to *Kyunglung* crosses the united streams by a bridge, said to have been built by a Juhari. On the opposite bank a cave was pointed out to us, where a man exercising the functions of a rural policeman was said to be posted by the *Kyunglung* authorities. These caves—for there are many of them in the alluvial banks—are commonly used as winter residences and storehouses by the nomadic Huniyas. A robbery was said to have taken place the year before of goods and chattels deposited in one of these caves, and to prevent the repetition of such outrages, the policeman had been posted here. During the whole of our journey we were continually hearing of certain gangs of robbers, said to prowl over these parts of Tibet, and known by the Bhotiyas under the name of *Khampa*. This name, which appears at first to mean simply a man of the province of *Kham*, is, my brother, Captain Henry Strachey, informs us, an ignorant corruption of the word *Kyampo*, which signifies "nomad," and is applied by civilized Tibetans to the wilder races that exist along the northern part of the tableland abreast of the provinces of *Nari* and *Utsang*. Our Juharis were in constant terror of these marauders, who plunder tents and carry off cattle, when they dare, and we were told that some of them had just robbed a Bhotiya or Kumaon at *Darchin*. I received also long details of a raid made by the *Kyampo* two years back, on cattle belonging to the people of *Dungpu*, a village about 20 miles west from *Shib-chilam*. To avenge this, a considerable party of Juharis, who happened to be near at hand, combined with the villagers to hunt down the robbers, whom they appear to have treated as so many wolves, firing upon them without the least compunction. Five or six *Kyampo* were killed, some being shot in the capture by the Juharis, and the rest being summarily disposed of by the Huniyas, to whom such prisoners as were taken were made over by their allies. One or two of our party were present on this occasion, and evidently considered it rather good sport. The Juharis several times repeated to me that in *Hundes* the life of a man is looked upon as about of as much importance as that of a goat; their own civilization is sufficiently advanced to make the difference perceptible.

The constituted Tibetan authorities do not seem much superior to their subjects in matters of this sort, and I was told that one of their regular modes of execution was to smash with a sledge-hammer the thigh-bones of their prisoners, who were so left to die. In this manner, it is said, they murdered an officer of Golab Sing's *Dogra* army that invaded this part of *Nari*. When beleaguered in the Sikh fort at *Kardam*, he foolishly went out to treat with the besieging Tibetan force, when he was instantly seized and treated as I have said, though, with exceptional politeness, they ended by cutting off his head, a distinction not bestowed on ordinary culprits, who are left to perish as they may. No one will be surprised to hear that this brutal treachery and cruelty is accompanied by the basest cowardice.

In the valley down which we had come the vegetation was meagre, but I mention as deserving of notice, **Salsola Kali* and **Triglochin palustre*. This Triglochin I afterwards found again at *Hoti*, growing with **Triglochin maritimum* also at an elevation of about 15,000 feet. In addition to these plants, I should mention as being found in other parts of Tibet, and often associated with salt plants, Salsola, Eurotia, and the Triglochins already mentioned, a Crambe, *C. Cordifolia*, not greatly differing from *Crambe maritimum*, and *Glaux maritima*. With these are commonly seen many common northern forms of Potentilla, Ranunculus, etc., so that, strange as it may appear, we here often have at these great elevations, and in the middle of the continent of Asia, an assemblage of plants which may any day be found growing together on the sea-coasts of Northern Europe. It has been suggested with some reason that this curious feature of the Tibetan flora may be attributed to the immigration of the saline types of the Caspian. But considering that a coast-line certainly existed along the northern base of the Himalaya as late as the Cretaceous period, and the probability of the alluvial deposits of Tibet having been originally laid out beneath the ocean, it is not a very wild speculation to suppose that this marine flora may have been diffused along a former coast-line in the past ages of the Earth, and subsequently raised, by the general elevation of the surface, to its present position.

Early in the morning we had sent on two men as videttes to see that the high-road, which we here had to cross, was clear; on arrival at *Shib-chilam*, they reported that a beggar with a few goats constituted the only danger visible, so, he having been voted contemptible, we proceeded to cross the *Chirchun* river. The water is muddy and dark-coloured, partly perhaps from its rising in glaciers, but partly also from the rotten black shale which here forms its bed. Having forded the stream, we ascended the high bank and again stood on the surface of the great plateau, which was here somewhat narrowly circumscribed by hills of bold outline. The road, or rather track, to *Kyunglung*, which place was now about 12 miles distant, could be seen for a mile or two in a north-easterly direction over the plain, and then, entering the hills, was lost to us. On the west we saw the track to *Dungpu* to a somewhat greater distance, winding between two low rounded lines of hills, the northern of which abuts on the *Chirchun* river near *Shib-chilam.*

TIBETAN BEGGARS.

Judging from their deep red colour, these ridges may probably be composed of igneous rocks, which are abundant in many parts of *Guge.* The bed of the *Satlaj* was not yet visible, but some low ranges due north of us were pointed out, some of which, we were told, lay on this side, and some on the other side of that river. The coast seeming to be clear, we kept on down the *Kyunglung* road, but before we had got far the alarm was given of a party of strangers coming towards us. An attempt to make out more exactly what they were with a telescope proved fruitless, in consequence of the mirage or haze, which utterly distorted all distant objects seen over the surface of the ground, for the sun was already beginning to show himself in earnest. After some consultation, during which we were quickly approaching the strangers, our people, influenced no doubt by their wishes, declared that they must be Bhotiyas, and not Tibetans, since some of them had on white clothes, which shone out brilliantly in the sun, whereas the habitual dress of the Tibetans is of a dark colour, either naturally or with intense dirt. So we went without hesitation, but to the horror of every one, when it was too late to get out of their way, they turned out to be a party of Huniyas. W. and I instantly tried to sneak off unobserved down a ravine near which we were moving, but the effort was evidently futile. The enemy, however, was plainly not dangerous in point of numbers, the party consisting only of two; so our people, having nearly ten to one in their favour, went on to meet them with great heroism. We soon saw that an amicable arrangement had been come to, and the combined forces, after a short conversation, came to the spot where we had posted ourselves. The Tibetans were two inhabitants of *Dungpu*, one dressed in white, one in black, with square-cut caps, Tartar physiognomy, very dark complexions, and long pigtails, and were well known to our people. They approached us making many polite bows, and, taking off their caps, presented the cloth of ceremony, as was becoming from inferiors to superiors. This is a form which is universal in Tibet, and extends into China, though I do not remember ever to have heard an explanation of the custom. The cloth we received was of cotton, badly woven, but of a fine texture, about the size of a small handkerchief, but so dirty as to show that it had frequently performed similar offices of civility before. The more wealthy classes employ silk instead of cotton cloths, the legend, "*Om mane padme hum*," being commonly woven in damask at each end. The sale of these cloths of ceremony, I was given to understand, constituted a Government monopoly in this part of Tibet. I made out that the strangers felt, or affected to feel, great alarm at having seen us, fearing the vengeance of their rulers, should it be discovered that they had become accessories to our felonious inroad into Tibet. They seemed, however, to have a preponderating respect for our friends the Juharis, with whom they had commercial dealings, and in whose favour the balances of trade were said now to be rather heavy. They were, in short, poor creatures who evidently were neither capable nor desirous of doing us any harm, or of opposing our advance; and after some talk they showed us how we might go straight down to the *Satlaj*, by a ravine near the head of which we then were, and so get out of the public road and at once avoid all risk of further notice. Assurances that they had only to keep their own secret, and a few rupees which we gave them, soothed them considerably, and we parted excellent friends. Before they left, however, we heard from them that nothing was known of us at *Kyunglung*, beyond the old reports that we were coming.

At 2.30 p.m. we stopped at the head of the ravine down which we were to go to the Satlaj, to put up the barometer, and the surface of the plain here proved to be 14,820 feet above the sea. The thermometer was 53°, but slight rain was falling, a storm accompanied by a strong wind having just swept longitudinally over the plain from west to east. The sun had been very hot in the morning, and the usual wind from the south hardly blew, which the Bhotiyas told us was a sign of rain. We here found growing on the dry surface of the plain, which was as barren as ever, *Chamærhodos sabulosa*, a Siberian plant; and an aster, *A. molliusculus*, with a rather handsome purple flower, was also common. A few more grasses were also seen, *Deyeuxia compacta*, *Stipa Eversii*, and *mongholica*, *Oryzopsis æquiglumis*, *Lasiogrostis mongholica*.

The ravine we followed took us gradually down among more vigorous vegetation, and some hares and partridges that we saw showed that the locality was better suited to support animal-life also. The partridge is, I believe, the same species (*Perdix Chukar*) common in the lower parts of the outer Himalaya, and in Kumaon called *Chakor*, but why he should reappear here in a climate so very different is more than I can say. Our people occasionally set to work, and without difficulty ran down three of these birds, which I understand are common throughout Tibet. The hare, *Lepus* [illegible], is also frequently seen all over the plain of *Gugé*, being probably the most common of the creatures we observed. It is remarkable for its white tail, and its singular habit of squatting close to its human enemies.

In passing along the ravine, I noticed that in the proximity of calcareous rocks that were seen to underlie the alluvial deposits of which the plain is composed, the boulders, gravels, and sands are frequently cemented together by carbonate of lime,

RIVER SATLAJ AT CAMP OF SEPTEMBER 9 (LOOKING EAST). ELEVATION, 13,350.

forming a thoroughly solid rock. This appeared to be precisely the same as the matrix which may often be noticed adhering to the mammalian fossil remains that are brought from these regions, and there can be little doubt that it is from some parts of the finer of these conglomerates that the fossils have been obtained. In the conglomerates, caves such as I have already mentioned are likewise common.

As we continued to descend, the horizontal alluvial beds were at length again seen to rest on shales and shaly limestones, which dipped at a high angle most commonly to the north-west, but much shattered and varying considerably in their precise dip and strike. The ravine, which had at first been straight, open, and with smooth sloping banks, now that it entered the solid rock, became much narrower and more tortuous, and ended in an extremely narrow gorge with highish cliffs on either side, from which we had the satisfaction to emerge at about half-past four, on the edge of the *Satlaj*, close to which we encamped.

The spot on which we had thus almost stumbled was rather singular. The river flowed in a beautiful clear blue stream, in a deep and narrow bed, from the banks of which nothing was to be seen but the black shaly cliffs immediately overhead. The upper end of the gorge from which the river issued, seemed at first quite blocked up, but a closer examination showed a rent hardly exceeding 15 feet in breadth, through which the water came with a current that was hardly perceptible, proving the great depth of the channel, for the stream within 20 or 30 yards of its point of issue was already a sparkling rapid, some hundred yards wide, and by no means easy to ford. I thought I saw something like a trap dyke among

SATLAJ RIVER GORGE, ELEVATION 13,350 FEET (CAMP OF SEPTEMBER 9, LOOKING WEST).

the rocks in this chasm, but they were so steep that it was impossible to get at them. On examining the boulders and pebbles in the river, I found that the great majority were of the slates and calcareous rocks of the vicinity, but that a notable proportion were composed of porphyries, only one or two specimens of granite being seen. Similar porphyries have been brought to me from *Sansurga*, on the affluent of the Indus that passes *Gar*, and it is therefore probable that some at least of the intermediate mountains are composed of these rocks, a supposition which is rendered more probable by the fiery red colour of the surface which was remarked by Moorcroft, and which is confirmed by the accounts of the Bhotiyas, who are in the habit of going to the fair at *Gar*.

In the shales near the Satlaj I also found an Ammonite and Inoceramus, showing that these strata are either Jurassic or Cretaceous. We had here descended to 13,350 feet, the lowest point we reached during our expedition, and the vegetation was more cheerful, though still not much to boast of. The largest shrub was *Myricaria elegans*, a plant closely allied to the tamarisk, here growing to a height of 5 or 6 feet, with stems often 3 or 4 inches in diameter. The dama (*Caragana pygmæa*) was more luxuriant than usual, rising to 3 feet or more. We here also found *Clematis graveolens*, greatly resembling *C. Flammula*; *Crepis glauca*, very like a form of the Altai mountains; two species of *Tanacetum*, *T. gracile* and *alternisoides*; and several species of *Artemisia*, or wormwood, a genus largely developed in Tibet, of which may be mentioned *A. sacrorum*, *salsoloides*, and *Roxburghiana*; also *Christolea crassifolia*, a cruciferous plant which might have been added to the list of saline types before given.

We found our encampment on the Satlaj, after the discomforts of the preceding days, quite luxurious. The *Myricaria*, which they told us was abundant at *Gar*, also gave us admirable firewood, an article in which we were speedily becoming connoisseurs, while we were greatly sheltered from the wind, and quite concealed from inquisitive Tibetans.

September 10. *From the Satlaj to Ligchephu, or Likstephu*, 16 *miles*.—Thermometer at 5.30 a.m., 36°·4. Having thus happily accomplished the first part of our projected expedition by reaching the Satlaj without interruption, we now turned off eastward towards the lakes.

As we started to-day, a stray yak was seen on the hillside just over our tents; it was forthwith taken possession of, according to the custom of these parts. The owner, if he is discovered, gets the animal again by paying half its value, and I afterwards heard that this happened in the present instance.

From the bank of the Satlaj we at once climbed to the level of the plain, but, among the low limestone hills by which we found ourselves surrounded, the presence of any alluvial deposit was a little doubtful. The vegetation became as scanty as before. From this position we had a fine view of the Himalayan peaks to the south-west. The morning was splendidly clear, and there was not a speck of cloud to be seen. The mountains at the head of the Milam glacier, and Kamet with its dependencies, came out very finely. Two other very distant peaks were also noted, almost directly down the course of the Satlaj, probably *Porgyul*, rather more than 100 miles off, opposite to which this river makes its great bend to the south. We continued for some time among low hills, and saw many barhal. As we were now again approaching the Kyunglung road, it was necessary to be more careful in our proceedings than on the previous day. The village of Kyunglung was not visible from our road, as it lay among the ravines near the Satlaj; but, understanding that it was one of the highest places in Tibet where crops of grain are produced, we sent a man round to pluck some barley from the fields. He returned to our camp in the evening with several ears nearly ripe. This grain, *Hordeum vulgare*, is the variety, *H. nudum*, the spikelets in two ranks, and grain not awned. He also brought some curious concretionary pebbles, evidently formed from fine shingle encrusted with concentric layers of carbonate of lime, derived from the water of a hot spring that issues from the south bank of the Satlaj opposite Kyunglung. These little pebbles are of all sizes, from that of a pea to a pin's head. They were quite separate one from another, though in a second hot spring at Tirthapuri, on the Satlaj, some miles higher up the river, a compact rock is formed by the agglomeration of similar pisiform spheres. In the Tirthapuri rock, specimens of which are often brought away as curiosities by the Bhotiyas who visit the place, the grains are very uniform in their dimensions, much more so than the Kyunglung pebbles. Both these springs are said to be very hot, that at Tirthapuri the hottest, so that it is disagreeable to put one's hand in it. The Kyunglung spring, from the accounts given of it—and it is noticed by Moorcroft at some length—is no doubt charged with sulphuretted hydrogen, the offensive smell of that gas affording an easy means of recognizing it. I should add that the water of this spring, besides coating the pebbles as above explained, forms a large bed of tufaceous limestone, which is remarkable for its pure white colour and its friable texture.

Our route now lay over very uninteresting, undulating ground, dry and barren in the extreme; there was no road or even track, and the sun meanwhile was getting intensely hot. We halted about noon to rest the cattle at a place called *Gam*, where there was a small spring, and sought in vain for some shelter among the stunted bushes or rocks, none of which, however, rose high enough to afford even a little shade for our heads. The exposure during the heat of the day had by this time completed the removal of the skin from our faces. The extreme dryness of the air, and the cold winds, combine with the intense power of the sun to produce this effect, which is exhibited on the blackened faces of the Tibetans themselves, the poorer classes of whom are nearly as dark as the natives of the plains of Northern India. All about the halting-ground at *Gam* were many small pillars, built of dry stone, which we were told were erected by the Huniya shepherds to scare away the wolves and leopards from their flocks. The last-named animal is the ounce, *Felis uncia*. He is characterized by his long tail and the obscure markings of his skin, which is of a dull ash-grey colour. He is not uncommon in Tibet generally, and descends as low as 10,000 feet among the Himalayan valleys, and, it is said, often makes much havoc among the sheep. The wolf, called *shang* by the Tibetans, and the same species, I believe, as the wolf of Europe, offers curious example of the reappearance in the open regions of the Tibetan plateau of an animal which, although quite unknown on the wooded slopes of the Himalaya, is very common in the plains of North-Western India, and shows how the conditions of surface affect the development of animal-life, no less strongly than those of climate and temperature.

On leaving *Gam*, we gradually ascended. I set up the barometer on one of the highest parts of the ridge, 15,940 feet, which we crossed on our way from the *Satlaj* to *Ligchephu*, and while so employed was overtaken by a violent hailstorm accompanied by thunder and lightning. We saw this storm, like that of the previous day, driving up from the west, looking very black, and it passed on over us towards the lakes. The regular south wind had been wanting to-day also, and this had no doubt made the sun's power seem to us so excessive. During this storm the temperature of the air was not below 46°.

We now began to descend towards the foot of the hills which here separate the Satlaj from the great plain of *Guge*. Our route first lay over a flat piece of ground, which looked like a portion of the alluvial deposits of the plain that had been pushed up a few hundred feet more than the rest.

The halting-ground—for it is nothing more—called *Ligchephu*, soon became visible, marked only by a patch of green, under some limestone cliffs at the edge of the great barren plateau below us, while some small pools of water beyond it showed the position of the river by which we were to halt. We reached our camp at about 6 p.m.; it was pitched near the half-dried-up river-bed, on ground which, though now dry, looked as if it were at times swampy, or even altogether under water.

The evening was very fine, and the setting sun lighted up the mountains on the east and south-east most brilliantly, showing us very distinctly the towers at the place called *Lama-Chorten*, distant about 15 miles across the plain, close to which my brother passed on his visit to the lakes in 1846. *Lama-chorten* is the first halting-ground in the open plain of *Guge* on the way into Tibet from the Himalayan valley of *Darma* and *Byans*, by the passes of *Kach*, *Nyue*, and *Lankpya-lekh*. The buildings called chorten or choktan by the Tibetans are votive edifices, which are described by my brother as "little towers of dry stone, stuck about with dags." These particular customs, I was told, are [illegible] the married women of *Darma* as a [illegible] offering for their husbands' safe return from their travels in Tibet, and it is a common joke that the young unmarried women also set up their [illegible] in hopes of getting husbands in whom they may take a similar interest. It may here be mentioned that the people of *Darma* and *Byans* are so Tibetan that they have not adopted the Hindu customs of marriage, which, however, prevail to a great extent amongst their neighbours of *Juhar*. The girls of *Darma*, accordingly, instead of being betrothed and finally disposed of when mere children, are not married till they are grown up, when their own views are more or less consulted.

The sight of these [illegible] towers, which they were enabled to see distinctly by help of a telescope, greatly amused the less instructed of our Bhotiyas, and they talked of it for days afterwards.

This day had been particularly barren of botanical interest, not a single novelty being added to our list. The elevation of *Ligchepia* is 14,950 feet. At [illegible] thermometer in the air, 44°, in the tent, with the help of the fire, 58°. These figures will show the effect of the fire. In general we managed to keep the temperature inside about ten degrees above that of the external air, but only so long as the fire was burning, and in the morning there was generally but little difference of temperature between the inside and outside until the sun rose.

September 11. *Ligchepia* to *Gunda Yankti*, [illegible] miles.—At *Ligchepia* at sunrise about 6 a.m., thermometer [illegible]; at 7 a.m., air, 33°; earth, a foot below the surface, 50°. The river at *Ligchepia* is the *Chu-nakti*, or Black river. The part of it which will be seen from the map to bend suddenly back below this place, flowing nearly in an opposite direction to its previous course, is locally called *Bipha Kiu*, a name meaning "contrary-flowing," and the *Bipha Kiu*, therefore, is not a distinct stream, as was supposed by my brother. There is a great difference between the rivers in the eastern part of *Gnari*, from the *Chu-nakti* inclusive, and those in the west. The latter all flow in deep ravines, the depression of which below the surface is often exceedingly great. The beds of the eastern rivers, on the other hand, are all shallow, and not sunk more than 25 feet or so below the general level of the plain. This difference, which gives a totally different aspect of the two ends of the plateau, is readily explained by reference to the gradually increasing depth of the bed of the *Sutluj* as it flows westward, combined with the circumstance of the channels both of the minor streams and of the *Sutluj* itself being more in solid rock in the eastern parts of the plain, and more in unconsolidated alluvial matter in the west, where the thickness of those deposits is very much greater. The *Chu-nakti* was at this season but a small stream, broken up into several different channels, all very shallow, and evidently constantly shifting their positions.

Leaving *Ligchepia* behind us, but still having on our left, at a distance of a mile or two, the hills from which we had descended the evening before, we forded the river and struck across the plain. Its surface was almost perfectly level, covered with small shingle, and having quite the appearance of a dried-up lake. This continued with no variation to the *Gunda Yankti*, a stream somewhat larger than the *Chu-nakti*, with a bed 200 yards wide, its water also flowing in several different channels, and sunk about 25 feet below the plain. This section shows nothing but gravel, finer, however, than that seen in the larger ravines near *Tisum*. On the banks of this stream grows a small *Hippophaë*, *H. rhamnoides*, a species found on the east coast of England, which we had before met on the edge of the Milam glacier. It was here covered with small yellow fruit, which was exceedingly sour, though of a pleasant flavour, and it was eaten most voraciously by the Bhotiyas as they passed.

Beyond the *Gunda Yankti*, about 4 miles more of the plain brought us to the rma Yankti, a stream still larger than the former, but quite similar in character. here again approached the hills more closely, and finally encamped at an altie of 15,230 feet, under a low ridge round which the river flows.

Our march to-day was short, and after our journey was over I attempted to ke observations with the theodolite to determine the height of *Gurla*, which untain was becoming a more and more prominent object as we approached it. t a cold wind, which did not subside till late in the evening, was blowing th great force all the afternoon, and made it very difficult to observe angles with y degree of nicety. From the point where I had taken up my position, I looked er the plain towards *Tisum* for not less than 25 miles, but the view was rendered ry indistinct by the mirage, which was so great that objects near the horizon st their true forms even at short distances, and became quite confused, appearing quiver and flicker as much as ever I saw them do in India.

On our road to-day we again observed a wolf, and some small antelopes (*Propra picticauda*), but too far off to come within range of Bachu's gun; many *yang* were of course seen. The vegetation was still most meagre, *Oxytropis tracheyana* being the only novelty. In the evening we held a council to consider ur route, and determined to go on *viâ Gyanima*, intending thence to turn up to he north of *Rakas tal*; a plan, however, that we next day changed for the southern oute, which we actually followed. At 9 p.m., thermometer in air, 41°·8.

September 12. *Darma Yankti to Gyanima*, 10 *miles*.—At 6 a.m., thermometer 28°; at 9 a.m., 53°.

Hugging a projecting point of the low hills on our left, or to the north, the summits of which barely reach a height of 15,400 feet, and leaving on our right two or three small detached hills that rise abruptly from the flat, we made directly for the so-called fort of *Gyanima*, or *Nima-khar*, the former name being a compound of the Tibetan words, *Gya*, "splendour," and *nima*, the "sun;" the latter of *Nima*, the "sun," and *khar*, "fort." The hill on which the fort stands soon became visible, though the lake at its foot did not appear till some time afterwards. The miserable slow pace of the cattle, the great power of the sun, and the extreme violence of the afternoon wind, made us heartily sick of this arid plain, which offered no novelties in any shape whatever to engage our attention during the hours we were crawling over it. At last we came sufficiently near to the lake to make us brighten up a little, for we knew that there would be Tibetans encamped with their cattle on the pastures along the water, and it was necessary to be careful where we went. The mirage, however, was so strong again to-day, that it was difficult to make out objects with a telescope any better than with the naked eye, and a solitary wild donkey standing in our way kept us on the *qui vive* for some time. When at length he was clearly distinguished, we went on with additional confidence, for his presence showed that men were still far enough away. By degrees, as we approached the water, the haziness became less, and we saw distinctly several encampments a mile or two off. There were clusters of small black tents, with cattle grazing near, and human figures were seen moving about them. We were so little elevated above the sheet of water that its form could not be made out, but we saw that it extended to the north-west many miles in length, and that its borders were fringed with vegetation, the dark colour of which contrasted with the pale bare surface of the plain beyond. On the opposite side of the lake rose fine-looking hills, bold and utterly barren; they are the highest between the Indian watershed and the *Satlaj*, and yet we could only discern a single small patch of snow on one of the highest summits, which I afterwards determined to be 18,400 feet above the sea. Their rich reddish-brown tints made it probable that they were composed of some of the igneous rocks on which we were just entering.

The plain over which we had been travelling for the last two days, its perfectly level or gently sloping surface covered with shingle, the mountain slopes which bounded it, and the detached hills that rose from it, presenting cliffs that sloop up abruptly like rocky coasts and islands, forcibly suggested that here was the dried-up bed of some great lake or inland sea, to which the effects of the mirage frequently gave a wonderful reality.

The hill of Gyanima is an isolated mass of eruptive rock, chiefly hypersthene or bronzite. The surface is much fissured, and the rock breaks up very readily into small fragments. Coatings of serpentine and siliceous matters are also common on the faces of the joints, and it weathers to a reddish-brown colour. The regular road lies through a depression in the middle of this hill, which our cavalcade therefore avoided, moving off round the south-east extremity, under the further angle of which our camp was formed.

TIBETAN TENT.

I myself went straight down to the lake, passing tolerably close to a Huniya tent, the people near which, however, took no notice of us. The ground at the north-west angle of the hill over which I passed is customarily occupied earlier in the season by the Juhari Bhotiyas, who encamp here, as I was told, this being one of the regular marts for the traffic between the Tibetans and the people of the upper Himalayan valleys, the former bartering salt and borax for grain or Indian or European commodities brought up by the Juharis. The soil was covered with green turf intersected by numerous small streams, and in some parts was even a little boggy. *Ranunculus aquatilis* and *Hippuris vulgaris*, or horsetail, both common English plants, were growing in all the pools; *Ranunculus cymbalariæ*, a small creeping species with tridentate leaves, is common in all the valleys of Hundes, and widely diffused over Northern Asia and America; two *Gentians*, and a very small purple *Primula*, *P. Tibetica*, not exceeding an inch in height, were abundant amongst the herbage. In the streams, which were usually only two or three feet in depth, were many small fish. One of these we managed to catch, and our Bhotiyas said that when they are encamped here they get plenty of larger size. Men stand in the shallower parts of the streams with sticks, ready to strike at the fish, which are driven down from some distance by another party, who come along in the watercourses. I saw no large fish, however, and it was suggested that they had retired into the lake, as it was now getting cold again; and it is possible, for these small rivulets must cool down much before the general mass of water in the lake.

Not being certain whether or not there might be any one living in the remains of the old fort on the top of the hill, we did not venture to intrude upon it, but we were given to understand that it consisted only of the ruins of the walls. I did not gather that any historical or mythical interest was attached to the ruins. From the foot of the hill, however, we got a good view of the lake, which is a sheet of water 10 or 12 miles long, but nowhere probably much more than a mile in breadth. From its lower end, I was told, a stream flows off and joins the *Darma Yankti*, which soon afterwards unites with the *Gunda Yankti*, and the combined river then takes the name of *Chu-kar*. The upper end of the lake where we stood terminates in pools of water and swamps, a very small stream only flowing in from this quarter. The ground along the edges of the water was generally low, and many Huniya encampments were dotted along the banks, with immense flocks of sheep, herds of yak, and a few horses, all of which we saw very distinctly with our telescopes. Innumerable waterfowl covered the spits of mud that ran out into the lake at this southern end, and large numbers of birds were also collected about the pools and swamps. Of these may be enumerated a fine large grey bustard with black neck and tail, grey geese, ducks, teal, snipe, terns, sandpipers, curlew, a fishing-hawk, and small heron. The bustard refused to be shot, and walked off triumphantly as the sportsman approached; and a goose, anxious, I suppose, to support the reputation his family has earned, was the only victim of Bachu's arts. Sticking to one of the feet of the goose was a small leech.

The ground all about our camp was covered with the burrows of a small rat-like animal with a very short tail (*Cricetus songaricus*), a specimen of which I afterwards managed to catch.

Along the foot of the hill issued many copious springs, the temperature of which was 36½°. The open running water in the afternoon, about five o'clock, was 43°, and the temperature of the earth 9 inches below the surface, 47°. The surface of the lake was calculated to be 14,880 feet above the sea.

On returning to the tents after our short stroll to the point overlooking the lake, we found our company drinking tea in the Tibetan style. This is quite a different operation from the Chinese or European infusion system. The tea used is of the description known as brick-tea, which is tightly compressed into brick-like blocks. It is boiled with carbonate of soda and butter, flavoured with salt, and thickened with barley-meal, thus forming a sort of soup. To my taste this particular brew was simply nauseous. The compound, when concocted with proper materials and on scientific principles, is declared by competent authority to be good. I suppose, therefore, that as there certainly are differences in English teapots, so there are also in Tibetan kettles. Tea-drinking is a constant occupation for a Tibetan. In every tent and in every house the tea-kettle is always on the fire. The laws of hospitality bind all to present tea to their guests, and every Tibetan carries with him a wooden bowl of Himalayan maple by way of teacup. The universality of tea-drinking in Tibet is such that it would appear to offer a good market for the produce of the Himalayan tea plantations. At 8 p.m., thermometer 36°.

September 13. *Nima-khar to Jungbwa Tol*, 20 *miles*.—At 6 a.m., thermometer 23°·5. This temperature may perhaps have been affected by radiation, but the cold had been rapidly increasing during the last few days, when the rainy weather on the Himalaya seems to have ended. At 8 a.m., thermometer 42°. Leaving *Nima-khar*, we crossed the plain at the head of the lake, here something under a mile in breadth, and came upon low rounded trap-hills, similar in their constituents to the hill of *Nima-khar* before described. A few isolated points also projected from the middle of the plain.

We had now reached the extreme eastern end of the great plateau of Guge, and entered a hilly country characterized by numerous valleys with perfectly flat alluvial bottoms by which it is intersected. Most of these were quite dry, small streams existing only in a few of them. This circumstance, added to the almost perfect horizontality of their transverse section, their general agreement in elevation with that of the great plateau, the abrupt rise of the rocky hills on either side of them, and their general uniformity of breadth for considerable distances, seems quite to preclude the possibility of existing agencies having caused them. They must, without doubt, have been produced by the action of currents in extensive bodies of water that have formerly been spread over large portions of the plateau, but I cannot say that there seems any decisive evidence to show how or when this action took place. I have elsewhere given my reasons for believing that the alluvial deposits of *Guge* were first laid out by the ocean. The valleys to which I am now alluding may either have assumed their characteristic forms before the elevation of the great plateau above the sea-level, or they may have been formed after some partial elevation, when lakes much larger than those now remaining still existed, the waters of which have been since drained off.

Crossing over a considerable spur from the high hills north-east of *Gya-nima*, we again descended into a broad level valley, which, by taking a more circuitous route, we might have followed the whole way from the lake. Up it we had, for the first time, a complete view of the grand dome-like peak of *Kailas*, distant from us about 35 miles. This valley, which is about half a mile wide, is called *Tara*. It had once been green, no doubt, but was now quite burnt up and yellow, and it is probably only in the spring, when the snow is melting, that the vegetation has any activity. A little further on we came to a stream in which we saw many small fish. We managed to catch a good many, but through the stupidity of one of my servants, they were unfortunately all thrown away soon after my return to Kumaon. They were of three species—the largest about 8 inches long, with scales, no doubt carp (*Cypridæ*); the others 4 or 5 inches long, with cirrhi and without scales (*Siluridæ*). The stream seemed nowhere to be more than three feet, and was generally only one foot deep, and during the winter it must certainly have been frozen into a solid mass, with all it contained. The question naturally arises, Do the fish live through the winter frozen up with the water? The only way of getting over the difficulty, if this be a difficulty to a fish, is by supposing that the stock is renewed every year from the lake at Gyanima, at a season when there is sufficient water to supply a continuous stream the whole way along. When we were there no such communication existed, and the bed of the stream was in many places dry, but while the winter's snow is melting off, the quantity of water may be larger. This valley we followed up for many miles. It was bounded on either side by trap hills covered with loose stones, and utterly bare of all vegetation. The diminutive stream at its bottom had green margins, which now afforded but scanty pasture, for the ground had been closely cropped by the flocks of the Huniyas. The valley was now abandoned, but we everywhere saw signs of their old encampments. After a long and tedious march, in which the previous labours of the sheep and goats rendered our herborization null and void, we passed the watershed, beyond which the drainage begins to fall into *Rakas-tal*. The division of the waters is hardly marked, the two valleys running into one another with hardly any interruption. The summit level is probably not more than 200 feet above the level of *Rakas-tal*, or 15,200 feet above the sea. We here, for a short distance, went over the same ground that was passed by my brother in 1846. He, however, ultimately turned off round the north end of *Rakas-tal*, while we made for its southern border.

It was now nearly sunset, and we were rapidly approaching *Jungbwa-tol*, where camps of Tibetan shepherds were certain to be found, and, what was worse, Tibetans who knew our Milam people. One of them was known to have left Milam only a few days before us, and if our party was discovered, it would have been at once detected that we had no legitimate business here. Nobody knew the precise localities, so it was clearly desirable to come to a halt before dark, as otherwise our difficulties might have been much increased. Scouts were consequently sent on in advance, and we anxiously looked for water, without which we could not halt, but water there was none. Thus forced to advance, we very soon received a report that we were close to some Tibetan encampments, and, turning a corner, we looked through a side ravine into a most inviting green valley with plenty of water; but it was not for us, and we passed rapidly on. Hoping to get a better idea of the localities, or to be able to discover some place where we might get water, I started up the hill on our left, from the top of which I looked down into the valley we had just seen. It was wide and open like that of Tara, with a stream or succession of pools of water tolerably near; but it was fully occupied by Tibetans, and we could do nothing but go on. In coming down the hill, I descried some large flocks of sheep in the valley directly ahead of us, so it was evident that we must run the gauntlet of our supposed enemies. We went on, therefore, as boldly as might be, the Bhotiyas in a desperate fright, and, on turning a projecting point, we found that the valley along which we had come opened into another larger one, in which we saw, within a quarter of a mile of us, two Tibetan encampments on our right and one on our left. It was now dusk, and as turning back was out of the question, we went to what appeared to be a stream in the centre of the valley, but to our utter disgust it was quite dry. However, a halt had now become quite unavoidable, and, moreover, it was plain, as the Huniya tents were so near us, that water must exist close by. So here we encamped.

Boru, the Padhan of *Tola*, who by this time had shown himself to have far the best head of the party, was immediately sent off to reconnoitre. He fell in with an old woman who was driving home a flock of sheep, and soon came back and reported that the *dong*, *i.e.* pastoral encampments, belonged to shepherds from *Hortol*, a place the other side of *Manasarowar*, who were pretty certain not to know any of our people. Water was also pointed out in the bed of the stream close by, and matters appeared to begin to mend. By this time the night had set in, and the moon was shining brightly. Our tents were just pitched, when from one of the camps near issued a most alarming-looking horseman, who rode straight down towards us, the long dark shadows adding to the terrors of his appearance, but the spectre dissolved into nothing more than the reality of a boy taking home a stray pony.

As it was now getting dark, and every one was tired, Boru once more started with one other Bhotiya for the nearest Tibetan tent, to see how far our more pressing wants could be supplied without further exertion on the part of our men. He very soon returned with a large bundle of firewood, and a great copper pot of water for immediate consumption. Boru had most successfully imposed upon the Huniya, but it was, nevertheless, at once noticed, from his dialect, that he came from Juhar—a matter, however, which was of course instantly explained away. The other Bhotiya affected not to understand Tibetan, so that he could not have awkward questions put to him. The Tibetan, though most polite in most particulars, was firm on one point—he flatly refused to give us milk, although the money was produced. It was unlucky, he said, to sell this at night, but we might have as much as we pleased in the morning. On the whole, we seemed to have got well out of our scrapes, though our scanty supply of wood sent us to bed miserably cold, and with a rather less luxurious supper than usual.

September 14. *Jungbwa-tol to Camp south of Rakas-tal*, 8 *miles*.—It had been settled beforehand that W. and I were to start by daylight, leaving the rest of the party to follow a little afterwards, so that we might escape observation as much as possible. We had a cold walk for about a mile over low hills, still composed entirely of eruptive rock, and of the same rounded forms that we had met on the previous day. On getting to the top of a ridge which we reached before sunrise, we saw in the valley below us, and the direction it was supposed we ought to go, the smoke of another Huniya encampment. As the single Bhotiya we had taken with us knew no more of the country than we did ourselves, we thought it best to stop here till the main body came up, so that we might then go on together, for in such rugged ground it might have been difficult to find our party again if we had once diverged from the proper track. We sat on the top of the hill for a long time shivering in the cold, with the thermometer some four or five degrees below the freezing-point. The only thing that could be seen was the smoke curling up from the valley below in the faint grey light of the morning, and the silence was broken only by the barking of the dogs about the tents. At length the sun rose, and we found that we were overlooking a broad flat valley, the continuation of that in which we had encamped, which manifestly led down to *Rakas-tal*. The shepherds soon were stirring, and not long after we saw their flocks driven off to graze. The appearance of the sheep on these bare hills, which present no objects of known magnitude by which the eye can rapidly form a correct estimate of their distance, was most deceptive; even till the last, when among these barren wilds, I was quite unable to distinguish offhand, even at moderate distances, between sheep and white stones, or between dark objects, such as bushes and men. In the Himalaya, in looking across a deep precipitous valley where there is no gradation of distance, owing to the centre of the picture being unoccupied, I have often found it difficult in like manner to judge of magnitudes, and have consequently mistaken goats for cows, and *vice versâ*.

Our people now soon came up, having left their ground without the least suspicion being raised. We all started again together, straight across the hills, nearly due west, over such ground as no beast of burden but a jhobu could have passed; at one time climbing rocks, at another floundering down infamously steep slopes covered with loose fragments of stone, to face which on the backs of our cows required some nerve even after the apprenticeship we had gone through in the previous part of our journey. This rough riding rapidly carried us clear of the pastoral Tibetans, and it was not very long before we were rewarded by a first sight of the sacred lakes. On turning a corner on one of the ridges we had to cross, we suddenly caught a glimpse of the beautiful blue water of *Rakas-tal* sparkling within a few miles of us. Through a depression in its further shore, a small portion of the lake of *Manasarowar* could also be distinctly traced as a small dark line, beyond which rose a distant range of purple mountains.

We stopped to breakfast in a ravine, near which many of the Sikh or Dogra invaders of this country were said to have perished in the winter of 1841–1842, chiefly from the cold. Their bones and those of their cattle, with remains of clothing, etc., were pointed out to us as we went along. What we saw were the remains of some of the less fortunate parties of fugitive Sikhs. The Sikh expedition has made so strong an impression on the Bhotiyas and the people of these regions, that the year in which it took place is invariably referred to as the *Singh Sal*, *i.e.* the Singh or Sikh year, when allusion has to be made to events that happened about that time.

Among these ravines the vegetation was a little more vigorous, and had been less disturbed by sheep or goats, and we added a few plants to our collections, of which I may name the small willow, *Salix sclerophylla*, not uncommon; *Rheum*

Moorcroftianum, a species of rhubarb very common in Tibet; a handsome gentian, *G. nubigina;* and *Lagotis glauca*, a plant of Northern and Arctic Asia; *Arenaria Stracheyi*, and *Pleurospermum Hookeri*. The rugged nature of the hills that here flank the southern shore of *Rakas-tal*, or, as it is called by the Tibetans, *Tso-Lanak*, *Tso* signifying "lake" in their language, obliged us to keep at some distance from the water's edge, and to ascend to a considerable height above its level. In crossing one of the ridges on our route, a magnificent view of the lake at length opened out to us, though it must be confessed that the frightful south wind, that had already begun to blow with extreme violence, rendered real enjoyment very difficult. The lake of the *Rakshasas*, or "Demons," is of a somewhat irregular form, about 20 miles in extreme length from north to south, and about 12 miles in extreme breadth across its southern end; its northern half, however, nowhere exceeds 6 miles in breadth. As I cannot improve on my brother's description of this lake,

Peak of Kailas, 22,000 feet.

LAKE OF RAKAS-TAL OR TSO-LANAK, 15,000 FEET.

I extract it entire: "The snowy mass of *Momanangli*, a name now replaced in our map by the more euphonious one of *Gurla*—and the authorities on which this last name rests must not be examined too curiously—was again conspicuous to the south-east, and from the base of the mountain a lofty range of hills, partially tipped with snow, stretched north-westward, separating the lake from the head-valley of the Karnali, and forming its south-western banks nearly parallel to the course of the river." Across the spurs on the north face of this range, I may observe, we were advancing, and though a little snowy when seen by my brother, it was at the time of our visit quite bare, excepting in very few spots in the most retired ravines; the snow that he saw having no doubt fallen during the bad weather that immediately preceded his visit to this part of Tibet. The highest points of this ridge rise somewhat more than 2000 feet above the lake, or say 17,500 feet above the sea. "These hills," continues my brother, "rose abruptly out of the water in bold rocky banks, with many deep inlets, promontories, and one or two islands of the same character. This part of the lake is altogether so irregular in outline, that it could hardly be defined without detail survey and close inspection of every point. The eastern shore was bounded by shelving ground and low hills, the south end being a good deal recessed eastward into a deep bay, the middle part advancing further westward in a rocky bank of moderate height, and the north end sweeping round to the westward as far as could be seen, with a margin of green grassy plain, from the bank of which the *Kangri* mountains rose in dark steep slopes. The main peak of *Kailas*, now beautifully developed to its very base, was seen on the extreme left of the range (so far as visible to us), and over the low hills in the middle of the eastern shore, a streak of bright blue showed a distant glimpse of *Manasarowar*. The western shore of the lake was undulating ground or low hills, over which we had been travelling this morning, at the foot of steep and lofty hills here and there streaked with snow." The highest of these hills, I may again notice, our subsequent operations have shown to rise to 18,400 feet above the sea, or above 3400 feet above the lake. "The water of the lake was of the clearest, brightest blue, reflecting with double intensity the colour of the sky above, and the northern horn of the water, overshadowed by the wall of mountain rising above it, was darkened to a deeper hue, partaking of the fine purple colour that distinguishes the rocks of *Kangri*. Fresh breezes broke the surface of the water into waves that rolled upon the shore. The surrounding hillsides, though very bare of vegetation, were tinted with many shades of red, brown, or yellow, happily varied with the margins of verdant grass in other parts of the shore, and bright sunshine spread a warm glow over the whole landscape, entirely divesting it of the cold barren aspect that might be supposed inseparable from these intemperate regions."

We halted for the night at an elevation of 15,440 feet, in one of the ravines at about a mile and a half from the edge of the lake, any view of which, however, was prevented by the precipitous character of the intervening ground. The distance we had travelled was perhaps not much more than 6 miles in a direct line, but the extremely rugged nature of the country caused us to make long *détours*, which greatly increased the length of the journey. Thus far the rocks were entirely of the same eruptive nature as before, chiefly hypersthenic, and the surface was everywhere covered with loose angular fragments, generally of a dull red colour, and utterly barren excepting in the ravines.

A further consultation was here held as to our route. The Bhotiyas protested most vehemently against passing along the northern edge of *Rakas-tal*, under the Tibetan settlements of *Darchin* or *Tarzum*, excepting during the night—an arrangement that we thought would be highly objectionable, for we found the day marches quite sufficiently painful, and very little could have been seen at night to compensate for the discomforts we must have put up with. We determined, therefore, to continue our course round the south end of *Rakas-tal*, and to go up between the two lakes as far as *Ju*, at the north-west corner of *Manasarowar*, where the point of efflux of that lake was supposed to be. This we were anxious to see, for Moorcroft had denied the existence of any opening there, though my brother had crossed a large stream some miles to the west of *Ju*, which he was informed came from *Manasarowar*. We proposed to return from *Ju* to this place, and thence, crossing the ridge to the south of us, to proceed by the *Karnali* valley back towards *Tazang;* and we therefore here left behind us a depôt, only taking on with us eight men and ten jhobus, with supplies for five or six days. At 6 p.m., thermometer 28°.

September 15. *Along the South Shore of Rakas-tal*, 10 *miles*.—At 6.15 a.m., thermometer 28°·2; at 8 a.m., thermometer 29°·5. Close to our camp we came upon a direct track, said to be one of those leading from *Jungbwa-tol* to the valley of *Purang*. The road—a mere track for men and cattle, any approach to wheeled carriages being utterly unknown in these regions—comes round this way, apparently out of the direct line, to avoid the high rugged hills along the flank of which we had been travelling yesterday, for the ridge becomes much rounder and less elevated at its eastern end. We followed this track for about a mile, and then, hoping to be able to keep along the edge of the lake, we turned down a ravine to the left, which we followed till we reached the water. We saw many wild animals as we passed through these rugged and secluded hollows—several herds of *Ovis Burrhel*, and, for the first time, a few of the larger wild sheep, *Ovis Ammon*; also a large colony of marmots. We got to the water's edge about noon; the altitude of the surface I have calculated to be just 15,000 feet—that is, about 750 feet lower than the summit of Mont Blanc. The temperature of the air was 45°·3; that of the wet bulb, 33·8°; and of the water of the lake, a little over 50°. The latter cannot, however, be taken as the general temperature of the lake-water, for the bottom was very shelving, and it was not possible to reach the deep water. On the following morning, at about 8 o'clock, the water was 37°, and the air 33°; at 10 o'clock, the water was 45°, air 38°, and wet-bulb 29°; and on our return to *Rakas-tal*, three days later, the edge of the water early in the morning was just frozen in some places for a foot or two from the shore, the air-temperature falling to 22°·8.

We were, after all, disappointed in our hopes of being able to go along the edge of the lake, for steep cliffs shut in the little shingly bay into which we had come, and forced us to ascend again over the hills, which had now become so much less rugged that the ground was in parts almost level. At this time, the peaks of *Gurla* and *Kailas* being both quite clear of clouds, and the wind not having yet set in with much strength, I thought the opportunity might be taken to determine the heights of the two peaks trigonometrically. I therefore stopped to set up the theodolite at an elevation which proved to be 15,970 feet above the sea. But before the last angles were measured, the wind had become so dreadful, and we were all so utterly perished with cold, that I was on the point of giving it up as impracticable, and I was not surprised to find, on subsequent examination, that a mistake had been made in one of the angles. This, however, was of no real importance, as the more careful triangulation of the following year has made good the deficiency. The violence of the wind on this occasion may be conceived when I mention that a 100-foot tape, used for measuring my working base, had its ends successively torn off, one after the other, by the mere force of the wind, in the hands of my friend Mr. Winterbottom, while he was endeavouring to draw it straight.

While I was delayed at this job, all the rest of the party went on with the exception of two men and as many jhobus, one for me to ride, and the other to carry the theodolite; and I was only too glad to be off when the last angle was observed and the instrument put back into its box. By the time I came up to our camp it was very nearly dark, and as the tents were pitched in a rather out-of-the-way nook within a few hundred yards of the edge of *Rakas-tal*, and no one had remembered to look out for us, I was as near as possible passing on without finding them. Luckily, I saw a man's head appearing over the top of a hill, and on examination he proved to be one of our people getting firewood. The pleasures of a bivouac in the open air that night would have been questionable, for we found it most miserably cold in the tent, and, contrary to custom, the wind continued to blow nearly all the night. The thermometer at this time was not very low, for when I set up the theodolite at half-past two it stood at 47°, and it was probably not below 32° when I reached our tents; but no clothing will keep out these intolerable winds excepting furs or sheepskins, with which we had not provided ourselves, but which every traveller in Tibet ought to take with him, even in summer.

September 16. *From Rakas-tal to Manasarowar*, 14 *miles*.—At 6 a.m., thermometer 20°·8. We started to-day over undulating ground slightly broken up by ravines, and were enabled accordingly to keep pretty near to the margin of the lake. The rock at the commencement of our day's journey was still the old hypersthenic trap, but we almost immediately came upon mica schists and fragments of granite. I cannot positively say whether we passed over any granite *in situ*, but *Gurla*, at all events, seemed in great part to be constituted of that rock. This mountain was now so close to us that the summit was possibly concealed by some outlying spur. The grey granite stood up strangely among the pure white snow, and the pale and spectral masses contrasted finely with the deep reds of the surrounding trap hills and the purples of the *Kailas* rock on the north. A long open slope brought us to *Lagan-Tung-kong*, a small ruined mud hut or dharmsala at the south-east corner of the lake; as we approached, a horseman left it apparently rather in a hurry, and went off rapidly along the road to *Purang*. He seemed as anxious to get out of our way as we were to avoid him, and in a country such as this, where there is no law, still less any police to enforce it, it is not wonderful that travellers are a little shy of making acquaintance with strange parties of men. We were by this time becoming aware of this fact, and began to calculate on not being very rigorously scrutinized by persons whom we might meet by accident on the road. We reached the water's edge at the extreme south-east angle of *Rakas-tal* about 10 a.m., and the wind now blowing lightly from the north, small waves were breaking on the shore. The thermometer was 38° in the shade.

Beyond this point the ground separating *Manasarowar* from *Rakas-tal* rises rather steeply to about 300 or 400 feet above the level of the lakes, being apparently altogether composed of alluvial deposits made up of pebbles, precisely similar to those now found on the beaches of the two lakes, of granite, mica schists, and quartzites, sometimes cemented together and forming conglomerates, but more commonly in the state of loose gravel. The general structure of this alluvial mass is so perfectly identical with that of the deposits of the great plateau that they must all be held to have had a common origin; but it is impossible to offer any opinion as to the probable time at which this particular portion assumed its present position relatively to the rest, whether before, with, or after the general movements that have elevated the whole. On this soil the vegetation was again a little more cheerful than on the miserably barren trap hills we had been passing over for the last three days, but still no novelty was seen. As we reached the summit of this ridge, we at length came into full view of *Manasarowar*, in honour of which event our followers did homage to the sacred lake by prostrating themselves at full length on the ground. All along the roadside—for we were now again following a well-beaten track—were a number of little piles of stones erected by travellers who have passed. A similar custom exists in India, and it has perhaps been introduced into Tibet by Hindu pilgrims. It is said to originate in the fancied sanctity attaching to the construction of a house at any holy spot, and those who are too poor to build substantial mansions get over the difficulty by setting up half a dozen stones one on another. Multitudes of such piles may be seen at Hardwar, raised by the devout Hindus in the bed of the sacred Ganges. The same thing is seen at *Badarinath*, at the point where the temple first meets the eye of the pilgrim coming from the south. These small piles must not be confounded with the larger cairns which the superstitious of so many nations, including the Hindus and Tibetans of the Himalayan regions, raise at certain spots, more particularly on mountain passes. To these every well-disposed traveller adds his contribution, usually a stone, though in some places shreds of rag are seen stuck on a bush, or the pile is made up of twigs instead of stones. Accumulations of all sorts of oddities are often found on these piles, among which horns and skulls of wild animals, fossil shells, bits of crystal, or eccentric-looking stones invite the sacrilegious attacks of European travellers, and many of my specimens of ammonites are spoils of this description. The Bhotiyas have no scruple in assisting in such proceedings, and I may add that they generally appear to care but little, unless impelled by considerations of temporal expediency, for the superstitious practices of their Tibetan or Hindu neighbours. These votive cairns are by the Tibetans called *Lapcha*, though this word is perhaps more properly applied to a substantial tower built to receive votive offerings.

Manasarowar is the Indian name of this lake, which in Tibet is called *Mapham*. It is nearly rectangular in its general form, its shores extending from north to south and from east to west, about 12 and 15 miles respectively. Cliffs rise abruptly from the water only at its north-west angle; on all other sides it seems to be bounded by sloping banks or by a shelving beach. Though in form far less picturesque than *Rakas-tal*, it is, when viewed from the south-west corner, set off by a much finer background of mountains. Towards the east the ranges were difficult to distinguish, nor did I make out any visible depression of any importance for the passage of the road to *Lhasa*, though we know that such exists. The water is, on the whole, of the same intense blue as in the other lake, but some parts showed a quite sea-green colour, a circumstance also noticed by Moorcroft, and caused, I suppose, by shoals of yellowish gravel.

We kept for some distance along the top of the separating ridge, till a hollow that nearly cuts it through caused us to descend to the level of the lake, in doing which we met a party of Huniyas with sheep on their way to *Purang*, but we hurried by unnoticed. This depression in the ridge between the lakes marks the point where the unconsolidated gravel deposits, over which we had been travelling from *Lagan-Tung-kong*, give place to the stratified rocks which constitute the projecting headland on the east shore of *Rakas-tal*, and which are continued across to the cliffs at the north-west corner of *Manasarowar*. Where we crossed the hollow, which was close to the edge of *Manasarowar*, there were one or two small pools of water, around which the surface was muddy and covered with an efflorescence of some salt, which at a little distance gave the whole the appearance of being a solid mass of some white deposit. The outer edges of this mud were pretty firm, but in going on to it rather too far in search of some of the salt, I found, by suddenly sinking up to the knees, that it was soft enough below. Between this muddy flat and the lake is a raised beach of shingle, its top, I suppose, about 6 feet above the level of the water of the lake on the one side, and of the muddy flat on the other, between which it forms a complete raised embankment, having quite the appearance of artificial regularity, and in the middle of it has been built a small *Chorten* tower. Similar raised beaches are to be seen at many points of both the lakes, sometimes of larger dimensions, and sometimes having two or three external subsidiary lines of beach in front of them, indicating variations of level of the water-surface. These beaches are, no doubt, mainly produced by the action of the breakers caused by the violent winds that blow with such great regularity in these regions; but what is the exact reason that they are seen along particular portions of the shore only, I cannot say, nor can I further do more than suggest that their occasional great size may perhaps be in part dependent on the ice, which forms along the shores of these lakes during all the colder months of the year. Many of the lakes and rivers of Russia that are frozen over for several months at a time, are described as fringed with piles of rocks heaped together by the combined action of the waves and the packed ice, and some analogous process may go on here. The breakers formed against the cliffs on the shores of these lakes must be very heavy, as we saw their white heads distinctly at a distance of 6 or 8 miles.

I can now only regret that I have no specific notes of their action on the rocks, nor of the size of the boulders they form, though my impression is that the gravel on the beaches was mostly small.

(To be continued.)

A JOURNEY THROUGH ABYSSINIA TO THE NILE.*

By HERBERT WELD BLUNDELL.

APPENDIX.

NOTES ON GEOLOGY AND ANTHROPOLOGY.

By Dr. REGINALD KOETTLITZ.

I. Geology.

As the line of our route begins in Somaliland, I must not omit to mention some of the main features observed. At first the surface of the country we passed over was a sandy desert, forming a belt from the seashore for about 12 to 20 miles; this is marine formed, and gradually and imperceptibly rises inland. Much of this sand is composed of disintegrated coral, small and large masses of which lie loose on the surface. Here and there, some [illegible] miles from the coast, rising through the desert sand are isolated rocky hills, one of which I examined cursorily. It was apparently a granitic boss which had pushed up and displaced the overlying, hard, compact, marbled limestone, which also appeared to have been altered by the heat of the granitic mass. The country then becomes rough and rocky. Gneiss, granites, syenites, and quartzites are the exposed rocks; these are intersected in every direction by veins and dykes of biotite, quartz, etc. Flat-topped hills, more or less isolated, rise on the northward of our route, which are capped with basalt of compact and also vesicular type. A chalky kind of rock was also met with, and the surface occasionally is strewn with loose chips of flint and chert. Here and there, as at Jalelo, a quartzite sandstone, hard slaty rock, and schists occur, these being also permeated with veins of biotite and quartz.

A noticeable and remarkable feature of the country are the extraordinarily deep, but dry river and water cuttings. These sometimes intersect the land in a bewildering manner; they are often broad and deep, with perpendicular sides. This even occurs through granitic rock in situ, the rock having become so disintegrated by atmospheric action as to allow the water to thus quickly cut through it, for they are evidently caused by torrential rains. Further inland we passed over considerable plains which were almost flat, and from what I observed I am inclined to think are basalt plateau surfaces which have not been raised like the hills around.

For some distance before we arrived at Jig-jigga, as well as at that place, a chalky limestone appeared very frequently through the surface in an anomalous manner. This I frequently found contained fragments of quartz, sanidine, and quartzite embedded in it. This same substance, or similar, I also found filling up fissures in the basalt, not only on the flat, but also on the sides of hills with the basalt in situ, and in a position where it cannot have been recently washed into them, and where it must have been when the basalt I saw it in was first exposed, as at Sotoli. It had all the appearance of having been plastered in, like mortar.

* Continued from p. 121. Map. p. 308.

After crossing the Abyssinian frontier, and in our journey across this southern portion of that country, two main facts become increasingly apparent. The first is that there have been two great periods of volcanic activity. The earlier, when the basalt masses were poured out, probably mostly through fissures, as sills and dykes, as well as lavas, tuffs, and agglomerates; and the later, when the trachytes, rhyolites, and andesites were discharged as lavas, tuffs, and agglomerates from volcanic vents. The second fact which strikes one is that on the route we followed we traversed only the confines, or edge, of the main great basalt invasion of the surface, for, although further north the thickness and mass of the basaltic beds is enormous, on our route from east to west we saw nothing but the most shallow beds, which every now and then we lost entirely.

Underlying the basalts are for the most part the older schists, with apparently older volcanic rocks, granites, syenites, etc., such as appear on the surface in Somaliland and Beni Shongul. I, however, saw limestones and sandstones underlying and interbedded with the basalts among the range of mountains we traversed between Lake Haramaya and Laga Hardim, as well as at the Mardo pass near Jig-jigga. I was, however, unfortunate enough to only once find fossils in any of the stratified rocks met with.

The main masses of the basalt in the districts over which we passed appear to me, in the first place, to extend in the direction of the chain of mountains we traversed between Fyambiro and the Hawash plain, and again at Godoburka, on the other side of the Hawash plain. The former run, roughly, from an east-north-easterly to a west-south-westerly direction. These mountains are for the most part capped with basalt in many tiers or strata, with interbedded tuffs, etc. They do not, however, except rarely, show the distinctly flat, plateau-topped profile; they have more the appearance of high rounded downs, and have a "flowing" outline, as though long ago they had been exposed to ice-action. The denuding action of the atmosphere, sun's heat, and rain must, to my mind, having now seen the effects of this agency in these extremes of latitude, be greater here than in arctic regions and the high north, where the frost is supposed to work such ruin and devastation.

The flat-bottomed valleys between the hills, which are so frequent, are without doubt, for the most part, silted-up lakes. Another main mass of basaltic rock we saw when we arrived at Godoburka, as stated above, where it faces one in the form of a remarkable rampart-like wall, up the steep side of which we had to climb to gain the summit at Balchi, when it is discovered that this surface is the southern extension of the great raised plateaux of Abyssinia. From here one travels upon an undulating plain, but imperceptibly descending, till one arrives at Addis Abbeba. This rampart-like wall extends roughly in a north and south direction; it bounds the Great Hawash valley and plain on the west, while the first-named range bounds its eastern side.

The dark grey to almost black coloured basalt composing the main mass of the mountains on the east side is for perhaps the most part compact, yet very much of it is vesicular, and also contains cavities, which are, in many cases, filled with opalescent and other quartz, etc. The vesicular varieties are met with everywhere, but especially about Laga Hardim and when descending to the Hawash plain, where it is abundant, and where clinker-like rock and basalt pumice can be seen in large quantity. This basalt is also very much interbedded, as above mentioned, with tuffs and agglomerate, the beds being thick and extensive. At Balchi, on the other side, the rock is rather different, being of a dark red to purple colour; * here it seems to lie upon old slatey rock, which is tilted at a high angle, as well as bent and twisted very much.

* Similar rock I also saw on the eastern side near Lake Chercher.

The general dip everywhere appeared to be to the north-west. After the descent from Laga Hardim, the rock met with when crossing the Hawash plain, traversing the Fantalle hills into the Kassam valley, and on to Godoburka, has quite a different character, and apparently belongs to the second great volcanic period, above referred to; it has everywhere a similar appearance to that at Aden and the south of the Red sea. It is probably of the same quite recent age. Masses of trachyte, rhyolite, andesite, etc., lavas, and tuffs are the prevailing rock, the last often soft, so that the passage of the traffic over it so pulverizes it as to cause clouds of dust, which is so fine as to remain long suspended in the atmosphere, and cause very fine effects at sundown, as well as irritate the respiratory passages considerably.

Off Fantalle and Choba southwards, and stretching south-west to Mount Saquela and further, are a number of truncated volcanic cones showing very perfect craters, many of which are small, but there is at least one large one, that of Mount Saquela. It is evident that south of Addis Abbeba and extending north-east in the Great Hawash plain, the basalt disappears and is replaced by the later volcanic rock. I would suggest that the outbreak of volcanic activity which gave rise to these numerous craters and this outpouring of molten material was produced through a line of weakness which had occurred in the Earth's crust here; this line ran roughly north-east and south-west from the south of Addis Abbeba and probably still further to the south-west as far as Lake Rudolf (where I believe there is still an active volcano), and possibly further, and extends to Aden and as far as the Dead sea.

The comparatively recent outbreak of this later phase of volcanic force is especially manifested in the beautiful preservation of the perfect extinct craters, and by the occurrence of hot springs, some of which are in the near neighbourhood of Addis Abbeba. One of the most perfect, as well as the largest, of these crater-topped cones I visited while Mr. Weld Blundell and Lord Lovat were obliged to go north and see the king. This was the holy mountain of Saquela, as above mentioned. It is situated some 40 miles to the south of Addis Abbeba, and is in the form of a truncated cone, rearing itself 2000 feet or more above the level of the surrounding crater-studded, volcanic plain. All round it, branching off its sides, are spurs, or shoulders, which jut out from its main body, and evidence the remains of some of the lava-flows which were ejected from its vent. Its sides are steep and rocky, yet covered with verdure, and, especially on the higher portions, with forest. Upon its summit is an oval, rocky-walled, flat-bottomed valley, a mile to a mile and a half in diameter, and about 200 feet deep, which is partially filled by a lake. The altitude of its summit (10,000 feet above the sea) causes the climate here to be comparatively cold and bracing.

The hot springs close to Addis Abbeba are simply jets of hot water which bubble up through the mud floor, in which they have formed small basins. They are dispersed over a surface of about 100 yards, close to a small rivulet, into which the water runs. There are some twelve or thirteen of them; the temperature of the hottest of them I found to be 76·7 C. (170 Fahr.). They are made use of by sick people afflicted with skin eruptions, rheumatism, and other diseases, who remove their clothing and sit in the basins, where the water is less hot, in full public view, both males and females.

Not far from Addis Abbeba is Mount Managasha, referred to by Mr. Weld Blundell. This hill has all the appearance of having been a volcanic "neck;" it is, however, very much covered and its structure hidden by wood and vegetation.

At Addis Abbeba there is very little basalt, most of the rock exposed in quarries being a whitish-yellow, tuff-like, though hard stone, showing fragmentary structure, and often having a coarsely columnar arrangement. In river cuttings, however, one can see that a hard compact basalt underlies it in part. For a day's journey west the rock is very similar to that composing Mount Saquela, which has a gabbro-like appearance, and weathers in the same rough fashion. Further west the basalt is thin; in fact, one may consider the Mecha, Sobu, and Kwunche mountains the boundary of its southern extension here. Undoubtedly basalt still covers the surface somewhat south of this, but only in comparatively small quantity, for the volcanic rock of the later period seems to take its place. The surface is, however, modified and coloured by this basalt and its associated tuff, which, though of light yellowish-grey colour, weathers a deep red to purple, and this, with the basalt, gives the soil the same prevailing colour.

The country for the most part continues undulating and down-like as far as Guder, though to the north are the Mecha and Sobu ranges. The latter are then crossed to Chellia. The basalt of the mountains varies somewhat, being coarser and highly crystalline. The plain we traversed between Chellia (Chellahah of Mr. Weld Blundell) and Bilo, at the foot of the Soddo range of mountains, is without doubt again a large silted-up lake, for even now here and there are marshy portions, while the soil all over it is composed of a black sandy loam.

The Soddo range has been upheaved plainly by a comparatively recent convulsion. A large number of faults here run roughly north and south, which have formed escarpments which face east to south-east, and the dip of the strata is to the west and north-west. Further west, after crossing a series of rounded basalt-covered, knoll-like downs, we come to the Didesa river, which here runs from the south-east to the north-west, apparently following a line of faults or displacements of the earth's crust, for the Sarti mountain range, on the west side of this river, and at the foot of which the river runs, is a series of enormous escarpments facing east to north-east. This series of escarpment-forming faults continues very markedly on the further side of this range for more than a day's journey. The same mountain range, with the accompanying river, appears to continue north until it joins the Gumbi mountains, with which it is continuous, and thus bends somewhat to the north-west, while the Didesa river joins the Abai, or Blue Nile.

The Gumbi mountains are of the same or similar rock; they are north-east of Mendi, and bound the valley of the Abbi on the south, at the point where the river bends round northwards towards Fasokl. The upheaval which formed this range exposed to view the rock underlying the basalt, and demonstrates very markedly how very thin the covering of this rock is. The basalt is then seen to lie upon schistose, slatey, granitoid, and gneissic rock several thousands of feet in vertical thickness; this is permeated with quartz reefs, some of which are of enormous extent and thickness.

Similar down-like country continues as far as the Dabus river, the frontier of Abyssinia. The Shangalla country (Beni Shongul) rocks are mainly similar schistose, slatey, granitoid, and gneissic rocks like those exposed in the Sarti mountains, and similar quartz reefs intersect them. Here and there some of the hills have a slight capping of a coarse dolerite. A large portion of the lower country is alluvium.

II. Anthropology.

Our route, roughly east to west, took us through the country of Somali, Abyssinian, Galla, and Shangalla races. The Somalis are so well known that little that I could mention would be unknown. I will therefore pass them over, and mention a few points about the Gallas, the Abyssinians, and the Shangallas.

Southern Abyssinia is inhabited by Abyssinians and Gallas, as mentioned by

Mr. Weld Blundell. The former are apparently a mixed and non-pure-bred race their blood being largely altered by the free inter-marriage, which must have been going on for ages, between them and their captives in war; for, being a military people, wars and raids are frequent with them. The Gallas of their own country the negroes of the Nile basin, the Sudanese, and Arab tribes have all contributed without doubt, towards the development of the present-day Abyssinian. Henc one meets with individuals resembling the Galla, the Arab, and the negro. They are a muscular, brutal, energetic, though scarcely brave race. They almost con fine themselves to their military occupation, for what agriculture, manufacture, an trade there are in the country are mainly carried on and produced by Gallas an foreigners, Indians, Greeks, Jews, etc.

The Abyssinian is pretentious and domineering to his inferiors, yet cringin and obsequious to his superiors. His business being that of a soldier, he is mor or less, though at times energetic, a lazy individual; he, though not a trader, i willing to take service as mule-driver and caravan help, but will always shorten his day's work as much as he can. His inseparable companions are his rifle cartridge-belt, and sword. The first is often of a most antiquated pattern, which even when mule-driving and performing long marches, remains with him, carrie over his shoulder. His sword is strapped tightly to his waist, and is a characteristi one, being short, very much curved (scimitar-like), but narrowing to a sharp point it is worn on the right side, and thus, when mounting a mule or horse, he alway does so on the right or off side. Besides these weapons, he uses in warfare large round, basin-shaped, embossed leather shield, often ornamented with silve work. He boasts of being a Christian, but the Christianity he professes is only i evidence in the keeping of feast and fast, though a few, very few comparatively attend church on early Sunday mornings, in response to the call of a doleful cracked-pot-sounding, tolling bell; and a few also wear rosaries, though I never saw one being used. These rosaries have forty-one beads, said to be symbolical of th number of stripes our Lord received when scourged. Whatever is the cause, th Abyssinian has deteriorated, for apparently he is a much worse liar, thief, an cheat than his neighbours about his borders.

The Abyssinian lives a more or less settled form of life, for he builds a house though even in a so-called town, such as Addis Abbeba, he pays no rent. Thi house is of a very primitive type, at least in those parts we visited. It is a circula one, the walls are formed of mud-plastered sticks, while the roof is of grass thatch supported on roughly interlaced branches of trees and sticks. The interior i partitioned off by an inner circular wall; between this inner and outer wall, th rough spare household utensils are kept, as well as a cow or two, mule, or pony The inner portion, with mud floor slightly raised, is where the family lives; be places, again slightly raised and formed of mud, are round it; upon these th inmates squat when at home. The fire is laid on the ground, and the kettle or pa is either suspended from above, or more frequently supported upon three or fou stones arranged round the few burning sticks which constitute the fire. N aperture, other than the door, is ever made for the entrance of light or the egress c smoke; a more comfortless home it would be difficult to conceive. His churche are of the same kind as his house. They are circular, roughly made, but large erections, and are surmounted by a cross, a characteristic Abyssinian one: it i composed of two iron (?) crosses arranged stelliform, with a circular band join ing and supporting each arm, the extremity of each being globular, and the whol is painted white. Except for this, and that it is larger, as well as for a number c gaudy European-made chromo-lithographs of the Virgin, Christ, and the Saint with, more rarely, some crude native drawings, attached to the inner circular wal there would scarcely be anything to proclaim the sacred purpose for which the building is used.

The Abyssinian priest is distinguished by wearing a peculiarly formed, white turban-like cap, and carries a fly-switch made of horsehair; otherwise his dress is the same as that of the other males. This dress consists of a pair of white cotton pantaloons; a long white cotton cloth which he folds about him, called a shammah, often broadly striped red in its length, or having an embroidered border; and in the early morning, or when it is cold, over this a dark brown long pelisse-like woollen garment called a bornouse. It is joined in front, and has an ample aperture at the neck; the whole is thrown over the head when put on. Not unfrequently a priest will also carry a wickerwork or grass-made umbrella or sunshade, of course uncollapsible.

The women wear a cotton skirt, and a loose cotton bodice, as well as also use the shammah. All walk barefoot, and when riding use the big toe only in the stirrup, which is made just wide enough for its reception. I say *white* cotton pantaloons, shirt, shammah, etc., but it is comparatively rare to see it this colour; for, being a dirty, vermin-infested people, the white colour these garments have when they are new soon disappears, the usual colour being a dirty slate-grey, caused by accumulation of dirt.

Monasteries, so-called, are not unknown in this part of the country; one such I visited when I went to the holy mountain of Saquela. This is, as already mentioned, an extinct volcanic cone, with a very perfect lake-filled crater upon its summit. The monks, or hermits, live in isolated huts embedded in the woods about the top and down the upper portion of its sides, not in a building such as monasteries are generally mentally associated with by most people. They are very little in evidence when one visits the place, yet I understand there are many of them there. They have a semi-maniacal look (those I saw), and are said to spend their lives in prayer and self-mortification. Churches, mostly in very bad repair, are in good number also, dispersed in this forest. It is probably on account of the extraordinary, to the native mind, though natural conditions that this mountain reveals, that it has a certain amount of superstitious attraction to the people in that part of Abyssinia, and thus causes the monks to locate themselves there.

People come from all distances and make pilgrimages to the place, especially the sick and sterile women, for the sake of the supposed healing virtues obtained by drinking the waters of the lake and other springs issuing from the rocky walls of the crater, as well as bathing in the lake.

The Abyssinian is very fond of display and of assuming importance. A man who is well-to-do, a chief, or important personage, never goes out walking; he always rides his mule, and has as large an attendant retinue as possible, who generally walk; these always, if possible, carry rifles. Even the abuna or primate and higher clergy do not neglect to be so attended when going abroad.

Of the few measurements I was able to take, the following is the mean:—

Age	26·7
Sex	♂
Stature	5 feet 5·4 inches
Length of upper extremity	22·3 inches
Length between tips of finger when arms are extended ...	5 feet 8·65 inches
Chest girth	34·125 inches
Head measurements—	
Occipito-frontal	7·5 inches
Occipito-mental	9·6 „
Bi-parietal	5·9 „
(The above diameter was 2 inches above and 0·77 inch behind external auditory meatus.)	

The Gallas were probably the aboriginal inhabitants of the country prior to the advent of the Abyssinians; they are said, however, also to be immigrants. They have been conquered, and are held in subjection by the help of firearms, which their conquerors take care they shall not obtain, and by this device they are kept in a position of distinct inferiority and abject servitude. They are without doubt a much purer race, have fine lithe figures, though spare, and have regular, handsome European-like features. Their hair is crisply curling, similar to that of people of Jewish stock. The hue of their skin varies from a light copper-colour to that of chocolate. They divide themselves into many tribes, according to the district, yet speak a similar language (though, as mentioned by Mr. Weld Blundell, there are several dialects). It was interesting to me to find that our Somali servants (which accompanied us through the whole of our route) could understand, they told me, some of the Galla words used by those people inhabiting the extreme south-west of the country, bordering upon the Sudan, and it points distinctly to a relationship of not very distant date. Other travellers have noted similar facts, I find. That they are of a similar race scarcely admits of doubt, for in feature and build they very much resemble each other. The Somali is darker coloured, however, his skin being of a dark brown to almost black tint; but this is accounted for in the fact that he inhabits a more arid, hot, and desert tract of country, and lives perhaps a more outdoor life, because of his nomadic habits, and thus the sun has acted more upon his skin than upon that of the Galla.

The Galla lives a settled life, has his permanent hut, either among a cluster in a village, or else occasionally apart upon land that he tills. His villages, like those of the Abyssinians, are invariably placed upon the summits or near the summits of hills, which keep him out of the heat of the lower lands, free from mosquitoes and consequent fever, as well as serve for the purpose of look-out and defence. They are the producers and cultivators, being an industrious folk. Around their villages and huts a tract of cultivated country can always be seen, with flocks and herds grazing near. There is no doubt that, if they were not so oppressed and taxed, they would produce more, but the only thing taxed in Abyssinia appears to be the produce of industry, that of husbandry, manufacture, and trade, the result being that these suffer. The Gallas grow cotton, spin it into thread by a peculiarly delicate spindle, and weave it into cloth. Wheat, barley, teff, pepper, coffee, tobacco, vetches, beans, and peas, etc., I also saw cultivated by them. Their huts are similar in shape to the Abyssinian, but, especially in the west, the arrangement of the interior is somewhat different, there being no inner circular wall, only a partition, somewhat back from the door, passing straight across the floor space, sufficient room only being left for use as a doorway; this divides the room into two, the outer acting as a porch, and as a place for keeping household necessaries, while the inner is the cooking part and women's quarter, and where also are the beds, which are screened off by wickerwork hanging screens.

The Galla is said to be pagan, and to worship a god which is in some way connected with a tree or rock. The Abyssinians, however, so despise the Galla, that our interpreters (who were Abyssinians) would not condescend to inquire, or could not obtain the information we asked for. It is possible, also, that, being an ignorant people themselves, they could not comprehend what really we wished to know.

As we moved along our route it was often pitiable to see the servile manner in which the Galla bowed and did homage to us or to our Abyssinian escort, and points to a savage oppression which does no honour to the Abyssinian. Evidence of their dependence and oppression was not wanting in other respects *en route*, for ıld especially be seen by the domineering manner in which a Galla (man, an, or boy) would be told to give up some of his possessions which he might rrying. If he did not comply or attempted to remonstrate, it was forcibly from him, he was maltreated and knocked down, and his goods confiscated, st in part. They are evidently in great fear of their conquerors, and have no . Because the Galla smokes, which he does from tobacco grown in his n, out of a kind of long hubble-bubble pipe (with water under the bowl), the sinian does not, for he despises too much anything practised by a Galla. 's give another and religious reason—"because tobacco is born in the tomb of ," and is therefore accursed.

he following is the mean of some Galla measurements:—

MALES.

... ...	27 years
re	5 feet 6·6 inches
h of upper remity	22·328 inches
measurements—	
ipito-frontal ...	7·49 inches
ipito-mental ...	9·6 "
parietal	5·7 "

e last diameter being 1·9 inch and 0·39 inch behind external ry meatus.

FEMALES.

Age	41·2 years
Stature	5 feet 3·3 inches
Length of upper extremity ...	21·3 inches

On account of the stiff wax-and-honey pomaded fashion in which the women do their hair, I was unable to obtain reliable measurements from their heads.

he Shangalla are the people that inhabit the country bordering South-West sinia, on the west side of the Dabus river, and south of the great bend of the Nile. Their country is a hot, comparatively low-lying, fever-stricken, and in ough and rocky district, yet much of the surface of the country is formed er alluvium. They are a negroid type of people, are darker coloured to t black, have thick lips, prognathous face, long arms, and appear to have s intelligence than the Somali, Abyssinian, and Galla. They are said to be ves of Amdurrahman, the Arab chief of the country, and are Mohammedans. eir district having lately been raided, devastated, and burnt by the inians, as well as largely depopulated, we saw it under distinctly dis- tageous circumstances. Their houses are, however, very similar in shape onstruction to that of the Galla and Abyssinian, yet are sometimes raised a platform of mud-plastered sticks and beams, as also their platforms for g grain—no doubt for the purpose of keeping them and their corn out of ater and wet during the rainy season. There was evidence of much cultiva- udging by the burnt durrha and other cornfields and gardens. These fields ardens I observed to be sometimes surrounded by a rough thorn hedge, lly not planted, but formed of cut boughs of the thorny acacia or mimosa xed into the ground.

ey are armed with spears of a barbed and ugly looking kind, carry a rifle ntly, and also the short dagger suspended to the elbow, which is seen so only in the Sudan. Some of them also have a peculiar and unique curved, -edged, branched sword; to what end this weapon has been developed into hape I was unable to obtain information. The blade or blades are engraved arked by ornamental and apocryphal devices. They also have a sort of club, or boomerang, like throwing-stick, with which they are very expert cking down small animals and birds, etc.; these are very much used by them, nost every male carries one.

th sexes are marked by a sort of tattoo, which is produced by gashes made

with a knife. The resultant scar has been made, by using some irritating subst
when healing, to protrude above the surrounding skin surface, hence this ca
these marks to show prominently. They are specially common on the faces
arms, but are not infrequent on any part of the rest of the body. These cut
made to assume regular shapes and patterns—in fact, have, on the dark negro
a not unpleasant effect.

When wishing to measure the men, who were often standing about
nothing, for anthropological purposes, they evinced a remarkable repugnan
being subjected to the process, and it was with considerable difficulty that I obt
the few I have, the mean of which I give below.

Both men and women of the Shangalla go about with very little clothing.
rule, both sexes simply wear a breech-cloth, often of leather, of very small dimen
Occasionally, I saw some of the men wearing some loose baggy cotton trousers
those of the Sudanese, with a sort of shirt on their shoulders, and Sudanese po
slippers on their feet; but these are not their natural costume, only borrowed.
all probability these men were personal servants of the chief.

The following is the mean of my measurements of Shangallas:—

Age	27 years.
Sex	♂
Stature	5 feet 5·8 inche
Length of upper extremity	23·08 inches.
Length between tips of fingers when the arms are fully extended	5 feet 10·7 inch
Chest girth	33·93 inches.
Head measurements—	
Occipito-frontal	7·42 "
Occipito-mental	9·57 "
Bi-parietal	5·54 "

The above diameter was found to be 2·18 inches above and 0·77 inch behin
external auditory meatus.

The Gallas, the stature is greatest (males).

In length of arm, the Shangalla.

In fathom stretch, the Shangalla.

In chest girth, the Abyssinian.

In head measurements—

The occipito-frontal is greatest in the Abyssinian.

The occipito-mental " " Galla (male).

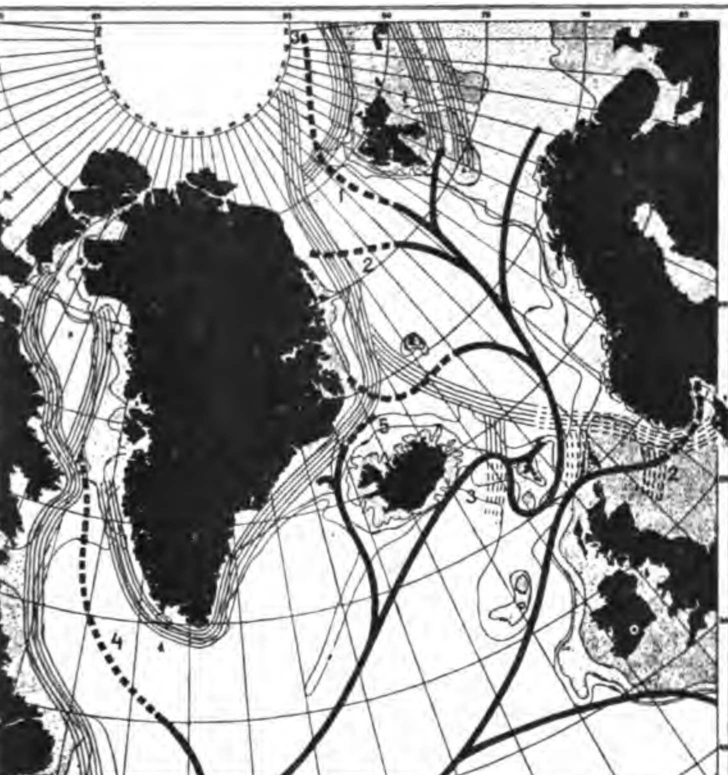
The bi-parietal " " Abyssinian.

And the bi-parietal diameter is nearest to the ear in the Galla.

MR. WELD BLUNDELL'S MAP.—The road from Addis Abbeba to Dessieh
back is worked out from a plane-table sketch, positions at intervals being fixe
observations for latitude and longitude by sextant. From Addis Abbeba to Fa
observations for latitude and longitude were taken nearly every day by 5-
theodolite, and details put in from plane-table sketch. The whole checke
Jordan's method of least squares.

THE DANISH "INGOLF" EXPEDITION.

report on the work done by the Danish cruiser *Ingolf* in the seas round Green-
and Iceland during two voyages in 1895 and 1896, is now being published at
xpense of the Danish Government. Separate editions are to be issued in the
h and English languages, and the whole is to be completed in six volumes.
irst part of vol. i. has already made its appearance; it includes the narrative of



CURRENT CHART OF THE NORTH ATLANTIC.

LF STREAM ——— ARCTIC CURRENT ___ UNDER CURRENT ■■■■ AND ⋮⋮⋮

Vöringen, 1878; *Lightning*, 1868; 2, *Hekla*, 1891; *Jackal*, 1893; 3, *Fram*, 1896; *Ingolf*, 1896; 4, *Ingolf*, 1895; 5, *Ingolf*, 1896.

xpedition, by the commander, Commodore C. F. Wandel, and the report on
hysical and chemical work, by Dr. Martin Knudsen.

he chief contributions in the way of new soundings consist of a survey to the
-west of Cape Reykjanes, where the existence of a submarine ridge has been
lished in the region of the much-discussed Busse Island, from which earth-
es have also been reported more than once. This ridge appears to be of recent
nic origin, and is merely a prolongation of that forming Cape Reykjanes, where
is still much volcanic activity. A large number of additional soundings have

been made within the 100-fathom line off Greenland and Iceland, and the positic of the banks on the west side of Davis strait have been explored.

The most important novelty in the equipment for physical observations on bo the *Ingolf* was the modification introduced by Dr. Knudsen in the reversing th mometer. The older pattern has frequently given trouble through the uncert breaking of the mercury column, and probably also through the weight of mercury in the bulb forcing additional quantities into the tube during hauling Dr. Knudsen obviates the risk of errors of this kind by simply bending the th mometer into a U form, the column breaking close to the bend, so that when instrument has been reversed, there is no tendency for more mercury to find its into the tube.

In the chemical and physical work, the salinities were estimated from chlo determinations in the usual way. During the cruise in 1895 large numbers samples were collected and brought home for analysis of gas contents, and analyses were afterwards carried out by Dr. Rordam. The results of these led Rordam to suspect that the amount of dissolved oxygen in the waters suffered c siderable change after collection, and Dr. Knudsen accordingly devised a spe form of apparatus for executing the analyses on board ship immediately after samples were obtained. The important results arrived at by this means w reference to the evolution and absorption of oxygen and carbonic acid by organis in sea-water, were published in the *Comptes Rendus* in 1896.

The observing stations of the *Ingolf* are arranged in series of sections, affect distinct regions: first, the area south of Iceland and Greenland, and the Denm strait; next the east and north-east of Iceland, northward to Jan Mayen, and sou ward and eastward across the Norwegian Sea; and lastly round Greenland westw into Davis Strait. Each section is discussed separately, and the circulation in e region is studied by comparing those in each group.

In the first group, much fresh light has been thrown on the relations of East Greenland polar current to the Irminger stream, or current flowing nor wards to the west of Iceland. It had been shown that the Irminger stream sp into two at a point south of the Denmark strait, one arm turning south-westw and accompanying the polar stream along its outer margin round the south-east Greenland, and the other passing northward through the strait and ultimat becoming an undercurrent to the north-west of Iceland.

The westerly branch of the Irminger stream reinforces the large quantitie Atlantic water sent up into Davis Strait, and even as far as Baffin's bay. S face observations show that the water is frequently covered by drift mov eastward from the Labrador current.

In the Greenland-Iceland-Jan Mayen region, the *Ingolf* expedition has d very valuable work in bringing out the immense relative importance of the E Iceland polar current. The existence of a southerly movement of water off the e and north and north-east of Iceland has long been recognized, but it has hithe been assigned a very secondary place in the system of circulation. It is now fu recognized that this current is of very considerable volume, and that its waters m profoundly affect the circulation near the coast of Norway and in the North S There is no doubt that this stream, as well as the East Greenland current, primarily due to the melting of the pack-ice between Greenland and Jan May by the warm water moving northward from the Atlantic. Dr. Knudsen is opinion that the Irminger stream from the north-west of Iceland is responsible the greater part of this melting, and bases this conclusion on the fact that t temperature of the warm under-layer of water *falls* from the north southwa instead of rising as it should do if the warm water was moving northward fr

ween Iceland and Norway. It seems possible to explain the temperature observa-
ns otherwise, and in any case it is scarcely credible that the enormous volume
warm water sent northward from the eastern Atlantic should cause less melting
n the smaller branch of the Irminger stream. This has already been discussed
Prof. Pettersson in a paper on the effect of ice-melting on oceanic circulation
ongl. Vetenskaps-Akademiens Handlingar 1899), and Prof. Pettersson's view
istinctly supported by surface observations.

It being known that the part of the polar stream nearest to the east coast of
and actually does move southward, the observations of the *Ingolf* give some
information about its further course, and about the movements more to the
thward. Excellent use has here been made of "drifters," or floats, supplement-
the temperature and salinity observations. On the voyage from Iceland to Jan
yen in 1896 twenty drifters were thrown overboard; ten of these have been
vered, including one at the Faeroe Islands, one at Romsdalen on the west coast
Norway, and a third on the coast of Finmark. It does not of course follow that
drifters which started in the polar current remained in its waters all the time,
might have moved southward and then come under the influence of the warm
rent moving northward from the Atlantic. The general form of the circulation
forth by the surface observations of temperature and salinity made during recent
rs has shown, however, that at least during the earlier months of winter the
r water covers over the weakened Atlantic current, and makes its way eastward
surface drift to the coast of Norway, as indicated by the drifters, and even, as
shown by the Swedish investigators in 1893 and 1894, into the Kattegat.

The recent advances in our knowledge of the circulation in this region of the
n, and the sources from which they have been derived, are well shown in the
mpanying sketch-map, which we copy from the paper by Prof. Pettersson,
rred to above.

THE MONTHLY RECORD.

EUROPE.

lustries and Agriculture in Germany.—In a map published in the Decem-
number of *Petermanns Mitteilungen*, Herr Langhans shows in a striking
the distribution of industries and agriculture in the German empire. The
is based on those published by the Imperial Statistical Office, but differs from
latter in showing at a single view the distribution of the two occupations in
stion, which so far outweigh all the rest that in no single area does even a
tive majority of the population devote itself to any other. Thus, even in the
t trade centres, the trading population falls short of the industrial. In Herr
ghans' map the areas in which a majority, absolute or relative, of the in-
itants is occupied in agriculture (in which are included gardening, rearing of
k, and forestry) are coloured green, while red is used to denote the industrial
s, the nature of the majority being in each case shown by a difference in tint.
the agricultural areas by far the greater part is shown as possessing an absolute
ority devoted to such pursuits, while an absolute industrial majority is of
rse found in comparatively small districts, the largest being those of Southern
ony and of Westphalia and the Rhine. East of the Oder the only industrial
, apart from the towns, is the mining district of Upper Silesia, which is entirely
rounded on the German side by agricultural areas. Herr Langhans has treated
rt from their surroundings all towns for which separate figures were given in

the census of 1895, and thus brings out clearly, among other points, the fact th in the flat lands of Bavaria industry is almost confined to the towns.

The "Vogtland" as an Orographical Unit.—This is the title of one the recent issues of the *Forschungen zur Deutschen Landes- und Volkskunde*, th useful series which has already supplied so many careful geographical studies various portions of the German Empire. The Vogtland—so named from its o rulers the Vögte, "guardians" or "administrators," who received their title fro the Wends in the twelfth century—lies immediately to the north of the Fichte gebirge, in the angle between the Erzgebirge and Thuringer-Wald. It has be variously assigned to each of these neighbouring ranges, some considering it merel as the somewhat elevated base of the Fichtelgebirge. The author of the prese monograph, Dr. Albert Wohlrab, sets himself the task of showing that the distri has an individuality of its own, and to this end he examines minutely its orogr phical characteristics, basing these, of course, on geological structure. In this respe it is marked by the great development of Palæozoic formations, which in neighbou ing districts occupy merely a narrow belt running north-east; and by the fact th it forms a syncline between two great anticlines. The strata have been subject much faulting and dislocation, which have acted chiefly in two directions, a nort westerly and a north-easterly. These dislocations are seen to have had a pote influence on the general orography of the district, which has the character of gently undulating plateau, deeply furrowed by valleys, by which last the form a direction of the ridges are determined. The general northerly direction of t streams is the resultant of the two directions, north-east and north-west, which, already stated, are those of the main lines of dislocation, and the valleys are th marked by the frequent occurrence of rectangular elbows. The study of the hyp metry of the district, into which Dr. Wohlrab enters minutely, brings out its gene character as a plateau, the difference between its average height above the sea a the average elevation of the crests of the ridges amounting to only 260 feet, compared with 920 feet in the case of the Erzgebirge. Deviations from the gene evenness of the heights are due to the petrographical character of certain portio the elevations being composed chiefly of quartzites, etc. In the eastern part of t district, however, a granitic *massif* breaks the regularity of its character. The l part of the paper deals with the anthropogeography as resulting from the o graphy of the Vogtland. Its lower elevation than that of the districts to the e and west, and its position at the head of an embayment of the North Germ plain, mark it out as a natural highway of commerce, whilst its other charact tend to locate roads and settlements on the higher levels, and induce the charact istic ring-shaped form of the villages.

ASIA.

Baron von Oppenheim's Explorations in Syria.—We learn from *Pet manns Mitteilungen* (1899, p. 297) that Baron von Oppenheim, attaché at t German consulate at Cairo, has since June of last year been engaged in explo tions in Syria and neighbouring countries, principally in the interests of archæ logy. From Damascus he visited the summer encampments of the Aneze Bedu afterwards crossing the Bikah northwards to the Tell Nibi Mindu, and reachi Homs by the eastern shore of the lake. Crossing the Nosairi (Ansarieh) mou tains to Masgaf and Hamah, he went east to Salamija, and thence by a zigz course to Aleppo. During this last stage of the journey he discovered a numb of hitherto unknown cities of the Christian-Greek period, with forts and hou still in part standing, and containing finely ornamented stones and inscriptio Of these copies and photographs were taken. From Aleppo the traveller purpo

to the Ancient Harran, and thence make a circuit to the south-east to
eported Jebel Abdul Aziz. Afterwards his intention was to reach the line
e future Bagdad railway by way of Mardin and Diarbekr, and follow it to
and Constantinople. He hoped to explore the at present unknown part of
otamia east and west of the Belik, where possibly the remains of old civili-
may be found.

me Ancient Localities in the East.—One or two discussions of points
cted with the ancient geography of the East have lately appeared. In a re-
from the *Proceedings* of the Oriential Congress at Paris, Mr. St. Andrew St.
brings together some notes on the identification of the ancient Takkola,
oned by Ptolemy as a mart of the Golden Chersonese, and also alluded to in a
ge of the *Milinda Pañha,* a work of uncertain date. Mr. St. John possesses
knowledge both of the languages and coasts of Burma, and with this aid
pts to decide between the rival theories which place Takkola either in the
peninsula or in the estuary of the Sittang. The latter view, adopted by
orchhammer, is contested by the writer, who holds that there is no indication
'aik-kala and Thaton, with the former of which that commentator identifies
la, were once frequented ports. He is inclined to agree with Lassen and
in placing the old mart in the Malay peninsula, probably at or near the
of the Pakchan river (lat. 10° N.), whence the merchants would cross the
us of Kra to the Perimulic gulf. Mr. St. John also discusses other places
oned by Ptolemy when treating of the coasts of Burma, etc., with some
ks on the ancient Suvannabhumi of the Buddhists, considered by some to
ce the delta of the Irrawadi, but the precise locality of which he thinks has
be fixed. With regard to the ancient Argyre and Chryse, he throws out the
tion that the names originated in the fact that certain races of the region in
on prefer silver, others golden ornaments. Dr. G. Schlegel, in notes reprinted
he 'T'oung-Pao' (Leyden: Brill), attempts the identification of several places
oned in the old Chinese records. One of these, Tan-tan or Dan-dan, he con-
the same as the Dondin of Friar Odoric, which has been the cause of so much
e to commentators. The identification of this with the Andamans he thinks
bable, as Odoric went southwards from Ceylon, and apparently passed the
of Malacca before reaching Dondin. According to the description of Tantan
Chinese geographers, we must, he says, look for a country between Siam and
Sumatra), and thus arrive at the Malay peninsula, where all the products
oned by the Chinese authors are to be found. Another locality treated of is
-possibly the same as Ptolemy's Koli—which Dr. Schlegel shows to be un-
dly Malacca, this first appearing in the Chinese annals under its present
during the fifteenth century.

tanin's Journey on the Chinese-Tibetan Border, 1893.—Although
years have elapsed since the date of Potanin's last journey in Western China,
ailed account of the same had been published until the end of last year, when
mary of the chief events of the journey appeared in the *Izvestia* of the
ial Russian Geographical Society (1899, pt. 4). From this account an out-
the journey, with remarks by Dr. Bretschneider, is given in the first number
ermanns Mitteilungen for 1900, accompanied by a sketch-map of the route
ed, and a short account of the previous work of the Russian traveller. This,
Bretschneider remarks, is too little known away from Russia, and it is much
regretted that the accounts of Potanin's journeys—second to none for the
of the information they contain—have not been made generally accessible by
tion. In 1893, as on former journeys, Potanin was accompanied by his
whose serious illness, which in the end proved fatal, curtailed the journey to

some extent, and was also the cause of the long delay in the publication of th results. Other members of the expedition were MM. Beresovsky, Kashkarof, an Rabdanof. From Peking the route *viâ* Singan-fu across the Tsinling mountain to Cheng-tu was taken, the journey being continued by the usual route to Ta tsien-lu. Here the real work of the expedition began, the ground chosen being th almost unknown mountain region to the north of the frontier post just name Ascending the Tung-po ho, a tributary of the Ta-tsien-lu river, past sever Tibetan villages, Potanin crossed the Ta-pao Shan by a pass some 14,000 feet hig and proceeded down a valley to the town of Rumi-jangu, on the bank of the T kin ho, or Great Gold river, which, joining the Siao-kin ho, or Little Gold rive forms the Tatu ho of Chinese maps. The further route lay up the valley of th Little Gold river past various villages and small towns, inhabited by Chinese an Tibetans, and each having a Chinese and a Tibetan name. The district is know to the Chinese as Kin-chuan, or the "gold valleys." In this region the Russi party had been preceded, in 1891, by the Austrian traveller Rosthorn,* the fir account of whose journey appeared in the *Mitteilungen* of the Vienna Geographic Society for 1895. Rosthorn, an official of the Chinese customs service, reached t Little Gold river from the east by way of Kuan-hsien, and continued his journe westward to the upper valley of the Great Gold river. The "gold valleys" we also visited in 1896 by members of the Lyonese Commercial Mission. Potanin co tinued his journey across the divide at the source of the Little Gold river, and pass through the Miao-tze country to Li-fan-fu, visited by Captain Gill and Mrs. Bisho Dr. Bretschneider's explanatory remarks deal with various points connected with t history and ethnology of the country, some, *e.g.* the list of all European travell who have visited Lhasa, not immediately connected with Potanin's journey.

M. Klementz's Journeys in Western Mongolia.—Among recent Russi travellers in Central Asia few have been more active and enterprising than Dmitri Klementz, who since 1885 has traversed Western Mongolia in directions, from the sources of the Obi and Irtish to the Selenga and upper Amu His reports have mostly been published in Russian, so that the *résumé* of all journeys down to 1897, which he contributes to the third part of the Pa Geographical Society's *Bulletin* for 1899, is of much interest. Since 1897 Klementz, as already noted in the *Journal* (vol. xiii. p. 658), has turned attention to more southern parts of Central Asia. His earliest journeys (1885–9 took him to the regions of the upper Obi and Yenisei, where he explored so quite new ground and made many corrections in the maps, especially as rega the Kemchik, a western tributary of the upper Yenisei. During his exploratio he repeatedly crossed the Sayan mountains, and brought to light new facts respe ing the geology of the range. It is formed of two great folds, the northern p consisting of talcous, chloritic and clayey schists, overspread by limestones, wh in the south a clayey conglomerate and schists with fossils, probably of Cambri age, are met with. In the valleys of the Kemchik and Ulukem, which between the Sayan and Tannu-ola chains, eruptive formations occur. The vege tion of this region is intermediate between the forests of Siberia and the Mongoli flora, larches forming the chief component of the forests. The inhabitants are t Soyots, placed by Castrén among the Samoyedes, but who seem to differ mu among themselves, those of the valleys (shepherds) being very distinct from tho of the mountains (hunters). Between 1891 and 1896 M. Klementz explored t

* The latter paragraphs referring to Rosthorn's journey have been evidently m placed in the German article, occurring in the midst of the description of the open stages of Potanin's journey.

of the Orkhon and Selenga, visiting in 1892 the ruins (comparable to those rakorum) on an island in Lake Teri-nor. In this region the rocks are every- crystalline. During these and subsequent years M. Klementz travelled sively in the Khangai and Southern Altai systems, of the physical features ich he gives a sketch. The Khangai, although of a considerable average de, contains, with the exception of the Otkhon Tengri, no important peaks. gically, it consists of a series of folds falling abruptly to the south, while the separating it from the Altai has a trench-like form. The range is marked great development of eruptive formations, including some extinct volcanoes. vegetation of the two slopes differs greatly, larch forests occupying a large n the north, while forests are rare on the south. On the Altai they occur in sheltered valleys. This range is formed, in M. Klementz's opinion, of a of folds, inclined towards the south, the dip being abrupt in the Dzungarian The paper is accompanied by a map based on Russian sources, showing all lementz's routes. The mountains are not inserted, it being pointed out by itoff, in a note appended to the article, that the orographical features as ated by Russian cartographers are largely fanciful.

AFRICA.

he Tanganyika Expedition.—The following letter, dated Kibita, Tangan- November 4, 1899, has been received by Sir John Kirk from Mr. J. E. S. , the leader of the Tanganyika expedition:—"I have just returned from the end of Lake Tanganyika, where I have left the loads, etc., and where I am o be able to tell you that I found it quite possible to go north over the tracks ally arranged. I am also glad to be able to tell you that Fergusson has got a observations which show Tanganyika to be a long way out in the old maps in . We have also obtained a number of new fish and other forms, which will cer- be interesting from the point of view of the origin of the marine forms which nyika possesses." An interesting communication with map has also been received Mr. Fergusson, which will be published in the next number of the *Journal.*

xploration in the Sobat Region.—The following letter, dated December 20, has been received from Major H. H. Austin, who is accompanied by Lieut. t:—"As during the last few weeks, during our journey up the Nile, we have been o fix some points with tolerable accuracy, some of the results we have obtained be of interest to the Geographical Society. We have now been able to fix the osition of Omdurman by telegraph with Cairo. The point taken was the Kha- house, near the Mahdi's tomb. Times and observations were taken by Colonel t, R.E., and myself at Omdurman, whilst Captain Lyons, R.E., officiated at the end of the line. The position of Omdurman now fixed, viz. long. E. 32° 29' and lat. N. 15° 38' 15", differs very materially from the previously accepted on of Khartum, which is only some 2 or 3 miles distant, near the junction of hite and Blue Niles. Ravenstein, I think, accepts E. 32° 45' as the position artum. Goz Abu Guma, another place on the White Nile south of Omdur- was fixed by Colonel Talbot and myself by telegraph as long. E. 32° 41' 37"·5 t. N. 13° 10' 54"·2, on my way up the Nile. Marchand's fort at Fashoda, is built inside Gordon's old enclosure, I made E. 32° 7' 37"·5 and N. 21"·2, whilst Sobat fort, near the junction of the Sobat with the White Nile, e E. 31° 33' 36"·7 and N. 9° 21' 48"·5. I have taken a whole series of other along the White Nile and Sobat, but as these may be difficult to locate, it is ly worth my while sending them to you. As I have really good instruments atches with me on this trip, I hope to get some reliable work done between obat and Lake Rudolf, which I am now making for, to join on with my old work done last year from the Mombasa end. If successful, we shall have thorough survey done practically from Mombasa to Omdurman. I cannot yet s definitely what route Bright and I will follow until we come in contact w difficulties ahead; but, roughly, we propose following the Ajouba down from junction with the Pibor to near its source in the Abyssinian hills, when we sh strike south to Lake Rudolf. On the return journey we hope to investigate anot route north, along the base of the Abyssinian plateau to Gumbila or Gore, on Baro river, which we propose following down to Nasser. If all goes well we h to be back at Nasser early in June, and home perhaps a month later. Lie Gwynn and Jackson, R.E., are working up the Blue Nile from Omdurman, and join on to the southern portion of the survey to be carried out by me, probably b at Gumbila and Nasser, so that portion of the Sudan should be accurately kno Telegraphic positions of both Wad Medani and Roseires on the Blue Nile have b fixed; but I have not the results, so am unable to give them to you. It is extraordinary low Nile this year, and the waters of all the rivers are as low usually two months later in the year. It is not a bad thing as far as I am c cerned, as I hope to be able to cross large areas shown as swamps, provided t the tall rank grass has been burnt by the natives. We shall probably trav country previously visited by both Bottego and Wellby, so I fear we shall not able to make any new discoveries like they did, but still I hope will be able to some blanks still existing in those regions. It may be of interest to you to kn the strength of the party with Bright and me. We have an escort of 22 men the 11th Soudanese Battalion under a native officer, and 24 Jehadin, or ex-dervis also armed, in charge of the transport animals. We muster about 50 blacks told, including servants, besides ourselves. For transport we have 120 donke 7 camels, and 10 mules, as we must be capable of carrying at least two mont supplies of food for the whole column in this inhospitable region."

Mr. Grogan's Journey from the Cape to Khartum.—The letter from A. H. Sharp, printed in the December number of the *Journal*, gave some particul respecting the first stages of the expedition undertaken by him and Mr. E. Grogan to the country north of Lake Tanganyika, where, among other geographi work, the course of the Rusizi and Lake Kivu were mapped. Mr. Sharp, it be remembered, was obliged to return home by Uganda and the East coast, his companion remained behind in the hope of continuing his journey down Nile to Khartum. In this he has been successful, telegrams from Omdurm announcing his arrival at that place on February 8. From Lake Albert Edwa Mr. Grogan went down the Semliki, and by the west shore of the Albert Nya to the Nile, which he followed as far as Bor. Thence, to avoid the swamps, made a detour through the Dinka country to the Bahr-el-Zeraf, which he stru 30 miles from its junction with the Bahr-el-Jebel. Having reached the base Major Peake's expedition for the cutting of the *sudd* on the Bahr-el-Abiad, he co tinued his journey by the central channel of the river. Mr. Grogan is now, believe, on his way to this country.

French Expeditions in the Sahara and Central Sudan.—After ma rumours of disaster, news has at last been received of the safe passage of t Foureau-Lamy expedition across the Sahara to the central Sudan. Passing throu Air, M. Foureau arrived at Zinder by a route not traversed by Europeans for nea fifty years, the great expedition of Richardson, Barth, and Overweg, whi reached the Sudan by this route in 1850–51, being, in fact, the only previo enterprise which had met with success in this direction, while the last travel to penetrate so far as Air had been the German Erwin von Bary (1877). Zind the important point of rendez-vous for caravans across the Sahara, both fr cco and Tripoli, had already been reached by Lieut. Pallier in command of e-constructed Voulet-Chanoine expedition, by which it had been occupied, in of some slight opposition on the part of the inhabitants. Some account of xpedition appears in the February number of the *Revue Française*. The erers of Captain Cazemajou (*Journal*, vol. xii. p. 316) were found and ted, but an attempt to push on to Lake Chad was frustrated by a mutiny g the native auxiliaries. The leader of the expedition, who led the mutineers to the Sudan along the line of the Anglo-French frontier, found the whole ry to the north of that line exceedingly barren, the last villages and wells ring just on the frontier. The expedition of M. de Béhagle, which was vouring to reach Lake Chad from the south (*Journal*, vol. xiv. p. 320), has encountered difficulties, and its leader has, according to recent accounts, made prisoner. He appears to have ventured into the territories of Rabah only six followers, and to have been arrested on approaching Dikoa, Rabah's al. M. Prins, the French resident left in Bagirmi by M. Gentil, seems to be with the Sultan of that country, and to have, during the last three years, done exploring work in the Shari basin. The latest news is to the effect that h's army has been defeated by M. Gentil, and that Rabah himself is a fugitive.

he British Niger Territories.—The administration of the Niger territories on January 1, 1900, formally taken over on behalf of the British government the representatives of the Royal Niger Company. The subdivision of the ory will in future be different from that which has hitherto held good. The r Coast Protectorate receives an accession of area, and is now known as Lower ria, extending up the river to the neighbourhood of Idda. The colony of s also gains an extension, being carried northwards to about the 9th parallel. rest of the territory formerly administered by the Niger Company is now n as Upper Nigeria, of which Colonel Lugard has been appointed governor, office in Lower Nigeria being held by Sir Ralph Moor, previously Commissioner Consul-General for the Coast Protectorate.

elimitation of the Dahome-Togoland Frontier.—The French section of nixed commission for the delimitation of the boundary between Dahome and land, has lately returned to France, after completing its labours, which have pied the greater part of two years. A short account of the work of the com- on, headed on the French side by Captain Plé, and on the German by Baron Massow (succeeded after his death by Dr. Priel), appears in the February ber of the *Revue Française*. The delimitation was carried out amidst great ulties, arising from the excessive rainfall, and occasional hostilities with the es, as well as from divergences of opinion between the representatives of the nations. Some portions of the line of country through which the frontier s were previously quite unknown, so that the surveys accomplished will result me additions of geographical knowledge.

he Upper Basin of the Old Calabar River.—A large-scale map em- ing the surveys of the active explorer, G. Conrau, in the upper basin of the Calabar river, is given in the fourth part of the *Mitteilungen aus den Deutschen tzgebieten* for 1899, with an explanatory note by Max Moisel. Herr Conrau's surveys in this district were made some years ago, but were revised during , while in that year and in 1899 the traveller followed an entirely new route ugh the districts of the Bangwa, Kabo and Basosi tribes, whose names have not ared in any previous map. This route seems to have kept for the most part to ower forest-clad country, traversed by the Manyu or Upper Old Calabar river its feeders, which together occupy a fan-shaped basin with a general slope to north-west. At his furthest point in the Bangwa district, however, the traveller gained an altitude of 4500 feet, the hills being there grass-covered. Parallel the route on the south-east the map shows a mountain range 4500 to 5000 fe high, though whether this was seen by Herr Conrau does not appear, a simil range having been shown on previous maps, though placed in these further to t south-east. The head streams of the Old Calabar have been previously show incorrectly, the Mbu, *e.g.*, which flows north, having been marked in former maps flowing west. The map gives many details as to the geology of the countr together with a number of altitudes obtained by careful boiling-point observation

Journey in Merere's Country.—Captain Prince, who has done much improve the knowledge of outlying parts of German East Africa, has recen explored the neighbourhood of the upper Ruaha valley, and an account of journey appears in the *Deutsches Kolonialblatt* for November 1 last. After visiti Uhenga and Gaviro, districts of Ubena, and settling a dispute between the Sult Merere and his brother, Captain Prince went north, and soon after left the und lating grass-lands characteristic of Ubena and entered the level plain of the Mpang or "Great Ruaha." After a strip covered with bush this formed an almost treel plain, extending as far as the eye could reach, and utterly desolate during the d season but for the vast herds of game, principally zebra and antelope. Capt Prince recommends that this district should form a reserve for zebra, the shooti of which by Merere's people be prohibited. Merere has lately formed a f settlements on the steppe, but there are none on the banks of the Mpangali. T stream was ascended to its junction with the Bavali and Kimara, being everywh navigable during this distance, but passing through a monotonous yellow pla heated by a scorching sun. Beyond Muhenjero, where the above-mentioned strea join the Mpangali, trees and cultivation were again met with in the district Donjera. The people here have both round huts and "tembes," the first for t dry, the second for the wet season. Crossing a number of copious clear-wa streams and an uninhabited stretch of bush, Captain Prince reached Utengu which was being rebuilt by Merere on its old site after suffering many vicissitu at the hands of predatory tribes. He also visited a new settlement on the w frontier of Merere's country, formed there by the Usafa escarpment. The pass which Usafa is reached appeared an easy one, and Captain Prince thinks it mig afford a good route from Nyasa to Rukwa and Tanganyika. He then traversed t country lying along the northern escarpment of the Kinga mountains—a well-wate tract which had suffered less than other districts from the prevailing drought—aft wards again entering Merere's country, and carrying his survey back to his startin point near Gaviro. During the journey the ravages of small-pox were everywhe apparent, but inoculation has now been carried out on a large scale.

Major Gibbons' Expedition.—The latest news received in this count from Major Gibbons shows that the traveller has, since last heard of, made so progress in his proposed journey to the source of the Zambezi. On October 6 l he was in south latitude 11° 37′, east longitude 23° 30′, a position, according existing maps, near the Liba river, a little east of Lake Dilolo. This was abo ten days' journey from the sources of the river, where he hoped to meet Capta Quicke, who was to have first explored the Upper Loenge or Kafukwe. Maj Gibbons still adheres to his plan of pushing on *via* Tanganyika and the Upp Nile to Khartum. Captain Hamilton has joined his regiment in South Afri He had visited the Mashukulumwe on the Lower Kafukwe as well as som striking falls on that river, which plunges 70 feet through a rift only 18 feet wid

North-Eastern Rhodesia.—This is the official title of the eastern part the British territory north of the Zambezi within the sphere of the British Sou Africa Company. An order in council, dated January 29, 1900, which giv tions for the administration of this territory, lays down its boundaries as : On the west the Congo Free State and Barotziland-North-Western ia (the latter comprising the western portion of the British territory defined previous order in council). On the south the Kafukwe and the Zambezi to the mouth of the Loangwa; the latter northwards to 15° S.; and the Portuguese boundary to the frontier of the British Central Africa Protecto- On the east the last-named frontier; and on the north the Anglo-German r, the south shore of Tanganyika, and the southern frontier of the Congo tate to Lake Mweru, including the island of Kilwa in the British sphere.

pedition in Northern Rhodesia.—A successful expedition to the least parts of northern Rhodesia was last year carried out by a prospecting party Mr. George Grey, who was accompanied by four Europeans. The expedition ulawayo on April 5, 1899, and crossing the Zambezi, went north through ga's country to the Kafukwe. Beyond that river the route led through dis- hitherto little explored, in which five months were spent. Friendly terms maintained with the natives throughout, and the travellers returned safely to ayo at the end of November.

AMERICA.

e Names of the Larger Features of North America.—A discussion tely been set on foot by Prof. Israel C. Russell, with a view of securing the on of a systematic nomenclature for the larger geographical features of America, and especially for the three great natural divisions of the con- . Prof. Russell's original paper, with remarks on the subject contributed by M. Dawson, Major J. W. Powell, Prof. W. M. Davis, and others, is printed *Bulletin* of the Geographical Society of Philadelphia for November, 1899. uggested system is mainly based on Prof. Dana's classification of mountains, , proceeding from the simple forms to the more complex, distinguished in turn and domes, ridges, ranges, systems, chains, and cordilleras. The last-named, applied to the largest group of all, is used by Prof. Russell to designate the reat mountainous regions of the east and west, under the respective titles tic and Pacific cordilleras. For the central region of plains and plateaux he sts the term "North American basin." The replies of the various geographers om reference was made on the subject, show the difficulty of attaining general ment in a question of the kind, some of the referees deprecating the adoption of igid nomenclature, and others objecting to the particular terms proposed. The f the term "cordillera" in the way suggested meets with general disapproval, he terms "Atlantic" and "Pacific" also find little favour. The best suggestion e two great mountain regions seems that of Prof. Davis, who proposes to call them tern and Western Highlands." The adoption of any collective term for the rn region is deprecated by Prof. Heilprin, on the ground of the great structural physiographical differences between the component parts. For the central region n" is preferred to "basin" by Dr. Dawson, while Prof. Davis suggests "medial " or "depression" as shorter and more convenient than Prof. Russell's phrase. r suggested terms are "the great central plain," and the somewhat clumsy ex- ion "Continental drainage areas." To the three regions already mentioned Prof. on would add a fourth, consisting of the Laurentian plateau or "shield."

orest Conditions of Porto Rico.—A report entitled "Notes on the t Conditions of Porto Rico," by Mr. R. T. Hill, of the U.S. Geological Survey, ecently been issued as Bulletin No. 25 of the Division of Forestry, U.S. rtment of Agriculture. It embraces the results of observations made by in January, 1899, and contains a statement of the forest resources of Porto

Rico and the extent of its timber lands, with succinct descriptions of the pl features of the island. Porto Rico was originally covered by forests, but largely deforested from a commercial point of view. The cultivation of coffee, and tobacco, the three staple agricultural products of the island, in a to a number of minor cultivations, have resulted in large areas of the surfac denuded of trees. The original forest has been preserved on the summit Yunque, the highest peak of the island, situated near the north-east end. the rainfall is very heavy, averaging 120 inches per year. A few insign patches of culled forest also occur in the central and north-western portions island. So far as was observed, the island presents two strongly marked an trasting zones of vegetation. One includes the whole of the mountains and coast, described as a region of great humidity, high altitudes, and stiff cla and where the general growth consists of deciduous trees of many specie the other is the foothill country of the south coast, a region of dry calcareou seasonal aridity, and low altitude, where the flora is largely of the type shrubby, thorny, leguminous, and acacia-like trees. The island appear adapted to the growth of trees, and in the author's opinion could be reforested. A number of characteristic views of Porto Rico and a relief the island illustrate the report.

Dr. Carl Sapper in Nicaragua and Costa Rica.—In a communica the Berlin Geographical Society (*Verhandlungen*, 1899, No. 10), Dr. Carl describes the principal results of a journey in Southern Central America m him in the early part of last year. They consist chiefly in material elucidation of the geology of that region, although some corrections of e maps as regards topography were also made. Dr. Sapper climbed a num the volcanoes of Nicaragua and Costa Rica, and in Chiriqui, across the fron Columbia, he made the first ascent of the volcano of the same name. In Nic he travelled from San Ubaldo (on Lake Nicaragua) to Agua Caliente on t Mico, and thence *viâ* La Libertad and Matagalpa to Leon. The districts through on this journey consist almost exclusively of recent eruptive rocks, also prevail in Northern Costa Rica. Towards the south-east of the latt central Cordillera consists chiefly of older eruptive rocks, while sedimentary d —including limestones, and tertiary marls, sandstones and conglomerates— both in the south-west of Nicaragua and in the coast Cordilleras of Costa Ric Chiriqui, a central mountain core of old eruptive rocks is flanked by more rocks of the same origin. The Chiriqui volcano lies on the southern slope former. The zones of climate and vegetation are more regular in Southern in Northern Central America. Moist primæval forests occupy the Atlantic varied in places only by tall grass and bush, while the Pacific slope is charact by dry forests passing here and there into bush-covered steppes or savannas. southern limit of pines runs in Nicaragua through Muy-Muy and the vol Viejo and Chichigalpa. In the province of Guanacaste (Costa Rica) forms c teristic of Northern Central America are still seen, while in the rest of the re South American types occur. Dr. Sapper came in contact with various tribes, paying special attention to the Chiripos, Bribris and Guatusos of Costa The new topographical data refer chiefly to the department of Cherita Nicaragua; the Nicoya peninsula, and other ports of Northern Costa Rica; a region of the upper Estrella and Chiriqui.

Prof. Hatcher's Explorations in Patagonia.—We learn from *Petern Mitteilungen* that Prof. Hatcher, Curator of the Museum of Princeton Univ whose first expedition to Patagonia was noticed in the *Journal* for 1898 (v p. 72), has since returned twice to that country, whence he has lately br e a large amount of valuable information respecting the geological structure ie country. In 1898 he examined the neighbourhood of Punta Arenas and region of the source of the Deseado. After returning home for a month, . Hatcher started on his third journey in December of the same year, this turning his attention to the upper region of the Santa Cruz river and the coast.

AUSTRALASIA AND OCEANIC ISLANDS.

'he "Albatross" Expedition to the Pacific.—*Science* of January 19 last ishes a second letter from Dr. Agassiz dated Papeete Harbour, Tahiti, ember 6, 1899, giving further particulars of the work of the *Albatross* expedi- While at Papeete an examination was made of that part of the barrier reef ahiti, which had been surveyed by the *Challenger*, with the result that the ition of the outer slope of the reef was found to differ from its description as n in the *Challenger* narrative. The growing corals were comparatively few umber. Point Venus was also visited for the purpose of examining Dolphin :. Only a few corals were found growing on it. The party left Papeete on ber 5 for the Paumotus, and an extended examination was made of the group. atea, which had been visited on a previous occasion, appears to have been ect to a great amount of denudation and erosion. Here a depression was d from 40 to 50 feet lower than the rim of either face of the island, and er at its southern extremity. After leaving Tahiti over a hundred soundings made. These soundings indicate that atolls do not necessarily rise from very t depths. The deepest sounding among the Paumotus was on the line to the hward of Hereheretue, in the direction of Mahetia, where a depth of 2524 oms was obtained. All the islands examined are formed of tertiary coralliferous stone, which has been elevated to a greater or less extent above the level of sea, the greatest elevation being at Makatea, about 230 feet. Dr. Agassiz isses at some length the structure and mode of formation of Paumotu atolls, a large number of photographs were taken to illustrate this subject. The ity of surface animal life in the Paumotu area is pointed out as remarkable. November 4 the party were well on their way to Mehitia, the eastern-most ie Society islands.

Supposed Fluctuations of Level in Samoa.—Many observers have pointed henomena in Samoa which are supposed to indicate the occurrence of recent eavals and depressions of the surface of the islands. The subject is discussed he first number of the new volume of *Petermanns Mitteilungen* by Dr. ustin Krämer, who during his journeys in Samoa has carefully examined the nd for proofs of such changes of level. His conclusion is that the phenomena rved can in no way be considered as establishing the fact of such movements, of them being capable of other explanations. Dr. Krämer has made the whole uit of Savaii on foot, aneroid in hand, by rough paths leading at times over s of the interior mountains. The ways often pass for miles over smooth blocks asalt, from one to another of which it is necessary to step, with constant danger lipping. In places the going is made easier by the presence of slabs of coral, rough surface of which gives firmer foothold. These coral blocks found at some ght above the sea have been taken as proofs of elevation, but Dr. Krämer thinks t they have been transported by the inhabitants, as the underlying rock is coral, while they are never found far from the paths, and coral reefs are ays to be seen on the coast in their vicinity. The coral blocks seen by Stübel nd from Apia near the temple of the cuttle-fish god are thought by Dr. Krämer have been transported in connection with the worship formerly carried on there. Cape Tapaga (Upolu) he found no trace of limestone rock *in situ*, such as is spoken of by Dana, while fragments of coral found near the summit of Fanuatapu island, a steep volcanic rock off the cape, may, he thinks, have been carried there as is stated by the natives, during hurricanes. Discussing the cause of the waterless nature of Savaii and Western Upolu, Dr. Krämer ascribes it rather to the sligh inclination of the surface than to its recent volcanic origin. Although inferior in picturesqueness, in its inland parts, to Upolu, Savaii stands first as regards it coast scenery, with its cavernous recesses, spout-holes, etc., which Dr. Kräme describes enthusiastically. As regards the encroachments of the sea on the sand beach in parts of Savaii, he sees in them no evidence of sinking, but rather of slow destruction by the sea of land formerly created by the same agency, possibly owing to increased violence of storms within recent years.

Journey in Celebes.—The well-known missionary in Celebes, A. C. Kruyt has lately made a journey across the eastern peninsula of the island from th gulf of Tomini to that of Tomori and back, the chief results of which are de scribed in a letter published in the December number of *Petermanns Mittei lungen* (1899, p. 297). From Posso the traveller, accompanied by Dr. N. Adriani went by sea to Uwekuli, a place near Tojo, crossing thence by land to the gulf o Tomori and sailing down the coast to the large river La (Tampira of the maps) This was ascended for two days, when a halt was made to allow of an arrange ment with the chief of Tomori for the continuation of the return journey to Posso This was satisfactorily accomplished, the chief, who had never before come int contact with Europeans, proving a fine specimen of a native potentate. He ha not yet embraced Mohammedanism, though much under Buginese influence Besides exploring the La (a larger stream than the Posso) and its tributaries, th travellers discovered the lake heard of by Sarasin under the name Lowo, which i drained by the Ngangalovo. It lies not north but south of the La, and is merel a piece of flooded grass-land only 2–3 feet deep in the dry season. In the rain season its eastern part is connected with the La. The latter traverses an enormou grassy plain about 450 feet above the sea, lying north of the Mori mountains The journey resulted in a better knowledge of the mountain and river systems of thi part of Celebes, while important linguistic and ethnological material was obtained.

Dr. Koch's Expedition to Java and New Guinea.—Dr. Koch, who ha undertaken a journey to the East for the purpose of malaria investigations, ha spent some time in Java before proceeding to New Guinea. He visited th Sanatorium at Tossari, 5600 feet above the sea, and obtained samples of the bloo of patients for the purpose of studying the malaria bacillus. He has now proceede to his further destination.

Miangas Island (Meangis of Dampier).—A difficulty has long been felt i identifying the Meangis island, first mentioned by William Dampier as lying, wit two more close by it, within 20 leagues of Mindanao, and abounding in gold an cloves. Many (including Valentijn) have supposed that the Nanusa group wa referred to, while others have considered the island quite mythical. The questio is discussed in the twelfth number of *Petermanns Mitteilungen* for 1899, by Pro A. Wichmann of Utrecht, who points out that in addition to Dampier's account ther are other authorities, dating from the early part of the nineteenth century, for th existence of an island of similar name apart from the Nanusas. To settle the questio he applied to Herr E. Steller, a missionary long resident on the island of Sangi, wh informed him that Meangis really existed, and that in 1895 it was examined an its position fixed by a Dutch ship, proving to be identical with the small islan known as Palmas in the time of the Dutch East India Company, which is betwee the Nanusas and Mindanao. The true name is said to be Miangas. Dampier wa wrong in saying that there were three islands, but Prof. Wichmann quotes Cartere calls it Hummock island), as stating that from a distance it appears like l islands. In Homem's map of the Moluccas of 1568, the island for the first appears as "I. de Palmeiras," while in subsequent maps the names "Ya de ," "Isla de Palma," also occur. The form "Palmas" has survived in some rn maps.

POLAR REGIONS.

r. Otto Nordenskjöld's Proposed Antarctic Expedition.—It is stated first number of *Petermanns Mitteilungen* for the current year that Dr. Otto enskjöld, who is already well known for his explorations in Southern Pata-, has arranged a programme for an antarctic expedition, on which he hopes to in July, 1901, simultaneously with the German and English parties. His of operations will lie to the south of South America, and he proposes, after ng southwards in the summer of 1901–2, to establish a winter station on the Shetland islands.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

rof. de Lapparent's Treatise on Geology.—Prof. A. de Lapparent has tly published the fourth edition of his great work on geology,* and in several cts it is deserving of notice from the point of view of the geographer as well the geologist. The author has the honesty and the courage to change his in the present edition on several points, the new evidence regarding which hown him that the earlier position was untenable. The most thorough change work is the subdivision of the great geological systems and the treatment h stage in the important formations on a geographical basis, attempting in case to give an approximate map of the distribution of land and water at the No geological work was illustrated so richly with sketch-maps before. paleogeographical considerations are here applied on a world-wide scale ghout the whole range of geological time, and furnish an instructive and st bewildering insight into the frequency and variety of the interchanges h have taken place between land and water. Prof. de Lapparent is careful to l against the impression that these sketches are intended to delineate the l of fossil coast-lines; he clearly states that they are of a purely general cha-r, showing merely the relative positions of the larger stretches of land and . How completely the geographical rather than the biological idea dominates new exposition of geology may be gathered from the statement in the preface: adopting this point of view henceforth, it is our aim to allow geology to ge from its traditional dryness, and to present it no longer as a juxtaposition lated sections from which one endeavours to extract the elements of a history on the surface of the globe, but rather as a reconstruction of the successive des which are presented by the geographical evolution of the planet as a ." No author has done more than M. de Lapparent to urge on geologists the of geographical conceptions, and on geographers the fundamental importance ological facts.

he Dutch Deep-Sea Expedition in the Malay Archipelago.—The latest nts of the progress of this expedition (*Journal*, vol. xiii. p. 57), given in e from Prof. Weber's reports in the last two numbers of *Petermanns Mitteil-* for 1899 (pp. 272, 298), and in the first number of the *Geographische Zeit-t* for 1890, show that most valuable results have already been obtained. The tions have included, in addition to the zoological investigations, soundings,

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* 'Traité de Géologie,' par A. de Lapparent, membre de l'Institute. Quatrième n, refondue et considérablement augmentée. En deux parties—Phénomènes el, et Géologie proprement dite. Paris: Masson et Cie., 1900.

determinations of temperature, etc., extensive surveys of the coasts and harbou where existing maps have proved defective. The sea-areas examined include tl Macassar strait, Celebes sea, Molucca strait, Halmahera sea, and Ceram se while many of the adjoining coasts and islands have been touched at. The dee sea soundings have given unexpected results, which entirely modify our ideas as the configuration of many parts of the sea-floor. The examination of the sea nor of Bali and Lombok disclosed the fact that no continuous deep channel, such was taken by Wallace as the prime factor of the distribution of animals in this p of the world, exists between the islands, the deep water being closed in towa the south of the strait by a submarine ridge with no depth greater than 1 fathoms. Again, although a submarine ridge running across the Manipa st divides the Banda sea from that of Ceram, no such connecting ridge runs betw Buru and the Sula-Besi group, nor between Buru and Celebes, depths of 2200 a 2674 fathoms being found on the two lines in question. The Ceram sea is, ho ever, separated from the Molucca strait by a submarine ridge.

GENERAL.

The Russian Geographical Society.—The Russian Geographical Soci held its annual meeting on February 7, and at this meeting Admiral Rykatcl well known for his extensive meteorological work, was elected Vice-President of Society, to occupy the vacancy left by the death of General Tillo. The follow medals were awarded:—The great Constantine gold medal went this year to section of ethnography, and was awarded to A. M. Pozdyéeff for his great w 'Mongolia and the Mongols,' and his other works, 'The Monasteries of Mongo etc., devoted to the study of that country; the gold medal of Count Lütk L. K. Artamonoff for his geodetic work in Caucasia, Persia, and Abyssinia; gold medal of P. P. Semenoff to E. W. Bretschneider for his extensive w written in English, 'History of European Botanical Discoveries in China.' great gold medal of the Geographical Society, which had to be awarded this in the section of ethnography, was given to N. A. Marruza for his 'Collectio the Parables of Wordan;' and finally, the gold medal of Przevialsky was awa to E. E. Anert for his work on the geology of Manchuria. Small gold medals awarded to R. N. Savélieff for work in meteorology which he had done for Society; to N. N. Lelyakin for numerous astronomical determinations and o similar work; and to V. N. Iochelson for his paper on the nomad-stems in the b daries between the Indighirka and the Kolyma. The silver medal of P. P. Seme was awarded to Madame M. A. Lyamina for her popularization of the works acc plished by Russian travellers; while eleven silver medals of the Society were g to A. K. Bulatovich, V. Th. Novitzky, P. G. Ignatieff, and K. P. Mordvin for v done in the section of mathematical and physical geography; and to V. G. Bog (the explorer of Yakutsk), G. G. Iliinsky, P. Dvinovsky, G. Skurlatoff, G. Wilczi and Madame E. E. Lineff for work done in connection with the section of et graphy. Five bronze medals were awarded by the physical geography sectio MM. Lukianoff and Seid Sivachi (in Bukhara), and to three students of the l Polytechnical School, MM. Kozlennikoff, Malevansky, and Savélieff.

New Publication of the Paris Geographical Society.—Following precedent of the Royal Geographical Society in 1879, the Paris Geograpl Society has from the beginning of 1900 abandoned the dual system of publica which has for so long been the tradition of learned societies. In place of *Comptes Rendus*, or Proceedings, and the *Bulletin*, or Transactions, formerly p lished, the Society now produces a handsome monthly journal, including orig papers read to the Society, notes and bibliography under the title "La Géograp tin de la Société de Géographie." The January number contained eighty and 'ebruary number ninety-six of the largest octavo pages, accompanied by maps plates. The new publication is edited by Baron Hulot, the general secretary e Society, and M. Charles Rabot, editorial secretary. We congratulate the ty on the handsome appearance of its new journal, and wish it all success.

OBITUARY.

The Marquis of Lothian, K.T.

MBERG HENRY KERR, ninth Marquis of Lothian, whose death occurred in ary, after an illness of three months, had been a member of our Society since Lord Lothian formerly held various appointments in the Diplomatic ce, the last being in Vienna, where he was appointed second secretary in 1865. ucceeded to the title in 1870, and was Secretary for Scotland in Lord oury's second administration from 1887 to 1892. Lord Lothian's taste for aphy was no doubt stimulated by his service abroad, during which Persia had included in his sphere of activity. He had in recent years been President of Royal Scottish Geographical Society.

Sir William Wilson Hunter, K.C.S.I., C.I.E.

Ve regret to record the death, in his sixtieth year, of Sir William W. Hunter, well-known authority on Indian history and statistics, which took place on ary 7, as the result of an attack of influenza. The son of a Glasgow facturer, William Hunter was educated in that city, graduating at the ersity at the age of twenty. After completing his studies at Paris and Bonn, ok a high place in the Indian Civil Service competition in 1861, and was nted to a post at Birbhum, in southern Bengal. Here he devoted much time e study of local tradition and history under British rule, publishing the s in 1868, under the title of 'Annals of Rural Bengal.' By this work, and ond published in 1872, on the province of Orissa, Hunter's literary qualifica- became generally recognized, and in 1869 he was entrusted by Lord Mayo the important task of superintending the collection and publication of tical accounts of all the Indian provinces, regarding the true state of which ignorance had prevailed, not only in England, but even among those in rity in India. This work occupied twelve years, during which Hunter lled from end to end of the country, and thus gained a personal insight into arying characteristics such as falls to the lot of few. The results were shed in over 100 volumes, the substance of which was afterwards condensed e-arranged so as to form the well-known 'Gazetteer of India,' originally l in nine, but subsequently enlarged to fourteen volumes. Incidentally, a l service was done in the publication of the 'Gazetteer,' by the systematiza- of the orthography of Indian place-names, for which Hunter's method has generally accepted. After the conclusion of the work, during the progress hich he had held the post of Director-General of Statistics, Hunter was for years a member of the Governor-General's council, but retired in 1887, ng down near Oxford to a life of literary activity. Among the varied pro- ons of his pen, his 'Life of Brian Hodgson' (1896), and the opening volume great work on the 'History of British India,' published last year, may be ally mentioned. The latter was to have been the first of five volumes, in h the great mass of materials collected by Hunter during his life in India were to be drawn upon for a comprehensive account of the growth of Briti dominions in that country. Sir William Hunter was married in 1863 to daughter of Thomas Murray of Edinburgh, who, with two sons, survives him. William Hunter had been a Fellow of the Society since 1872.

Sir Henry William Gore-Booth, Bart.

The death has lately occurred of Sir Henry Gore-Booth, Deputy-lieutenant Justice of the Peace for the County of Sligo, who had been a Fellow of our Soci since 1879. Sir Henry, who succeeded his father as Baronet in 1876, was kno to geographers for the cruise in the Arctic seas which he undertook in 1879, hir for the purpose the Norwegian cutter *Isbjorn*, the vessel in which Payer Weyprecht had made their preliminary voyage to the north in 1871. He accompanied by Captain (now Admiral) A. H. Markham, who subsequen published an account of the cruise, which he also described in a paper read be our Society (*Proceedings*, N.S., vol. ii. pp. 1 *et seq.*). Although great results w not attained, the voyage was useful as throwing light on the state of the ice at time in the seas between Novaya Zemlya and Spitzbergen. Sir Henry G Booth succumbed to an attack of influenza at St. Moritz on January 13 last.

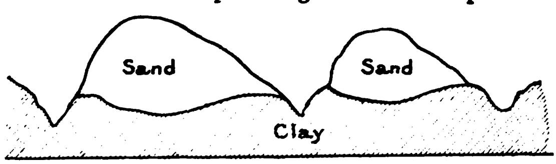
M. Henri Coudreau.

The death has been announced of M. Henri Coudreau, the well-known expl of French Guiana and neighbouring parts of Brazil, who succumbed to a se attack of fever while engaged in an expedition on the Trombetas, a north tributary of the Lower Amazon. M. Coudreau's exploring activity had b maintained with little intermission for nearly twenty years, and the result regards our knowledge of the interior of Guiana have been of much value. 1881 he obtained from the French Government a mission for the examinatio the geography and resources of the French territory, the execution of wl occupied him until 1885. The districts visited included that of the Galibi t in the northern part of the colony, the contested territory between the Oya and the Araguari, and the more remote region of the Rios Branco and Ne The results of the journeys were published in 1886–7 under the title of 'La Fr Equinoxiale,' a work which deals, in addition to the narrative of the journ with a wide range of subjects from the native Indian tribes to the history prospects of colonization, the latter being regarded by the author as bri Between 1887 and 1891 M. Coudreau continued his labours in the south interior of French Guiana, exploring the courses of the Maroni, Itani, Oya and other rivers, and determining the altitudes of a number of points in Tumuc Humac range, the climate of which he found healthy and exhilarat In the upper basin of the Oyapok, which he found almost uninhabited, he surve a large area of previously quite unexplored country, while he also crossed to southern slopes of the Tumuc Humac range. He described these journeys i work entitled, 'Chez nos Indiens' (1893), while their cartographical and o results were dealt with also in the *Bulletin* of the Paris Geographical Society. 1896 he turned his attention to Brazil, making a voyage up the Tocantins, an the following year undertaking, on behalf of the Government of the State of P an examination of the Xingu and its tributaries. In this he encountered c siderable difficulties, both from the rapids and from the hostility of the nati In 1898 he made an important journey between the Tocantins and Xingu, results of which were recorded in a work published last year, including a la nap in fifteen sheets. The most important rectification introduced was that course of the Anapu, the principal stream of the region south of Marajo till then practically a *terra incognita.* Of M. Coudreau's last disastrous y little is yet known.

CORRESPONDENCE.

The Regions of the Okovango.

eadwaters of the Okovango and Kwando or Chobé rivers drain a country of ills. These sand-hills rest on an extensive bed of clay; the river-channels cut through this clay bed long ago, so that the outcrop of clay is on the hill- nd often above the path. Towards the end of the rainy season the water s out all along these clay-seams and runs down to the rivers; and as the dry advances this trickle increases to quite a flow in some places. As an ry untrained observer, the theory has suggested itself to me that the weight heaped-up sand has caused depressions in the clay bed, corresponding in a way to the height of the heap of sand drifted by the wind on top (for the ills run roughly north and south, and their gradual slopes all face to the hich is the direction of the prevailing winds in that part of Africa), thus:



be so, then it is easy to see how, when the depressions in the clay fill up, ter will overflow, and finally be drained off by innumerable syphons into the eds. The smaller rivers and streams all flow rapid and clear as crystal.

FRED. S. ARNOT.

Belmont Drive, Liverpool, February 1, 1900.

Lake Rukwa.

at Lieut. Glanning (*Geographical Journal*, vol. xv. p. 179) should make the of the open water of Lake Rukwa to be over 50 miles—more than double found it—is interesting, because he was there in June, two months earlier year than I was, and the length of 50 miles is just midway between the assigned to the lake in the wet and dry seasons—80 miles at the end of season, say, in March, and 25 miles in the month of August, when I was -and is, therefore, in substantial agreement with my observations. That he have thought, however, that the lake does not considerably increase its ions in the rainy season, is probably due to the fact that the water was high he was there, and that his expedition passed from Muambunyu's (Mwini 's) round the east and south of the lake, where it alters least to Kasonso's Saisi. On the portion between Chiubi and Chipindi on this route, it can alter at all unless the water falls very low, for the sides are here often pre- s. On the south, where he supposes the lake to have retreated a mile within ten years, is the plain which I considered to be covered with water in the eason. It is more than probable that this plain is not covered every rainy and that the full length of 80 miles is not all open water every year, but e lake considerably alters its dimensions is evident from the fact that it was

25 miles longer when the German expedition was there last year than when I there in 1897, and the whole of the increase must be on the portion which I shown as swamp to the north-west. Beyond this swamp is the bare part, wh flooded from the river Kafu, and which in June was probably already dried it was when I crossed it in August.

As the German Government have now taken in hand more accurate surve this part of the country, probably any speculations as to the changes in volu the lake are useless, for these changes will certainly be very carefully note before long made known, and then I think it will be found that, at least d many, if not all rainy seasons, the full extent of 80 miles will be covered by which, in the dry season, will contract to only 25 miles, as it had done when there.

L. A. WALLA

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIET SESSION 1899-1900.

Fourth Ordinary Meeting, January 22, 1900.—Colonel Sir T. H. Ho R.E., K.C.I.E., C.B., Vice-President, in the Chair.

ELECTIONS.—*Alexander Alexander; Hubert E. M. Bourke; Captain Co 2nd Queen's (R. West Surrey Regt.); Captain H. J. Hare, R.E.; Dr. Guy tram; Basil Martineau; E. S. Preston, M.A., C.E., A.M. Inst. C.E.; Poulett-Weatherley; Wm. Scoresby Routledge, M.A. Oxon.; Godfrey H Joseph Williams.*

The Paper read was :—

"An Expedition to the Summit of Mount Kenya, British East Africa." J. Mackinder, M.A.

Fifth Ordinary Meeting, February 5, 1900.—General Sir CHARLE WILSON, R.E., K.C.B., K.C.M.G., Vice-President, in the Chair.

ELECTIONS.—*James F. J. Archibald; William Boyd; Frank R. Cana; A Higgs Cane; William Morris Colles, B.A. (Cambs.); Albert Crailsheim; W Christian Daish, M.D.; Gilbert Davidson; Francis George Didden; M Egerton; Percy Norman Furber; Robert Norrell Greenwood; C. B. Hau Clarence Hooper; Alexander Howell; Captain William Frederick O'C R.A.; George Sandeman; James White.*

The Paper read was :—

"A Fragment of the Geography of England : South-West Sussex." B H. R. Mill.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By HUGH ROBERT MILL, D.Sc., *Librarian*, R.G.S.

THE following abbreviations of nouns and the adjectives derived from the employed to indicate the source of articles from other publications. Geogra names are in each case written in full :—

A. = Academy, Academie, Akademie.	Mag. = Magazine.
Abh. = Abhandlungen.	Mem. = Memoirs, Mémoires.
Ann. = Annals, Annales, Annalen.	Met. = Meteorological.
B. = Bulletin, Bollettino, Boletim.	P. = Proceedings.
Com. = Commerce.	R. = Royal.
C. Rd. = Comptes Rendus.	Rev. = Review, Revue.
Erdk. = Erdkunde.	S. = Society, Société, Selskab.
G. = Geography, Geographie, Geografia.	Sitzb. = Sitzungsbericht.
Ges. = Gesellschaft.	T. = Transactions.
I. = Institute, Institution.	V. = Verein.
Iz. = Izvestiya.	Verh. = Verhandlungen.
J. = Journal.	W. = Wissenschaft, and compounds.
k. u. k. = kaiserlich und königlich.	Z. = Zeitschrift.
M. = Mitteilungen.	Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in he list below is denoted by the length and breadth of the cover in inches to the nearest alf-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

ustria—Bohemia. *Sitzb. A.W. Wien* 107, Abth. 1 (1898): 669–698. **Knett.**
Mittheilungen der Erdbeben-Commission der Kaiserlichen Akademie der Wissenschaften in Wien. VII. Verhalten der Karlsbader Thermen während des vogtländisch-westböhmischen Erdbebens im October–November 1897. Von Josef Knett. *With Map, Diagrams, and Plates.*

ustria—Bohemia. *Sitzb. A.W. Wien* 107, Abth. 1 (1898): 1179–1207. **Woldřich.**
Mittheilungen der Erdbeben-Commission der Kaiserlichen Akademie der Wissenschaften in Wien. IX. Bericht über die unterirdische Detonation von Melnik in Böhmen vom 8 April 1898. Von J. N. Woldřich. *With Map.*

ustria—Bohemia. *Sitzb. A.W. Wien* 107, Abth. 1 (1898): 789–959. **Becke.**
Mittheilungen der Erdbeben-Commission der Kaiserlichen Akademie der Wissenschaften in Wien. VIII. Bericht über das Graslitzer Erdbeben, 24 October bis 25 November 1897. Von F. Becke. *With Maps.*

elgium. *Mém. Cour. A.R. Belgique* 48, 2 (1898): 1–156. **Kurth.**
La frontière linguistique en Belgique et dans le nord de la France. Par G. Kurth.

ntral Italy. **Baedeker.**
Italy. Handbook for Travellers. By K. Baedeker. Second Part: Central Italy and Rome. Thirteenth Revised Edition. Leipsic: Karl Baedeker; London: Dulau & Co., 1900. Size 6½ × 4½, pp. lxxvi. and 454. *Maps, Plans, etc. Price 7 m. 50 pf. Presented by Messrs. Dulau & Co.*

rance—Vaucluse. *B.S.G. Marseille* 23 (1899): 31–51, 161–176. **Barrême.**
La géographie du Mont-Ventoux. Par M. Eug. Barrême.

ermany. **Schwabach.**
Trade of Germany for the year 1898. Foreign Office, Annual No. 2344, 1899. Size 10 × 6, pp. 44. *Price 2½d.*

ermany—Bavaria. **Gruber.**
Das Ries. Eine geographisch-volkswirtschaftliche Studie. Von Dr. Christian Gruber.—Forschungen zur deutschen Landes- und Volkskunde . . . herausgegeben von Dr. A. Kirchhoff. Zwölfter Band, Heft 3. Stuttgart: J. Engelhorn 1899. Size 9½ × 6½, pp. 187–292. *Maps and Diagrams.*

A geographical monograph of the small agricultural district known as the Ries, etween the Swabian and Franconian Jura, bordering on Württemberg.

ermany—Hamburg. *M.G. Ges. Hamburg* 15 (1899): 131–188. **Buchheister.**
Die Elbe und der Hafen von Hamburg. Von M. Buchheister. *With Plan.*
Also a separate copy presented by the Hamburg Geographical Society.

This memoir deals with the Elbe as a river, but mainly with the lower Elbe, its mprovement and lighting, the formation and growth of the harbours of Hamburg and uxhaven, and the trade of these ports.

ermany—Prussia. **Bernal.**
Trade of Stettin and District for the year 1898. Foreign Office, Annual No. 2345, 1899. Size 10 × 6, pp. 50. *Price 3d.*

Greece—Archæology. **Komni**

Panagiotoi Al. Komninoi. Lakonika Chronon proïstorikon te kai istorikon. Chor graphia Lakonikes kai topographia Spartes istorike. Athenais: Typographeio "Paliggenesias," 1898. Size 9½ × 6½, pp. 368. *Presented by the Author.*

Holland—Springs. *Verh. K.A. Wetens. Amsterdam* (2 de Sec.) **6** (1899): 1–40. **L**

Mededeelingen omtrent de geologie van Nederland, verzameld door de commiss voor het geologisch onderzoek. No. 26. Onze brakke, ijzerhoudende en alk lische Bodemwateren. Door Dr. J. Lorié. *With Plate.*

On the saline water of some springs and wells in Holland, with a discussion o origin.

Hungary—Carpathians. *C. Rd.* **129** (1899): 978–980. **Marto**

Sur l'histoire de la vallée du Jiu (Karpates méridionales). Note de M. E. Martonne.

The valley of the Jiu is peculiar in being a transverse valley cutting throu whole chain of mountains.

Italy—Alps. *B.S.G. Italiana* **12** (1899): 572–585. **D**

Balze per faglia sui Monti Lepini, nota del prof. William M. Davis, tradotta d socio dott. Fr. M. Pasanisi. *With Map and Illustrations.*

Italy—Lipari Islands. *Abh. A.W. München* **20** (1899): 1–274. **Berg**

Die äolischen Inseln (Stromboli, Panaria, Salina, Lipari, Vulcano, Filicudi u Alicudi) geologisch beschrieben. Von Alfred Bergeat. *With Maps and Plates.*

A study of volcanic geology, illustrated by coloured geological maps of the isl mentioned above, by numerous sketches and diagrams, and accompanied by exhau bibliographies.

Mediterranean—Cyprus. *J.R.I. British Architects* **7** (1899): 21–35. **Mu**

Excavations in Cyprus, 1896. By Dr. A. S. Murray. *With Illustrations.*

On the archæological results of the excavations at Salamis.

Norway—Hardanger Lakes. *Geolog. Mag.* **6** (1899): 533–540. **Monc**

Notes on some Hardanger Lakes. By H. W. Monckton. *With Illustrations.*

Russia. **Mic**

Trade of Russia for the Year 1898. Foreign Office, Annual No. 2343, 1899. Si 10 × 6, pp. 90. *Price 5d.*

Russia. **Woodh**

Trade of Riga and District for the Year 1898. Foreign Office, Annual No. 23 1899. Size 10 × 6, pp. 26. *Price 2d.*

Southern Europe. *C. Rd.* **129** (1899): 734–737. **Matte**

Sur l'état actuel des volcans de l'Europe méridionale. Note de M. Matteucci.

Sweden—Timber Industry. **Lunds**

Från Svenska Barrskogar. Förklaringar och Bilder till Sågverks- och Trävaru portföreningens utställning i Stockholm, 1897, utgifna af Axel N. Lundströ Stockholm, 1897. Size 9 × 6½, pp. 52. *Illustrations. Presented by the Universitets-Biblioteket, Upsala.*

A richly illustrated account of the pine-forests of Sweden and the trade in prep and manufacturing timber in that country. There are ninety-two pages of exce illustrations.

Turkey. *Verh. Ges. Erdk. Berlin* **26** (1899): 305–319. **Oestr**

Reisen im Vilajet Kosovo. Von Dr. Karl Oestreich.

United Kingdom—Ireland. *P.R. Irish A.* **5** (1899): 433–440. **Knowles and o**

Investigation of the Prehistoric Settlements near Roundstone, Connemara. Rep of the Committee, consisting of Messrs. W. J. Knowles, W. H. Paterson, R. Praeger, and F. J. Bigger. *With Illustrations.*

United Kingdom—Minerals. **F**

Mines and Quarries: General Report and Statistics for 1898. Part iii.—Outp General Report and Statistics relating to the Output and Value of the Miner raised in the United Kingdom, the Amount and Value of the Metals produc and the Exports and Imports of Minerals. Edited by C. Le Neve Foster, D London: Eyre & Spottiswoode, 1899. Size 13 × 8½, pp. 117–266. *Diagr Price 1s. 5d. Presented by the Home Office.*

ASIA.

. **Bent.**
hern Arabia. By Theodore Bent and Mrs. Theodore Bent. London: Smith, r & Co., 1900. Size 9 × 6, pp. x. and 456. *Portrait, Maps, and Illustrations.* 18s. *Presented by the Publishers.*

s recounts the various journeys made by the late Mr. Theodore Bent and by ent in Southern Arabia, and is accompanied by detailed maps, photographs, and of inscriptions.

lia—Rice Culture. *Rev. Scientifique* 13 (1900): 109–114. **Leclère.**
ulture du riz au Cambodge. Par M. Adhémard Leclère.

etc. *J. Linnean S.* (*Botany*) **26** (1899): 457–538. **Forbes and Hemsley.**
Enumeration of all the Plants known from China Proper, Formosa, Hainan, a, the Luchu Archipelago, and the Island of Hongkong, together with their ribution and Synonymy. By F. B. Forbes and W. B. Hemsley.

-Boats. **Cholnoky.**
ekedés a Rhinai alföldon. Cholnoky Jenö-töl. (Különlenyomat a Magyar nök- és Épitész-Egylet Közlönye 1899, évi v. füzetébol.) Size 12½ × 9½, 4. *Map and Illustrations. Presented by the Author.*

Chinese river-boats, with many illustrations of the vessels and their equipment.

-Bridges. **Cholnoky.**
hinaiak hídépítéséröl. Cholnoky Jenö-töl. (Különlenyomat a Magyar Mérnök-pítész-Egylet Közlönyének 1899, évfolyamából.) Size 12½ × 9½, pp. 12. *rations. Presented by the Author.*

Chinese bridges, with numerous illustrations of different types of bridges in

-Mongolia. **Suess.**
rreste von Rhinoceros sp. aus der östlichen Mongolei. Von Akadem. Ed. s. Mit Anmerkungen von W. Obrutschew. (Separat-Abdruck aus den andlungen der Kaiserlichen Russischen Mineralogischen Gesellschaft zu Petersburg. Zweite Serie, Band xxxvi. No. 2.) St. Petersburg: C. Birkenfeld . Size 9½ × 6½, pp. [10]. *Illustrations. Presented by M. W. Obrutschew.*

-Wuhu. **Clennell.**
le of Wuhu for the year 1898. Foreign Office, Annual No. 2340, 1899. Size 6, pp. 16. *Price* 1*d.*

ina. *B.S.G. Paris* **20** (1899): 330–343. **Barthélemy.**
pays des Moïs. Par le Comte de Barthélemy. *With Map.*

T. Asiatic S. Japan **26** (1898): 1–114, 163–218. **Riess.**
ory of the English Factory at Hirado (1613–1622). With an Introductory pter on the Origin of English Enterprise in the Far East. By Dr. Ludwig s.

Archipelago—Amboina. **Verbeek.**
Verh. K.A. Wetens. Amsterdam **6**, 2 Sec. (1899): 1–26.
de Geologie van Ambon. Door R. D. M. Verbeek. *With Plate.*

Archipelago—British North Borneo. **Cook**
le of British North Borneo for the Year 1898. Foreign Office, Annual No. , 1899. Size 10 × 6, pp. 20. *Price* 1½*d.*

Peninsula. **St. John.**
kola. By R. F. St. Andrew St. John. (From the *Proceedings* of the Oriental gress at Paris.) Size 11 × 7, pp. [18]. *Presented by the Author.*

ritical study of the position of Takkola, a place mentioned in the Milinda Pañha, has been localized as on the west coast of the Malay peninsula.

—Historical. **Hotz.**
ië. Overzicht van in de Nederlandsche Taal uitgegeven werken, gevolgd een Opgave van de voornaamste Buitenlandsche Schrijvers. Door A. Hotz. en: E. J. Brill, 1897. Size 10 × 6½, pp. 48. *Presented by the Author.*

s gives details as to works in the Dutch language dealing with Persia, and ces to books on Persia in other languages.

—Lake Urmi. **Günther.**
ributions to the Geography of Lake Urmi and its Neighbourhood. By R. T. ther, M.A. (From the *Geographical Journal* for November, 1899.) Size 6½, pp. 20. *Map and Illustrations.*

Persian Gulf.
Trade of Persian Gulf for the Year 1898. Foreign Office, Annual No. 2346, I
Size 10 × 6½, pp. 46. *Price 2½d.*

Russia—Siberia. *B.A. Imp. Sci. St.-Pétersbourg* 10 (1899): 269–318. B
Spécimens des matériaux pour l'étude de la langue des Tchouktches et du
lore, recueillis dans le district de Kolymsk. Par V. Bogoraz. [In Russian.]

Russian Central Asia. *Oester. Monats. Orient.* 25 (1899): 85–88.
Das Eisenbahnwesen in Centralasien und seine Bedeutung.

On the importance of the Russian railways in opening up Central Asia.

Tian Shan. *Z. Ges. Erdk. Berlin* 34 (1899): 1–62, 193–271. Frieder
Morphologie des Tiën-Schan. Von Dr. Max Friederichsen. *With Map.*
Also a separate copy presented by the Author.

Tibet. *B.S.G. Genève* 38 (1899): 122–141. Tur
Voyage et aventures de M. et M^me^ Rijnhart, médecins-missionnaires, dans le Ti
oriental. Par M. François Turrettini.

Turkey. *Deutsche Kolonialzeitung* 16 (1899): 514. Wy
Die deutsche Bagdadbahn. Von Dr. W. Wyneken. *With Map.*

Showing the route of the Asia Minor and Bagdad lines, for which the G
Railway Company has obtained a concession from the Sultan.

Turkey—Armenia. *M.G. Ges. Hamburg* 15 (1899): 1–23, 189–221. **Belck and Le**
Reisebriefe von der Armenischen Expedition. Von Dr. W. Belck and Dr. C
Lehmann.

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A brief historical epitome of the beginnings of English expansion introduces a fuller description of the adventurous journey to India and Burma in the reign of Queen Elizabeth that prepared the way for the establishment of the East India Company; and after a biographical sketch of Ralph Fitch, the chief adventurer, the history concludes with a short chapter recalling the results which have followed this early enterprise down to the present day.

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This curious result of imperfect education might be useful to teachers as a house of fallacies which could easily be answered by a class in practical geography

Photography. **A**

Hand Book of Military Photography. By Sub-Conductor C. J. Arbery. Si 1899. Size 6¼ × 4, pp. 10 and 30. *Illustrations. Presented by the Intellig Branch, Simla.*

This little book deals only with the mechanical work of using a camera, devel negatives, and making prints. It does not deal with the selection of points of exposure, emergency photography with pin-hole camera, or the like.

Travelling. —

In Journeyings Oft. Chapters by Various Missionaries on Travelling in Fore Lands. With Preface by the Right Rev. the Bishop of Athabasca. Lond Church Missionary Society, 1900. Size 8½ × 7, pp. vi. and 104. *Illustrati Price* 1*s*. 6*d*. *Presented by the Church Missionary Society.*

Notes by missionaries on modes of travelling in various out-of-the-way parts world.

NEW MAPS.

By J. COLES, *Map Curator*, R.G.S.

EUROPE.

Bavaria. **Av**

Aventins Karte von Bayern, MDXXIII. Im Auftrage der Geographischen Ges schaft in München zur Feier ihres dreissigjährigen Bestehens herausgegeben erläutert von Dr. Joseph Hartmann. Mit einem Vorwort von Prof. Dr. Eu Oberhummer. München, 1899. *Presented by Geographische Gesellschaft.*

The original of this map of Bavaria was printed in 1523, and is the wo Aventin, the first Bavarian historian. It was discovered at the beginning of the teenth century by Baron von Aretin in the monastery at Tegernsee, but seems to been forgotten until 1843, when it was deposited in the library of Munich; and only now, after this lapse of time, that, by the favour of General von Lobenhof reproduction has been allowed to be published.

The map is accompanied by full explanatory letterpress and a facsimile r duction of the original dedication.

England and Wales. **Ordnance Su**

Publications issued since January 8, 1900.

6-inch—County Maps:—

ENGLAND AND WALES (revision):—**Derbyshire,** 13 N.W., 28 S.E., 29 S.W. **Hertfo shire,** 32 S.E. **Sussex,** 29 S.W., 32 N.W., 43 N.E., 44 S.W., S.E., 57 N.E., 58 N.W., 80 S.W. **Westmorland,** 4 S.W., S.E., 29 S.E., 32 N.W., N.E. *1s. each.*

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11. 14, 16: XXXV. 4: XXXVI. 9. 10. 14: XLII. 5. **Nottinghamshire**, IX. 15; XV. 1. 3. 5. 7, 8, 10. 11, 12. 13. 15. 16: XVI. 5, 9, 13, 15; XX. 1. 2, 4, 6, 14. 16; XXI. 1. 3, 4. 10. 11. 14: XXIV. 3. 4, 6. **Oxfordshire**, XI. 16; XIII. 16: XV. 14; XVI. 14: XVIII. 9; XXII. 1. 5, 8: XXIII. 1. 2, 3. 5, 7, 9. 12. 15; XXXIX. 8; LVIII. 4. **Staffordshire**, X. 16: XI. 6, 11; XIV. 8, 15: XVIII 3, 8; XIX. 10, 11. **Wiltshire**. IIA. 14: II. 11: IV. 4. 7. 11; V. 1, 3, 5, 6. 10, 12, 15; VI. 2, 5, 10, 14; IX. 1, 2, 3. 4; XI. 11, 15; XXIII. 6, 8; XXX. 3. 3*s. each.*

Miscellaneous:—County Diagrams, scale 2 miles to 1 inch, printed in colours, showing unions, sanitary districts, boroughs, and civil parishes, also the $\frac{1}{2500}$ scale sheet-lines, viz. Brecknockshire, Carnarvonshire, Merionethshire, Pembrokeshire, and Worcestershire. *Price* 3*s. each.*

(*E. Stanford, Agent.*)

Switzerland. **Swiss Federal Staff.**

Topographischer Atlas der Schweiz im Massstab der Original-Aufnahmen nach dem Bundesgesetze vom 18 Dezember 1868 durch das eidg. topogr. Büreau gemäss den Direktionen von Oberst Siegfried veröffentlicht. XLVIII. Lieferung. Nr. 275, Alpbella; 302. Montricher; 416 *bis*, Gross Litzner; 417 *bis*, Martinsbruck; 421 *bis*, Reschenscheideck; 431 *bis*, La Cure; 432, Arzier; 451. Genève; 452, Jussy; 453, Carouge: 478. Pillon; 501 *bis*, Crodo. *Price* 1 *mark each sheet. Presented by the Swiss Federal Staff.*

ASIA.

China. **Bretschneider.**

Map of China and the surrounding regions. Scale 1 : 4,371,840 or 69 stat. miles to an inch. By E. Bretschneider. To illustrate the author's 'History of Botanical Discoveries in China.' Engraved and printed by A. Iliin, St. Petersburg, 1900. 4 sheets. *Presented by the Author.*

This is the second edition of a general map of China on which many of the routes followed by travellers are laid down. The importance of towns is indicated by symbols, and the type in which their names are printed. A full explanation of the symbols employed is given, as well as of some of the Chinese geographical terms.

China. **Cordes.**

Übersichts-Skizze der Wasserstrassen West-China's. Zusammengestellt nach E. Bretschneider's Karte von China. Scale 1 : 5,000,000 or 78·6 stat. miles to an inch. With a pamphlet. "Handelsstrassen und Wasserverbindungen von Hankau nach dem Innern von China," von H. Cordes. Berlin, 1899. E. S. Mittler und Sohn.

China. ———

Imperial Railways of North China, 1899. *Presented by W. R. Carles, Esq.*

Indian Government Surveys. **Surveyor-General of India.**

Indian Atlas. 4 miles to an inch. Sheets: 94, parts of districts Khamamet (Nizam's Dominions), of Kistna. Godavari and Vizagapatam (Madras Presidency) and Bastar State (Central Provinces), additions to 1899; 102, parts of districts Gorakpur and Basti (N.W. Provinces), Saran Champaran, and Muzaffarpur (Bengal), and Nepal, additions to 1897; 120, parts of districts Nadia, Burdwan, Jessore, Faridpur, Dacca, Murshidabad, Rajshahi, Mymensingh, Birbhum, Malda, Backergunge, and Pabna (Bengal), additions to 1897.—Quarter-Sheets: 31 N.W., parts of districts Ferozepore, Montgomery, Lahore, and of Native States Baháwalpur (Punjab), and Bickaneer (Rajputana)': 53 S.E., parts of districts Hoshangabad and Betul (Central Provinces) and the Native States of Bhopal and Holkar (C. I. Agency), additions to 1897: 126 S.W., parts of districts Hoakháli, Tippera, Dacca, Backergunge (Bengal) and Hill Tippera (Native State), additions to 1898.—Bombay Survey, 1 inch to a mile. No. 165. districts Colába and Poona. Season 1880–81, additions to 1898; 350. District Bijapur. Season 1895–96, 1899, 351. district Bijapur. Season 1895–96, 1899.—Central India and Rajputana Survey, 1 inch to a mile. No. 307. parts of district Nimár (Central Provinces) and Native State of Indore and Dhar (C. I. Agency), Seasons 1867–68–69–70 and 1876. 1899.—South Eastern Frontier, 4 miles to an inch (2nd edition) No. 2 N.W., parts of districts Chittagong (Bengal) Northern Arakan and Akyab (Lower Burma), and Chin Hills and Parokku (Upper Burma). Seasons 1853–61 and 1883–97. 1898.—Sind Survey, 1 inch to a mile. Nos. 19, 19A and 37. 20, 37A. 38. 57. 57A, part of Kalát (Baluchistan), and district Dera Ghàzi Khán (Punjab) Season 1897–98. 1899. Nos. 95, 95A; District Dera Ghàzi Khan (Punjab). Season 1897–98. 1899.—Bombay Presidency (exclusive of Sind), 32 miles to an inch, additions to 1899.—The Provinces of Bengal, Bihar, Orissa, and Chota Nagpur, 32 miles to an inch, 1899.—District Chittagong (Bengal), 4 miles to an inch, additions t 1898. 2 sheets.—District Dinájpur, Lower Provinces, Bengal, 4 miles to an incl additions to 1897, District Hissar, Punjab, 4 miles to an inch, 1899.—District c Amraoti, 8 miles to an inch, 1899.—District Dera Ghâzi Khán, Punjab, 16 mile to an inch, 1899.—District of Ellichpur, Hyderabad Assigned Districts, 8 miles an inch, 1899.—District Kángra, Punjab, 12 miles to an inch, 1899.—Distri Ráwalpindi, Punjab, 8 miles to an inch, 1899.—District Jubbulpore, Central Pr vinces, 8 miles to an inch. Corrections to 1899.—District Nágpur, Central Pr vinces, 8 miles to an inch, 1899.—District of Wun, Hyderabad Assigned Distric 8 miles to an inch, 1899.—District Malda, Lower Provinces, Bengal (2nd editio 4 miles to an inch, 1899.—Charts of Triangulation and Traverse: Sind, 2 miles an inch. Nos. 37, 37A, 57A, 70, 89, 90, 91, 95,-95A, 107, 108, 109. Seasons 189 98. 1899.—Himalaya, No. 332. Seasons 1885–88, 1899.—*Presented by H.M. Sec tary of State for India, through the India Office.*

AFRICA.

Africa. **P**

Philips' New Map of Africa. Scale 1 : 7,300,000 or 115 stat. miles to an in George Philip & Son, London and Liverpool.

Congo Free State. **Wa**

Carte de l'État Indépendant du Congo. Scale 1 : 5,000,000 or 78·9 stat. miles an inch. Dressée par A. J. Wauters. Bruxelles: Librairie Falk Fils, 1899.

German South-West Africa. **Lang**

Beiträge zur Kenntnis der deutschen Schutzgebiete Nr. 17. Verbreitung c Buren in Deutsch-Südwest-Afrika, nach den statistischen Aufnahmen von 18 von Paul Langhans. Petermann's Geographische Mitteilungen, Jahrgang, 19 Tafel 3. Gotha: J. Perthes, 1900.—*Presented by the Publisher.*

Transvaal. **J**

Jeppe's Map of the Transvaal, or South African Republic, and surrounding te tories. Compiled from surveys by F. Jeppe and G. F. W. Jeppe, Pretoria, Sou African Republic, 1899. Lithographed by Wurster, Randegger & Cie Schlumpf), Winterthur, Switzerland. Scale 1 : 476,000 or 7·3 stat. miles to an in 6 sheets.

This is a new edition of Jeppe's map of the Transvaal and surrounding territ It is drawn on a larger scale than the 1889 edition, but does not embrace so lar area. The present issue is printed on linen, and consists of six sheets.

Transvaal. **Joh**

Pictorial Bird's-eye Map of the Transvaal, Orange Free State, Natal, etc. W A. K. Johnston, Edinburgh and London, 1900. *Price 6d. Presented by the P lishers.*

PACIFIC OCEAN.

Samoan Islands. **Lang**

Spezialkarte der Samoa-Inseln von Paul Langhans. Gotha: Justus Perthes, 19 *Price 1 mark. Presented by the Publisher.*

ATLANTIC OCEAN.

Atlantic Ocean. **Petermann's Geographische Mitteilu**

Nordatlantischer Ozean. I. Tiefenkarte: Nordatlantischer Ozean. II. Tempera *Petermann's Geographische Mitteilungen* Jahrgang 1900. Tafels 1, 2. Got J. Perthes, 1900. *Presented by the Publisher.*

Azores. **Th**

Carte Bathymétrique des Iles Açores, d'après les cartes françaises et anglaises, sondages du *Talisman*, du *Challenger*, de S. A. S. le Prince de Monaco (*Hirond* et *Princesse Alice*) et de "l'Açôr." Par M. J. Thoulet, 1899. Paris: Imprim Vieillemard Fils et Cie. *Presented by S. A. S. le Prince Albert de Monaco.*

On this chart the soundings taken at the Azores, under the direction of the I of Monaco, as well as those of the *Challenger*, *Talisman*, and other vessels, ar down. The soundings are given in metres; the depths of the ocean from 500 t metres are indicated by a series of contours and different shades of blue.

GENERAL.

World. **Langhans.**

Justus Perthe's Alldeutscher Atlas. Bearbeitete von Paul Langhans. Mit Begleitworten: Statistit der Deutschen und der Reichsbewohner. Gotha: Justus Perthes, 1900. *Price* 1 *mark. Presented by the Publisher.*

World. **Vivien de Saint Martin and Schrader.**

Atlas Universel de Géographie. Ouvrage commencé par M. Vivien de Saint Martin et continué par Fr. Schrader. Paris: Librairie Hachette et Cie. Sheet: 32, Autriche-Hongrie. *Price* 2 *fr.*

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, November and December, 1899. *Presented by the Hydrographic Department, Admiralty.*

No.	Inches.	
3073 to 3084		Tidal streams:—Coast of Scotland. *Each* 4*d*. The same 12 charts bound together in an atlas. 5*s*.
30	m = 6·0	England, south coast:—Plymouth sound and Hamoaze. 5*s*.
3101	m = 1·5	Norway, west coast:—Atleö to Batalden, including the entrance to Stavfiord. 2*s*. 6*d*.
3105	m = 0·6	Norway, west coast:—Trondhjem fiords. 2*s*.
3046	m = {5·9, 8·9}	Newfoundland:—Bay Bulls, Cape Spear. 1*s*. 6*d*.
308	m = var.	Plans in the Gulf of St. Lawrence:—Mount Louis bay, Magdalen river, Ellis bay, south-west-point of Anticosti and Salt Lake bay, Bear bay, East cape (Anticosti) (reproduction). 1*s*. 6*d*.
3096	m = 0·88	United States, east coast:—Cape Cod bay. 2*s*. 6*d*.
3089	m = 3·6	Brazil:—Port Aracajú. 1*s*. 6*d*.
1306	m = var.	Magellan strait, plans in Barbara channel, Smyth harbour, etc., Labyrinth islands, Hewett bay, North cove, Fury harbour, approaches to Bedford bay, Noir road (reproduction). 1*s*. 6*d*.
558	m = 1·5	Magellan strait, plans on the south-west coast of Desolation and Santa Ines islands:—Discolation harbour, Latitude bay, Laura harbour, Week islands (reproduction). 1*s*. 6*d*.
778	m = 0·28	United States, west coast:—Conception point to Point Pinos. 2*s*. 6*d*.
1203	m = 3·5	Japan:—Uraga harbour. 1*s*. 6*d*.
3109	m = 4·0	Japan:—Yokohama bay. 1*s*. 6*d*.
2873		Anchorages in the Solomon islands, plans added:—Albatros bay, Austria sound, Lengo to Tetere.

(*J. D. Potter, Agent.*)

Charts Cancelled.

No.	Cancelled by	No.
1153 Mount Louis bay, Magdalen bay. 1150 East cape and Bear bay. 308 Ellis bay. 1147 South-west point and Salt Lake bay.	New sheet. Plans in the Gulf of St. Lawrence . . .	308
2113 Barbara channel. 1306 Ports in Barbara channel and Magdalen sound.	New sheet. Plans in Barbara channel	1306
558 Ports in Desolation and Santa Ines islands. 1330 Week islands. 769 Plan of Challenger cove on this chart.	New sheet. Plans on the south-west coast of Desolation and Santa Ines islands	558
2657 Plan of Yokohama bay on this chart.	New plan. Yokohama bay	3109

Charts that have received Important Corrections.

No. 1698, England, south coast:—Dover bay. 1991, England, south coast:—Folkestone harbour. 1967, England, south coast:—Plymouth sound. 1914, England, south coast:—Looe harbour. 1875, Germany, west coast:—Elb Weser, and Jade rivers. 2330, Norway, south coast:—Svenöer to Koster island 1974, Norway, south coast:—Jœlöen to Christiania. 72, Spain, west coast:—Po of Huelva, etc. 142, Strait of Gibraltar. 1520, Greece, east coast:—The Peirœu 1661, Grecian archipelago:—Port Mudros. 2210, Plans in the Black sea. 4 Cuba:—Port Xagua. 410, Cuba:—Cárdenas and Sta. Clara bays, etc. 284 British Columbia:—Haro strait and Middle channel. 655, India, west coast: Port of Bombay. 833, Bay of Bengal:—Rangoon river and approaches. 240 Singapore Main strait. 942A, Eastern archipelago, eastern portion. 2196, A chorages in the southern part of Celébés. 943, Philippine islands. 2454, Philippi islands:—Luzon island, northern portion. 2809, Yang-tse-kiang:—Shanghai Nanking. 1236, China:—Approaches to Port Arthur. 104, Korean archipela southern portion. 54, Ports and anchorages on the east coast of the Korea. 26 Japan:—Hakodate harbour. 769, Pacific ocean:—Admiralty and Hermit islan 1349, Anchorages in the Solomon islands. 191, Solomon islands:—Mboli harbo 1414, Anchorage in the Solomon islands. 1829, Fiji islands to Samoa islands.

(*J. D. Potter, Agent.*)

United States Charts. **U.S. Hydrographic O**

Pilot Charts of the North Pacific Ocean for February, 1900, and of the Nor Atlantic Ocean for January, 1900. Published at the Hydrographic Offi Washington, D.C. *Presented by the Hydrographic Office.*

PHOTOGRAPHS.

Andorra. **Sout**

Four Photographs taken in the Republic of Andorra, by S. C. Southam, E *Presented by S. C. Southam, Esq.*

(1) At Canillo; (2) Near Canillo; (3) Encamp; (4) Saldeou.

Europe. **Bu**

Forty-seven photographs of Albania, Servia, and Macedonia, by Noel Buxt Esq., 1899. *Presented by Noel Buxton, Esq.*

This series consists of forty-seven photographs, taken by Mr. N. Buxton durin travels in Albania, Servia, and Macedonia, chiefly illustrating scenes in the ever life of the people. The following is a list of the titles:—

Albania.—(1) Chief street at Gilan; (2) Newly-married couple at Gilan; (3) near Gilan; (4) Servian wedding-party at Gilan; (5) Albanian Moslem wedding cession at Gilan; (6) Servian wedding, Gilan; (7) Band leading wedding proce at Gilan; (8) Novi Bazar; (9) Street in Novi Bazar; (10) Combined sewer and p bath at Novi Bazar; (11) Market at Novi Bazar; (12) Novi Bazar; (13) C market at Novi Bazar; (14) Servian church at Novi Bazar; (15) The Mayor's at Novi Bazar; (16) Albanian peasants near Novi Bazar; (17) Servian town of Ra from Turkish side of frontier; (18) Between Rashka and Novi Bazar; (19) Alb peasants and Servian dragoonman; (20) Albanian peasants; (21) Turkish regula Servian frontier; (22) Christians and half-built church at Mitrovitsa; (23) Pries school at Mitrovitsa; (24) At Mitrovitsa; (25) Turkish pasha's house at Prish (26) Zapties in Macedonia; (27) Servian ruins at Novo Bordo and Servian Co (28) Armed priest and Servian peasants at Novo Bordo; (29) Road near Novo B (30) Servian women in Albania; (31) Turks and Servians on the frontier at Ra (32) Church destroyed by Turks near Domorovtche; (33) Ex-brigands in Mor mountains.

Servia.—(34) Chapel of Studenitsa monastery; (35) Abbot and priest with pe threshing near Studenitsa; (36) Archimandrite Theodosius, Studenitsa; (37) E at a memorial fountain near Kruschewatz; (38) Market at Kruschewatz; (39) F Kruschewatz, roasting whole sheep; (40) Vegetable market at Kruschewatz; Camping for the fair, Kruschewatz; (42) Servian ruins of twelfth century, Ibar va (43) Servian ruins, Ibar valley; (44) Servian family coach.

Macedonia.—(45) The vintage near Monastir; (46) Vintage festival day Monastir; (47) Escort from British fleet at Salonica.

N.B.—It would greatly add to the value of the collection of Ph graphs which has been established in the Map Room, if all the Fell of the Society who have taken photographs during their travels, w forward copies of them to the Map Curator, by whom they wil acknowledged. Should the donor have purchased the photograph will be useful for reference if the name of the photographer and address are given.

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The
Geographical Journal.

No. 4. APRIL, 1900. Vol. XV.

A BATHYMETRICAL SURVEY OF THE FRESH-WATER LOCHS OF SCOTLAND.*

By Sir JOHN MURRAY, K.C.B., D.Sc., F.R.S., and FRED. P. PULLAR, Esq., F.R.G.S.

Part I.—The Lochs of the Trossachs and Callander District.

Introduction.

About forty years ago excellent bathymetrical charts of Loch Lomond and Loch Awe were published by the Hydrographic Department of the Admiralty, based on surveys undertaken by naval officers. Some of the general charts of the Scottish coasts published by the Admiralty also show a few soundings down the centres of the fresh-water lochs forming the Caledonian Canal, viz. Loch Ness, Loch Lochy, and Loch Oich, but the charts of Lochs Lomond and Awe represent the only systematic surveys of the fresh-water lochs in Scotland that existed previous to the year 1883.

About that time many scientific men in Scotland felt that a survey of these fresh-water lochs should be undertaken, which led to the Councils of the Royal Societies of London and Edinburgh bringing this subject under the notice of Her Majesty's Government, as shown in the following correspondence :—

I. *The Secretary of the Royal Society of Edinburgh to the Secretary of H.M. Treasury.*

Royal Society of Edinburgh, July 11, 1883.

Sir,—In consequence of the investigations now being carried on with reference to the physical and biological conditions of the Scottish fresh-water lakes, and also because of the importance, in certain branches of geological inquiry, of knowing

* Maps, p. 452.

the form of the basins occupied by these lakes, it has been prominently brought under the notice of the President and Council of this Society, that no bathymetrical survey of these lakes exists.

I have, therefore, been requested by the President and Council to ascertain from H.M. Government if there is any probability of this work being soon undertaken, and, at the same time, to state that it would be a great satisfaction to the President and Council to learn that instructions had been issued by the Lords Commissioners of H.M. Treasury to the Officers of the Ordnance Survey, or of the Hydrographic Department of the Admiralty, to undertake a survey of a few of these lakes similar to the excellent ones already made of Loch Lomond and Loch Awe—say Lochs Morar, Maree, Lochy, Assynt, Shin, Tay, Ericht, Rannoch, Earn, Doon (in Ayrshire).—I am, etc., (signed) P. G. TAIT,

Secretary, Royal Society, Edinburgh.

II. *The Secretary of H.M. Treasury to the Secretary of the Royal Society of Edinburgh.*

Treasury Chambers, September 17, 1883.

SIR,—With reference to your letter of the 11th of July last, and the reply from this Board, dated the 10th ultimo, relating to a proposal to execute a bathymetrical survey of certain fresh-water lakes in Scotland, I am directed by the Lords Commissioners of Her Majesty's Treasury to acquaint you that my Lords are informed that the nautical surveys of Loch Lomond and Loch Awe, referred to in your letter, were undertaken by naval officers in the interests of navigation, and that the same considerations do not apply to the other lochs, of which surveys are suggested in your letter.

My Lords are also informed that the proposed bathymetrical surveys do not come within the functions of the Survey Department of the Office of Works (late Ordnance Survey).

Under these circumstances, my Lords regret that they are unable to sanction the proposed surveys. I have the honour to be, etc.,

(signed) LEONARD COURTNEY.

III. *Discussion in the House of Lords.*

In March, 1884, in reply to Lord Balfour of Burleigh in the House of Lords, Lord Sudeley said—

In reply to the noble Lord, I have to state that the operations of the Ordnance Survey have been hitherto restricted to such portions of the ground in the vicinity of fresh-water pools, and inland sheets of water generally, as are above the lowest water-levels. It is quite true, as the noble Lord has stated, that Loch Lomond and Loch Awe were surveyed, but that was undertaken by naval officers in the interests of navigation. The Government consider that a bathymetrical survey of all the lochs of Scotland would clearly be outside the function of the present Ordnance Survey of Scotland, which is already completed. Even if it were desirable, as the noble Viscount [Bury] has suggested, men would be taken off their work in England and the southern counties to carry this work out, and the general survey would be very much delayed. Such investigation would, no doubt, be most interesting from a scientific point of view in certain branches of geological inquiry to ascertain the forms of the basins occupied by the lakes. The Government will give the suggestions made by the noble Lord full consideration, and there will be no objection to lay the papers on the table.

IV. *The Secretary of the Royal Society of London to the Secretary of H.M. Treasury.*

The Royal Society, Burlington House, May 2, 1884.

SIR,—The President and Council of the Royal Society have had under consideration a communication from the Royal Society of Edinburgh, from which it would appear that the Lords Commissioners of Her Majesty's Treasury have stated that they are unable to sanction a bathymetrical survey of certain of the Scottish lochs, as proposed by the Royal Society of Edinburgh.

I am directed by the President and Council of the Royal Society to assure my Lords that they fully share the regret expressed by the Royal Society of Edinburgh that my Lords should have arrived at such a decision.

Neither from a topographical nor from a geological point of view can the survey of the United Kingdom be considered complete so long as the depths of the several inland waters remain unknown, and the absence of adequate data, concerning not only the Scottish lochs, but other large inland waters of the United Kingdom, forms, and will continue to form, a very serious obstacle to geological research.

The President and Council do not desire to urge upon my Lords any elaborate surveys entailing a large expenditure. They have reason to believe that the most important objects of the proposed surveys would be gained if series of soundings were carried across the important lakes not yet bathymetrically surveyed, at moderate intervals in each case. The exact closeness of the lines of soundings and the interval between each two soundings in each line must, in great measure, be determined at the time of observation according to the results which are from time to time obtained; but it has been suggested that lines of soundings at about a quarter of a mile interval, with soundings about 100 yards apart, would probably be found generally useful.

The President and Council venture to remind my Lords that the carrying out of such a bathymetrical survey is much facilitated by the fact that the contours of the lakes in question have all been already accurately laid down; also that the inland waters of the continent have been carefully surveyed by the several European Governments; and that, though in Scotland only Lochs Lomond and Awe have been surveyed (notwithstanding that some of the others are used for purposes of navigation) and the English lakes not at all, several of the Irish lakes were sounded by the Admiralty surveying officers in the years 1834–39 and in 1846.

The President and Council fully appreciate the difficulty which presents itself to my Lords in the facts that such bathymetrical surveys as those proposed do not fall within the province of the Survey Department of the Office of Works, and that, since the object sought is not one concerning navigation, they are foreign also to the duties of the Admiralty. The object, indeed, of the proposed survey may be most fitly spoken of as geological, but the Geological Survey has no means of carrying out such a work.

The President and Council would, however, venture to urge upon my Lords that the proposed survey, though of great scientific importance, is limited in scope and special in character, and so far not of a nature likely to establish an undesirable precedent, and they sincerely trust that my Lords may be led to reconsider their decision, and may see their way to make some arrangements by which a bathymetrical survey of the various inland waters of the United Kingdom not yet so surveyed may be speedily carried out.—I have, etc., (signed) M. FOSTER,

Sec. R.S.

There was no practical outcome from this correspondence; the Government declined to undertake any of the proposed surveys.

In the year 1888, Mr. J. S. Grant-Wilson published in the *Scottish Geographical Magazine* * an account of Lochs Tay, Earn, Rannoch, and Tummel in Perthshire, with special reference to the glaciation of the district, and he gives small contoured maps of these lochs, in which the positions of some of the deeper soundings are laid down. This, together with the Admiralty charts of Lochs Lomond and Awe, appears to be all the published information with respect to the depth of the Scottish fresh-water lakes. Attempts have, however, frequently been made, by neighbouring proprietors and others, to ascertain the depth of many of these lochs. About twelve years ago Mr. J. Y. Buchanan recorded the great depth of 175 fathoms in Loch Morar, and this was subsequently confirmed through numerous soundings taken by Sir John Murray, who recorded a depth of 180 fathoms near the same place. Sir John Murray and Mr. J. Y. Buchanan likewise took many soundings in the lochs of the Caledonian canal. Some of the English lakes have been surveyed within recent years by Dr. H. R. Mill, who gives an excellent account of his work in the *Geographical Journal* for 1895.†

* Vol. iv. p. 251.

† The subject of Limnology has lately excited a great deal of interest, especially on the Continent and in America. The following are some of the more important publications:—

Forel, F. A., 'Le Léman, mongraphie limnologique.' 2 vols. Lausanne, 1892 and 1895; and papers published in the *Arch. des Sci. phys. et nat.* Genève, 1886–1895.

Forbes, S. A., "On some Lake Superior Entomostraca," *U.S. Fish Comm. Report* for 1887; also Reports of the Director of the Illinois State Laboratory of Natural History since 1894.

Belloc, E., several Papers published between 1890 and 1894, in the Reports of *Assn. franç. pour l'Avanc. des Sciences*, in the *Comptes Rendus*, in the *Annuaire du Club Alpin français*, etc.

Zacharias, O., 'Forschungsberichte aus der biologischen Station zu Plön,' Theil i.–iv. Berlin, 1893–96.

Evermann, B. W., Papers on rivers and lakes with reference to fish environment in the *Bull. U.S. Fish Comm.*, vols. xiii., xvi., and xvii., 1893–97.

Reighard, J. E., "A Biological Examination of Lake St. Clair," *Bull. Mich. Fish Comm.*, No. 4, 1894.

Thoulet, J., "Contribution a l'étude des Lacs des Vosges," *Bull. Soc. Geogr. Paris.* sér. 7, t. xv. p. 557, 1894.

Marinelli, O., "Area, profondità ed altri elementi dei principali laghi Italiani," *Rivista geogr.*, 1894–95.

Magnin, A., 'Les Lacs du Jura.' Paris, 1895.

Penck, A., and Richter, E., 'Atlas der österreichischen Alpenseen,' Lief. i. and ii. Folio. Wien, 1895–96.

Mill, H. R., "Bathymetrical Survey of the English Lakes," *Geographical Journal*, vol. vi. pp. 46 and 135, 1895.

Ward, H. B., "A Biological Examination of Lake Michigan in the Traverse Bay Region," *Bull. Mich. Fish Comm.* No. 6, 1896.

Kofoid, C. A., "Plankton Studies," *Bull. Illinois State Lab. Nat. Hist.*, vol. v. p. 1, 1897.

Marsh, C. D., "On the Limnetic Crustacea of Green Lake," *Trans. Wisconsin Acad. Sci.*, vol. xi. p. 179, 1897.

Delebecque, A., 'Les Lacs français,' text 4to, with folio atlas. Paris, 1898.

In the present paper we propose to give the results of our numerous recent observations as to the depths in Lochs Katrine, Arklet, Achray, Vennachar, Drunkie, Lubnaig, Voil, and Doine, all of which belong to the catchment-basin of the river Teith, and have a special interest from being directly or indirectly connected with the excellent water-supply to the city of Glasgow.* It is true that at the present moment Loch Arklet belongs to the catchment-basin of Loch Lomond, but the Corporation of Glasgow has power to divert its waters into the catchment-basin of Loch Katrine.

METHODS.

To undertake a survey of these fresh-water lochs with the ordinary hand-line would have occupied a very long time; in order to accelerate the work, it was essential to procure a portable wire sounding-machine that could be used in small rowing-boats. Such an instrument was exhibited by Dr. Ule at the Sixth International Geographical Congress in London in 1895. This apparatus was purchased, and with it numerous soundings were taken in Loch Morar, in Lochs Frisa, Ba, and Uisg in Mull, and also in Lochs Katrine, Lubnaig, and other lochs. After a few months' use, however, the machine—which was more or less of a toy—

* In the year 1855 the Corporation of Glasgow was empowered by Act of Parliament to raise Loch Katrine 4 feet above, and to draw it down 3 feet below the previous summer level, thus giving a total available depth of 7 feet for the supply of water to the city, the quantity of water to be drawn from the loch being restricted to fifty million gallons in twenty-four hours. For the purpose of providing compensation water to the riparian owners on the river Teith, power was also given to raise Loch Vennachar 5 feet 9 inches above its previous summer level, and to draw it down 6 feet, and also to raise Loch Drunkie 25 feet. An aqueduct was built from the southern shore of Loch Katrine to Glasgow, 8 feet wide and 8 feet high throughout, with a semicircular top, and having a fall towards Glasgow of 10 inches per mile. At first only a portion of the available fifty million gallons per day was conveyed to Glasgow, but by the end of 1881 the whole of the works necessary to complete the original design were finished. In the year 1884 it was found necessary to provide a larger quantity of water in order to keep pace with the growth of the city, and it was then found that the roughness of the rock sides of the aqueduct had a very retarding influence upon the velocity of the water, and that the aqueduct could not be made to discharge more than forty-two million gallons per day. Power was subsequently obtained from Parliament to build a second aqueduct, to raise Loch Katrine an additional 5 feet, and to convert Loch Arklet, which flows into Loch Lomond, into a reservoir by raising it 25 feet in level. These works are now in progress, and when completed are estimated to give a supply of seventy-five millions of gallons of water per day to the city of Glasgow. Should a still greater supply be necessary in the future, it is believed this can be obtained by connecting Loch Doine with Loch Katrine by a tunnel through the intervening hills, and by constructing an embankment at the bottom of Loch Doine to raise the water-level 30 feet, and another at the bottom of Loch Voil to raise the water-level of that loch 10 feet, and if still more water were wanted Loch Lubnaig could furnish it (see papers by James M. Gale, Esq., M. INST. C.E., in the *Trans. Inst. Engineers in Scotland*, vols. vii., xii., xxvi., and xxxviii., and his Report on the proposed extension of the Glasgow Corporation Water Works, dated May 17, 1884).

turned out untrustworthy, and was consequently discarded. Subsequently Mr. Pullar designed the sounding-apparatus shown in Fig. 1, which in his hands has worked admirably and accurately.

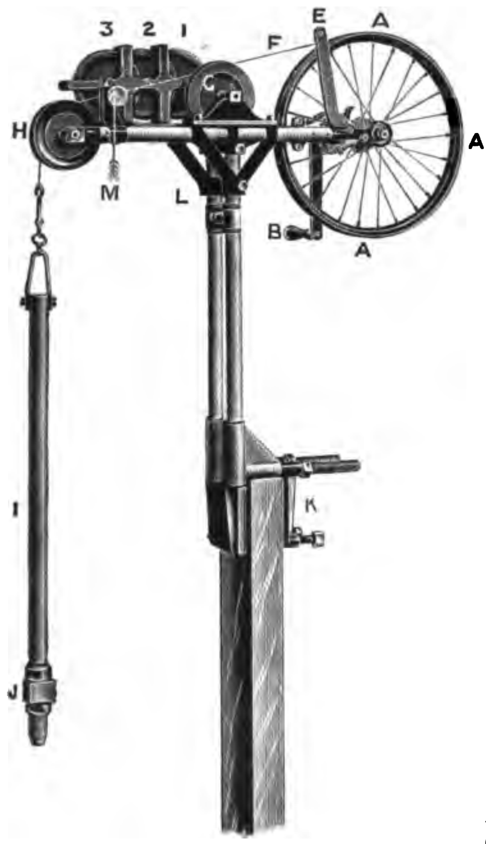

FIG. 1.—F. P. PULLAR'S SOUNDING-MACHINE.

Description of the Pullar Sounding-Machine.

The sounding-machine (see Fig. 1) is constructed of steel cycle tubes, which are held in position by means of gun-metal brackets, and is divided into two sections in order to pack into as little space as possible for transport. The first section consists of a bracket, carrying two upright tubes, with an adjustable clamp (K), by means of which the machine is fixed to the gunwale of the boat. Over the ends of the two upright tubes, at the disconnecting joint (L), is slipped the second section of the machine, consisting of two horizontal tubes, to which the drum with the sounding wire, measuring pulley, indicating dials, grease-box, etc., are all fixed. The drum (A), which carries the wire, is a small suspension wheel, with a U-shaped rim, tangent spokes, and gun-metal hub. The hub has cone bearings, which can be screwed up, so that any wear may be allowed for. The rim of the drum is capable of holding over 1000 feet of three-strand galvanized steel wire (F). On the hub of the drum is fixed a bronze pinion wheel, in gear with another pinion wheel fitted with a crank handle (B), by means of which the wire on the rim of the drum may be wound in, and on the other side of the hub is an adjustable band-brake (E) intended to regulate the speed of the wire when running out. There is also a stop for the purpose of preventing the weight from running out when the machine is not in use. The wire, after leaving the drum, takes a complete turn round a measuring pulley (G), then through a grease-box (M), and over a guide pulley (H), to the weight (I), which takes the form of a sounding-tube constructed to procure a sample of the deposit, with flap-valve (J) at the foot, the wire being attached to the weight by means of a splice and clip-hook. The measuring pulley has a circumference of nearly 1 foot (measured through the centre of the wire it is exactly 1 foot), so that for every foot of wire which runs out the measuring pulley makes one revolution. The motion of the measuring pulley is transmitted to a series of indicating dials (1, 2, and 3), one recording feet, another tens, and a third hundreds of feet. When the weight strikes the bottom the motion ceases, and the depth may be read off the indicating dials. The dials fitted to the present machine read only to a depth of 999 feet 6 inches, but by the addition of an extra dial greater depths could be sounded.

All the soundings recorded in this paper were taken from small rowing-boats, with the exception of a few obtained from Mr. Dunsmure's steam yacht on Loch Katrine, and they were all taken with Mr. Pullar's sounding-machine. It was usual to pass from side to side of a loch along definite lines, the length of the lines and the distances between them being ascertained from the 6-inch Ordnance Survey maps, which were throughout used for plotting the positions of the soundings. Before making a section across a loch, the boatman was trained for some time to ascertain the distance covered in ten, fifteen, twenty, and fifty strokes. The position on the line of soundings was determined by reference to poles or other objects placed one behind the other on shore, and by the

FIG. 2.—METHOD OF SOUNDING.
(*From a photograph by Lady Murray.*)

number of strokes between each position. When necessary the position was determined by means of a pocket sextant, and frequently the position of the soundings near the shore was ascertained by measurement with tape lines, or cords several hundred feet in length, stretched from the shore. In addition to the cross-lines, soundings were usually taken in several positions between the lines. When any special feature was indicated by the soundings, a series was taken in a radial manner from a fixed point.

The level of the surfaces of the lochs was obtained by reference to the bench-marks along the shore, but as a rule no correction was made for the variations in the rise and fall of the water while the work was in progress. Information was collected when possible from local people as to the height of the water in the various lochs in the dry and wet months of the year.

The samples of bottom-deposits were carefully collected by means of the sounding-tube furnished with a flap-valve at its lower end (see Fig. 1), the colour and general appearance being noted, and the samples carefully preserved for future examination.

Serial temperatures were taken in each of the lochs by means of Negretti and Zambra's reversing thermometers, specially adapted for use on the wire-rope of the sounding-machine; observations at the surface of the lochs, and in the streams feeding the lochs, were frequently made as opportunity offered. The pelagic fauna and flora of these lakes were examined by means of fine silk tow-nets, which were dragged through the water at different depths, and the colour and transparency of the water were frequently tested by the submergence of coloured discs.

After the completion of the survey of a particular lake, and when all the soundings had been plotted on the 6-inch Ordnance Survey maps, contour-lines of depth were drawn at definite intervals, and the areas between the consecutive contours were measured by the planimeter, from which the cubic contents and the mean depth of each loch were calculated. The drainage areas of the various lochs (as shown on Map I.) were marked off on the 1-inch Ordnance Survey maps, and the areas between the consecutive contour-lines of height were measured by the planimeter, from which the bulk and the mean height of the land above the level of the lochs were calculated.

Maps and Illustrations.

This paper is illustrated by seven coloured maps. The first three are intended to show the general physical features of the district in which the lochs, treated of in this paper, are situated, and are drawn to a scale of 2 miles to the inch.

Plate I. shows the orography of the district, the height of the land being indicated by different shades of brown, and the depth of the lochs in fathoms by different shades of blue, and the drainage areas of the various lochs are outlined by a distinctive coloured line. It will be observed that the drainage areas form together one compact area, and, indeed, it may be said that (excluding in the mean time Loch Arklet) they are in reality one united drainage system, since Lochs Doine, Voil, and Lubnaig drain into the river Leny, and Lochs Katrine, Achray, Drunkie, and Vennachar drain into the river Teith, which two rivers join above Callander, and flow onwards until they join the river Forth at Stirling, and ultimately empty themselves into the Firth of Forth.

Plate II. shows the surface geology of the district in various colours, and has been prepared from unpublished material collected during the progress of the Geological Survey of Scotland, revised by Messrs. Peach and Horne, and now published by permission of Sir Archibald Geikie, the Director-General of the Geological Survey of the United Kingdom. A discussion of the geology and glaciation of this district, and of the relation of the depths of the lochs to the surrounding geological features of the country, will be found in the valuable and important geological notes contributed by Messrs. Peach and Horne appended to this paper.

Plate III. shows the mean annual rainfall of the district in different shades of blue, the mean rainfall at the various observing stations being given in heavy black figures. We are indebted to Dr. Alexander Buchan, F.R.S., for information which has enabled us to prepare this map.

The remaining four maps show the details regarding each of the lochs under consideration on a larger scale (3 inches to the mile, 1 : 21,120), on which the majority of the soundings taken during the survey are given in feet, the intervals between the contour-lines of depth being indicated by different shades of blue, and the intervals between the contour-lines of height of the neighbouring country by shades of brown.

Plate IV. shows Loch Katrine and Loch Arklet, the contour-lines of depth being drawn in Loch Arklet at 25 and 50 feet, and in Loch Katrine at 50, 100, 200, 300, and 400 feet.

Plate V. shows Loch Achray, Loch Vennachar, and Loch Drunkie, the contour-lines of depth being drawn in Loch Achray at 25 and 50 feet, the area deeper than 90 feet being indicated by a dotted line; in Loch Vennachar at 25, 50, and 100 feet, and in Loch Drunkie only at 50 feet.

Plate VI. shows Loch Lubnaig, the contour-lines of depth being drawn at 10, 25, 50, 75, and 100 feet.

Plate VII. shows Loch Doine and Loch Voil, the contour-lines of depth being drawn in Loch Doine at 25 and 50 feet, and in Loch Voil at 25, 50, and 75 feet, the area deeper than 90 feet being indicated by a dotted line.

We tender our thanks to J. G. Bartholomew, Esq., F.R.G.S., for the care with which he has supervised the production of these maps, and for valuable advice and suggestions during the progress of the work.

In addition to the maps, there are eleven woodcuts in the text, illustrating the character of the scenery in the vicinity of the lochs, the sounding machine, etc.

DEPTHS OF THE LOCHS.

Loch Katrine.—Loch Katrine is one of the best known and most beautiful of the Scottish lochs. The celebrated woodland scenery of the Trossachs and Ellen's isle is situated at its south-eastern end, while splendid moorland scenery prevails at the north-western end. It has a total length of about 8 miles, with a maximum width of almost exactly

1 mile between the mouths of Letter burn and Strone burn on the northern shore to a small bay on the opposite shore. The mean breadth, obtained by dividing the area of the loch by its length, is 0·6 mile, or 1056 yards, being $7\frac{1}{2}$ per cent. of the length.

The waters of the loch cover an area of 3059 acres (or $4\frac{3}{4}$ square miles), and it drains an area about eight times greater, or about 24,900 acres (nearly $37\frac{1}{2}$ square miles).* The total number of soundings taken in Loch Katrine was 775, an average of 163 per square mile, and the average depth of these was $142\frac{1}{2}$ feet, the greatest depth observed being 495 feet ($82\frac{1}{2}$ fathoms).† The positions of the majority of the soundings are shown on Map IV.

FIG. 3.—LOCH KATRINE AND ELLEN'S ISLE.

(*From a photograph by J. Valentine.*)

The bulk of water contained in the loch is estimated at 27,274,000,000 cubic feet, or about one-fifth of a cubic mile, and the mean depth (supposing the loch to be of uniform depth over its present area) at 199

* When the waters of Loch Arklet are diverted into Loch Katrine this drainage area will, of course, be extended.

† As long ago as September, 1812, and September, 1814, Mr. James Jardine, C.E., recorded observations on the depth and temperature of Loch Katrine (see Buchan, *Proc. Roy. Soc. Edin.*, vol. vii. p. 791, 1872). The maximum depth recorded by him is 480 feet (80 fathoms), whereas, as stated above, we found a depth of 495 feet. His temperature observations are given in the table of serial temperatures, and discussed along with the recent observations. We believe that Mr. J. Y. Buchanan took soundings and temperatures in Loch Katrine some years ago, but, as far as we are aware, they were never published, and are therefore not available for discussion (see also Art. "Lake" in *Encycl. Brit.*, 9th edit.).

feet (33 fathoms), the mean depth being over 40 per cent. of the maximum depth. The length of the loch is 85 times the maximum depth, and 211 times the mean depth.

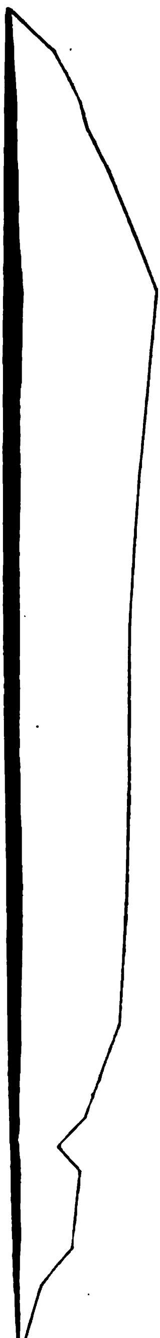

FIG. 4.—LONGITUDINAL SECTION OF LOCH KATRINE, ALONG THE AXIS OF MAXIMUM DEPTH. THE BLACK PORTION SHOWS THE TRUE SLOPES; THE OUTLINE SHOWS THE SLOPES EXAGGERATED TEN TIMES.

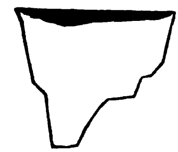

FIG. 5.—CROSS-SECTION OF LOCH KATRINE. THE BLACK PORTION SHOWS THE TRUE SLOPES; THE OUTLINE SHOWS THE SLOPES EXAGGERATED TEN TIMES.

The surface of the loch is, according to the Ordnance Survey maps, at an elevation of 364 feet above sea-level, so that our survey shows that a considerable portion of the bottom of the loch (equal to about 645 acres, or over one square mile) lies below sea-level, the deepest part being 131 feet (or 22 fathoms) below the level of the sea. The area below the level of the sea is indicated by a red line on Map IV. In this respect Loch Katrine differs from the other lochs referred to in this paper, for in none of them is the depth sufficiently great to bring any portion of their bottoms below the level of the sea.

The soundings show that Loch Katrine practically forms a single basin, not being divided, like Loch Lomond and Loch Lubnaig, for instance, into separate basins by any important ridges or rises on the bottom. The deepest part is in the centre of the loch, a long narrow depression, with depths exceeding 400 feet, extending for over 4 miles from opposite Coilachra to opposite Ruinn Dubh-aird, with a maximum width of over a quarter of a mile; this 400-feet depression has an area of about 515 acres, or 17 per cent. of the entire superficial area of the loch. The deepest sounding (495 feet) is situated at the very eastern extremity of the 400-feet depression.

The 300-feet depression is over 5 miles in length, with a maximum breadth of one-third of a mile; it extends from off Coilachra to near Ellen's isle. The area enclosed between the 300-feet and 400-feet contour-lines is about 415 acres, or 13 per cent. of the entire area of the loch.

The 200-feet depression is 5½ miles in length and half a mile in maximum breadth, extending from south of Ellen's isle to near Black island, where it is separated (by a sounding of 198 feet) from a small isolated area, lying between Coilachra and

Black island, one-third of a mile in length by nearly one-eighth of a mile broad. The area between the 200- and 300-feet contours is about 510 acres, or 17 per cent. of the area of the loch.

There are two 100-feet depressions, the principal one (6 miles in length) stretching from close to Ellen's isle to Black island, the other extending from Black island towards the point called Rudha nam Moine, with a total length of over half a mile. The area enclosed between the 100- and 200-feet contours is about 670 acres, or 22 per cent. of the area of the loch.

The 50-feet line follows pretty closely the contour of the loch, from Rudha nam Moine into the eastern arms of the loch at the Trossachs,

FIG. 6.—LOCH ARKLET, LOOKING WEST.
(*From a photograph by G. W. Wilson.*)

running outside of Black island, Ellen's isle, and the small islands near the shore all round, with a small isolated patch at the junction of the Trossachs arm with the arm leading to Achray Water; it encloses a small shallow, with a beacon on it, opposite the entrance of the Glasahoile. The area between the 50- and 100-feet contours is about 400 acres, or 13 per cent. of the area of the loch, while the area between the coastline and the 50-feet contour is nearly 550 acres, or 18 per cent. of the area of the loch, so that 82 per cent. of the floor of the loch is covered by over 50 feet of water.

Loch Arklet.—At the present time Loch Arklet drains into Loch Lomond, but the corporation of the city of Glasgow have power, by the erection of a dam at its west end, to divert the waters into the catchment-basin of Loch Katrine, in order to increase the supply of water to the city. The surface of this little moorland loch is, according to the Ordnance Survey maps, 455 feet above sea-level. It has a total length of over a mile, and a maximum width near the east end of nearly half a mile. The mean breadth is about one-third of a mile, or 587 yards, being 33 per cent. of the length. Its waters cover an area of about 210 acres (0·3 square mile), and it drains an area about sixteen times greater, or about 3400 acres (5¼ square miles). The number of soundings taken in Loch Arklet (see Map IV.) was 135, the average depth of these being 21 feet, and the greatest depth observed being 67 feet (11 fathoms). The mass of water in the loch is estimated at 222,000,000 cubic feet, and the mean depth at 24 feet, or 36 per cent. of the maximum depth. The length of the loch is 79 times the maximum depth, and 218 times the mean depth.

The wide eastern portion of Loch Arklet is shallower than the narrower western portion. The 50-feet depression extends little more than halfway towards the eastern end of the loch, and is slightly under half a mile in length, the greatest depth (67 feet) being approximately near the centre of the depression, and nearer the western than the eastern end. The area over 50 feet in depth is estimated at about 19 acres, or 9 per cent. of the area of the loch, while the area between the 50-feet line and the shore is about 191 acres, or 91 per cent. of the entire superficial area.

Two small islands appear on the chart in the shallower part of the loch towards the north-eastern end.

Loch Achray.—This pretty little lake is situated at the entrance to the Trossachs, and immediately before the windows of the Trossachs Hotel. Loch Achray, the surface of which is, according to the Ordnance Survey maps, 276 feet above sea-level, has a total length of about 1¼ miles, with a maximum width of nearly one-third of a mile. The mean breadth is about a quarter of a mile, or 458 yards, being nearly 21 per cent. of the length. Its waters cover an area of about 205 acres (one-third of a square mile), and the area draining into it is twenty-two times greater, or about 4500 acres (7 square miles). The number of soundings taken in Loch Achray (see Map V.) was 171, and the average depth of these was 36½ feet, the maximum depth recorded being 97 feet (16 fathoms). The bulk of water contained in the loch is estimated at 321,000,000 cubic feet, and the mean depth at 36 feet (6 fathoms), or 37 per cent. of the maximum depth. The length of the loch is 68 times the maximum depth, and 183 times the mean depth.

The 50-feet depression is over two-thirds of a mile in extreme length, with a maximum width of about one-fifth of a mile, lying uniformly near the centre of the loch, and covers an area of about 64 acres, or 31 per cent. of the superficies of the loch. Within this area there is a depression occupying about 32 acres where the depths exceed 90 feet, the greatest registered depth (97 feet) being recorded in two places approximately in the centre of the loch. At the west end of the loch, not far from the hotel pier, a detached sounding of 50 feet is recorded; off the mouth of the Achray water there are some shallow patches, and a shallow in the centre of the loch towards the west end, on which there are 2 to 3 feet of water, is marked by a beacon. The area less than 50 feet in depth is estimated at about 141 acres, or 69 per cent. of the total area of the loch. The eastern end of the loch is relatively shallow; at one place there is a depression with 27 feet surrounded by shallower water, and at another

FIG. 7.—LOCH ACHRAY, LOOKING WEST TOWARDS BEN VENUE.
(*From a photograph by J. Valentine.*)

place there is what appears to be a submerged crannog covered by only 1 or 2 feet of water.

Loch Vennachar.—Loch Vennachar, the surface of which is, according to the Ordnance Survey maps, 270 feet above sea-level, has a total length of about 4 miles, with a maximum width of less than three-quarters of a mile. The mean breadth is about two-fifths of a mile, or 704 yards, being 10 per cent. of the length. Its waters cover an area of about 1030 acres (or over $1\frac{1}{2}$ square miles), and it drains an area nearly eighteen times greater, or about 18,300 acres ($28\frac{1}{2}$ square miles). The total number of soundings taken in Loch Vennachar (see Map V.) was 423, an average of 263 per square mile, the average depth of these being

41 feet, and the greatest depth observed being 111 feet ($18\frac{1}{2}$ fathoms), so that it may be regarded as a relatively shallow loch. The bulk of water contained in the loch is estimated at 1,903,000,000 cubic feet, and the mean depth at $42\frac{1}{2}$ feet (7 fathoms), being 38 per cent. of the maximum depth. The length of the loch is 190 times the maximum depth, and 498 times the mean depth.

It will be observed from an examination of the map that the loch is deeper in the eastern than in the western portion, the western end being shallow and covered with weeds, so that one must proceed nearly a mile from the west end of the loch before encountering depths of 50 feet, and this is merely a small patch separated from the principal 50-feet depression by a distance of nearly two-thirds of a mile. In August the water in the loch is at its lowest, and the weeds at the west end most abundant. The principal 50-feet depression is about 2 miles in length, with

FIG. 8.—LOCH VENNACHAR, LOOKING SOUTH-WEST.
(*From a photograph by G. W. Wilson.*)

a mean breadth of about one-third of a mile and a maximum breadth of nearly half a mile. It includes two 100-feet depressions: the first one is very irregular in shape, situated approximately in the centre of the loch, and contains the greatest observed length (111 feet), which lies towards the northern shore; the second one occupies the central portion of the large 50-feet depression, the greatest depth observed therein being 106 feet. Towards the eastern end of the large 50-feet depression is a small shallow patch in the centre of the loch opposite Portnellan, in which a depth of 36 feet was found.

At the extreme eastern end are situated the sluices and weir, over which the compensation water passes into the river Teith; at some distance from the sluices the depth of water flowing over a weir is recorded twice a day.

The area between the shore and the 50-feet contour is estimated at about 635 acres, or 62 per cent. of the entire superficial area of the loch, while the area between the 50- and 100-feet lines is estimated at about 324 acres, or 31 per cent., and the area with depths over 100 feet is estimated at about 71 acres, or 7 per cent. of the area of the loch.

Loch Drunkie.—This picturesque and irregular Highland loch is shut in on all sides by high hills, is difficult of access, and rarely visited. The surface of the loch, according to the Ordnance Survey maps, is 416 feet above the level of the sea, but it was raised 25 feet in connection with the water-supply to the city of Glasgow, with the view of furnishing compensation water to the river Teith. The soundings shown on the map give the depth of the loch in April, 1899.

Loch Drunkie is remarkable in many respects. It is the smallest of the five lochs in the Loch Katrine district, but deeper than the larger Loch Arklet situated at a similar high elevation, and quite as deep as the neighbouring Loch Achray situated at a lower elevation. In form it is peculiar, consisting of a quadrangular portion throwing out three arms of various sizes in different directions. The largest arm runs in a north-easterly direction, the extremity approaching within a quarter of a mile of the southern shores of Loch Vennachar; this arm contains the greatest depths observed in the loch, and near its extremity the Ordnance Survey map indicates a small island which was not seen. The second arm in point of size runs directly west, and contains a maximum depth of 80 feet. The smallest arm runs in a south-westerly direction, deepening gradually though irregularly from 6 feet at the extremity to 15 feet near the junction with the quadrangular body of the loch.

The maximum length of the loch (between the extremities of the north-eastern and south-western arms) is over one mile; from the extremity of the western arm to the opposite (eastern) shore of the loch is a little less. The maximum width of the quadrangular body of the loch is over a quarter of a mile. The mean breadth is 0·21 mile, being 21 per cent. of the length. The waters of the loch cover an area of about 138 acres (0·22 square mile), and drains an area ten times greater, or over 1400 acres (2·2 square miles). The number of soundings taken in Loch Drunkie (see Map V.) was 155, the average depth of these being 38½ feet, the greatest depth observed (exactly the same as in the case of Loch Achray) being 97 feet (16 fathoms). The bulk of water contained in the loch is estimated at 217,000,000 cubic feet, and the mean depth at 36 feet (or 6 fathoms), being 37 per cent. of the maximum depth. The length of the loch is 54 times the maximum depth, and 147 times the mean depth.

There are two depressions with depths over 50 feet: one at the extremity of the western arm, about a quarter of a mile in length, and the other filling up the greater part of the body of the loch, and extending some distance up the north-eastern arm, being over one-third of a mile in length and about one-quarter of a mile in maximum width. The area over 50 feet in depth is estimated at 43 acres, or 31 per cent. of the total area of the loch, while the area between the shore and the 50-feet contour is estimated at 95 acres, or 69 per cent. of the area of the loch.

Lochs Voil and Doine.—These two lochs, the surfaces of which, according to the Ordnance Survey maps, are situated at an elevation of 414 feet above sea-level, formed at no very distant date a continuous loch, which has been divided into two portions principally by the deposition of material brought down Monachyle glen by the river; this

FIG. 9.—LOCHS VOIL AND DOINE, LOOKING WEST FROM ROB ROY'S GRAVE, BALQUHIDDER.
(*From a photograph by J. Valentine.*)

is supported by the fact that deep water extends close up to the dividing promontory of land on both sides. The former continuous loch must have been over 4½ miles in length. As the level of these two lochs is 50 feet higher than the level of Loch Katrine, it has been suggested by Mr. Gale that the water-supply to the city of Glasgow could, if necessary, be increased by connecting these lochs to Loch Katrine by a conduit through the intervening hills.

Loch Voil.—Loch Voil has a total length of over 3½ miles, with a maximum width (near the western end) of about one-third of a mile. The mean breadth is about a quarter of a mile, or 422 yards, being 7 per cent. of the length. The waters of Loch Voil cover an area of about 561 acres (0·88 square mile), and those of Loch Doine about 135 acres (0·21 square mile), or together over one square mile, while they drain an area thirty-five times greater, or about 24,600 acres (nearly $38\frac{1}{2}$ square miles).

The total number of soundings taken in Loch Voil (see Map VII.) is 279, the average depth of these being $39\frac{1}{2}$ feet, and the greatest depth 98 feet (or $16\frac{1}{3}$ fathoms). The bulk of water contained in the loch is estimated at 1,000,000,000 cubic feet, and the mean depth at 41 feet (or nearly 7 fathoms), being 42 per cent. of the maximum depth. The length of the loch is 189 times the maximum depth, and 451 times the mean depth.

Loch Voil becomes narrower and shallower towards the eastern end; one must proceed about a mile and a half (or over one-third of the length of the loch) from the eastern end before encountering depths of 50 feet, while deeper water is found towards the western end. The 50-feet depression extends from quite close to the western end for a distance of 2 miles towards the eastern end of the loch, with a maximum width of about a quarter of a mile. Towards the western end of the loch is a considerable area (over half a mile in length by a sixth of a mile in maximum breadth) having depths greater than 90 feet. In this all the deepest soundings are situated (the greatest depth, 98 feet, having been observed in two places). From this depression the bottom of the loch apparently rises very gradually towards the eastern end.

The area over 50 feet in depth is estimated at about 230 acres, or 41 per cent. of the entire area of the loch, while the area between the shore and the 50-feet line is estimated at about 331 acres, or 59 per cent. of the total extent of the loch.

Loch Doine.—Loch Doine has a total length of nearly one mile, with a maximum width of over a quarter of a mile; the mean breadth is about 0·21 mile, or 370 yards, being 21 per cent. of the length. The total number of soundings taken in Loch Doine (see Map VII.) was 90, the average depth of these being $34\frac{3}{4}$ feet, the greatest depth being 65 feet (11 fathoms). The bulk of water contained in the loch is estimated at 196,000,000 cubic feet, and the mean depth at 33 feet ($5\frac{1}{2}$ fathoms). The length of the loch is 81 times the maximum depth, and 160 times the mean depth.

In Loch Doine the deeper water occupies approximately the centre of the loch, the deepest soundings (65 feet) being found, however, nearer the eastern than the western end of the loch. The 50-feet depression covers over one-third of the area of the loch, being about three-quarters of a mile in length with a maximum width of over one-eighth of a mile. It seems doubtful whether this 50-feet depression is not really separated into a larger and a smaller portion, for the narrow neck shown on the map is founded upon a single sounding of exactly 50 feet. The greatest depth, 65 feet, was observed in several spots situated towards the eastern end of the loch. The area with depths over 50 feet is estimated at 47 acres, or 35 per cent. of the entire area of the loch, while the area with depths less than 50 feet is estimated at 88 acres, or 65 per cent. of the area of the loch.

Loch Lubnaig.—The outflow from Lochs Doine and Voil passes by the river Balvag, 5 miles in length, into Loch Lubnaig, the surface of whose waters is, according to the Ordnance Survey maps, 405 feet above sea-level, or 9 feet lower than that of the other two lochs. A consideration of the intervening ground indicates that in post-glacial times these three lochs formed one single sheet of water.

FIG. 10.—LOCH LUBNAIG, LOOKING NORTH.
(From a photograph by G. W. Wilson.)

Loch Lubnaig has a total length of nearly 4 miles, following approximately a line drawn down the centre of the loch, with a maximum width of about two-fifths of a mile. The mean breadth is nearly a quarter of a mile, or 422 yards, being 6 per cent. of the length. Its waters cover an area of about 614 acres (or nearly 1 square mile), and it drains an area $36\frac{1}{2}$ times greater, or about 22,400 acres (nearly 35 square miles). The total number of soundings taken in Loch Lubnaig (see Map VI.) was 394, the average depth of these being $20\frac{1}{2}$ feet, and the greatest depth observed 146 feet ($24\frac{1}{3}$ fathoms). The bulk of water contained in the loch is estimated at 1,144,000,000 cubic feet, and the mean depth at $42\frac{3}{4}$ feet (or 7 fathoms), being 29 per cent. of the maximum depth. The length of the loch is 145 times the maximum depth, and 493 times the mean depth.

Loch Lubnaig differs from the other lochs in the neighbourhood in that it does not constitute a single basin. The bottom is apparently very irregular; the contour-lines of depth do not follow the contour of the loch, hollows and ridges alternate with each other, and in some places comparatively deep water is found close to the shore, while in other places shallow water extends a considerable distance from shore. The loch is also, comparatively speaking, very narrow and shallow considering its size, nearly two-thirds of the area being under 50 feet in depth. The loch may be conveniently divided into two halves, defined by the central constriction in the outline of the loch at the entrance of the Ardchullarie burn, where the bottom shallows and separates the two principal deep depressions; the northern half trends in a north-west and south-east direction, while the southern half trends almost directly north and south.

There are two depressions in which the depth exceeds 100 feet, with an isolated sounding of 106 feet between them. The larger depression is contained in the southern half of the loch, and is over half a mile in length, with a maximum width of about one-sixth of a mile; the greatest depth in this depression is 118 feet. The smaller but deeper depression is situated at the base of the northern half of the loch, occupying a central position, and is over a quarter of a mile in length, with a maximum width of about one-sixth of a mile. The deepest sounding in the loch (146 feet) is centrally placed in this depression, lying north-westward of the point where the Ardchullarie burn enters the loch. The area over 100 feet in depth is estimated at about 55 acres, or 9 per cent. of the entire area of the loch.

There are three depressions in which the depth exceeds 50 feet. The largest is contained in the southern half of the loch, and is over 1½ miles in length, with a maximum width of over a quarter of a mile. The second in point of size is centrally placed, and is over half a mile in length, with a maximum width of over a quarter of a mile. The third and smallest (and also the shallowest, the deepest sounding in it being 62 feet) is situated near the northern end of the loch, and is little more than a quarter of a mile in length and about one-eighth of a mile in greatest width. At the upper end of the loch, where the river Balvag enters, there is a long spit formed of detritus brought down by the river, and this end of the loch for a distance of three-quarters of a mile is very shallow, while at the lower end the 50-feet contour is found within 200 yards of the outlet. The area between the 50-feet and 100-feet contours is estimated at about 162 acres, or 26 per cent. of the total area of the loch, while the area with depths under 50 feet is estimated at about 397 acres, or 65 per cent. of the area of the loch.

When the loch was visited on April 6, 1899, it appeared from marks on the shore that the water had lately been 4 feet 10 inches higher than at that time, and it has been known to have been 12 or 18 inches lower, so that the rise and fall is about 6 feet in all. On one occasion a disc was visible down to a depth of $17\frac{1}{2}$ feet, and on another down to $20\frac{1}{2}$ feet.

On the western shore, between $1\frac{1}{4}$ and $1\frac{1}{2}$ miles from the southern end of the loch, there is a remarkable sandy spit, which stretches out towards the centre of the loch, the origin of which appears to us somewhat puzzling (see the Geological Notes by Messrs. Peach and Horne).

The details regarding the different lochs have been collected together in the table on p. 330 for convenience of reference and comparison.

Deposits.

As a general rule, the materials forming the deposits in these fresh-water lochs become finer grained the further from the shore and the deeper the water. Off the mouths of rivers and burns there is frequently a considerable accumulation of gravel and fine sand, extending for some distance into the lake and occasionally reaching rather deep water. Large stones, gravel, and sand are usually found all round the shores within the limits of wave-action. The height and length of the waves, and the depth to which wave-action extends, depend on the size and depth of the loch.

The central parts of the lochs are occupied by a fine impalpable mud, which is found in its most characteristic form in the greater depths far from shore; it is usually of a light or dark brown colour, and sometimes there are indications of different-coloured layers. The usual mineral species are quartz, felspars, black and white mica, amphibole, pyroxene, magnetite, garnets, etc. Chemical analysis showed that these fine muds contained no appreciable calcareous matter, but traces of sulphuretted hydrogen were always present. The loss on ignition after drying at 90° C., due to organic matter and combined water, varied from 13 to 26 per cent. Diatoms were observed in nearly all the samples, and vegetable fibre was usually present in greater or less abundance.

The samples from the deepest part of Loch Katrine were brownish, fine-grained, homogeneous muds, with glittering mica-flakes, consisting principally (50 to 70 per cent.) of angular mineral particles exceeding 0·05 mm. in diameter, the mean diameter being about 0·15 mm., with clayey and vegetable matter, and many minute mineral particles less than 0·05 mm. in diameter. A few diatoms were observed, and one sample, after drying at 90° C., gave 19·91 per cent. loss on ignition.

The mud from the deepest part of Loch Achray was of a grey-brown colour, containing much vegetable and clayey matter, the mineral particles exceeding 0·05 mm. in diameter making up probably 30 or 40 per cent. of the whole deposit. Some fine diatoms were observed, and the loss on ignition, after drying at 90° C., amounted to 12·84 per cent.

The mud from a depth of 102 feet in Loch Vennachar was yellowish-brown in colour, containing about 20 per cent. of mineral particles with

Loch.	Elevation of surface above the sea.	Number of soundings.	Length.	Breadth, miles.		Mean breadth per cent. of length.	Depth.			Ratio of depth to length.		Volume, million cubic feet.	Area of loch.	Drainage area.	
	Feet.		Miles.	Max.	Mean.		Feet. Max.	Feet. Mean.	Mean per cent. of max.	Max.	Mean.		Square miles.	Total in square miles.	Ratio to area of loch.
Katrine ...	364	775	8·00	1·00	0·60	7·5	495	199·189	40·4	85	211	27,274	4·78	37 42	7 83
Arklet	455	135	1·00	0·50	0·33	33 3	67	24·190	36·1	79	218	222	0 33	5·33	16·15
Achray ...	276	171	1·25	0·33	0·26	20·8	97	36·003	37 1	68	183	321	0·32	7·06	22·06
Vennachar ...	270	423	4·00	0·75	0 40	10·0	111	42·410	38·2	190	498	1,903	1·61	28·65	17·80
Drunkie ...	416	155	1·00	0·25	0·21	21 0	97	36·050	37·1	51	147	217	0·22	2·20	10 00
Voil	414	279	3·50	0·33	0·24	6 9	98	40·936	41·8	189	451	1,000	0 88 }	38·47	35 29
Doine	414	90	1 00	0·25	0·21	21·0	65	33·130	51·0	81	160	196	0 21 }		
Lubnaig ...	405	394	4·00	0·40	0·24	6·0	146	42 773	29·3	145	493	1,144	0·96	34·97	36·43
		2422										32,277	9·31	154·10	16·55

a mean diameter of 0·1 mm., but principally made up of amorphous clayey matter with vegetable matter, and many minute mineral particles less than 0·05 mm. in diameter. There were a few diatoms; the loss on ignition, after drying at 90° C., amounted to 14 per cent.

The mud from the deeper part of Loch Drunkie was of a dirty brown colour, containing 10 to 20 per cent. of mineral particles with a mean diameter of 0·1 mm., but consisting principally of amorphous clayey matter, with many small mineral particles, and vegetable matter. A few diatoms were observed. The loss on ignition, after drying at 90° C., amounted to 26·38 per cent.

The deposit from the deeper parts of Loch Arklet was similar to that from Loch Drunkie, with even a larger quantity of vegetable matter.

The mud from the deeper parts of Lochs Doine and Voil was of a brown colour, with 30 to 40 per cent. of mineral particles, and clayey and vegetable matter, and a few diatoms. A sample from a depth of 80 feet in Loch Voil, after drying at 90° C., gave 22·74 per cent. loss on ignition.

The material from a depth of 136 feet in Loch Lubnaig was a brown impalpable mud, with 30 to 40 per cent. of mineral particles, much clayey and vegetable matter, and a few diatoms. The loss on ignition, after drying at 90° C., amounted in one sample to 16·29 per cent., and in another sample to 15·76 per cent.

Temperature Observations.

During the various visits to the different lochs, many observations were made on the temperature of the water, both on the surface and at intervals below the surface, down to the bottom. All the serial temperatures taken by us have been collected together in the table on p. 332,* and, in order to make the record more complete, the temperatures taken by Jardine in 1812 and 1814 in Loch Katrine are given in the first two columns.

Loch Katrine.—The surface temperatures taken in Loch Katrine during the seven days from June 5 to 11, 1897, are extremely interesting, as illustrating the effect of the wind. The range of temperature during this time was 12½°, from 45·3° to 57·8°, the highest reading being observed at Trossachs pier on the evening of June 5, and the lowest at the same place on the evening of June 9. This was evidently the result of a strong east wind, which commenced to blow on the 6th, and continued from the same direction till the 9th, blowing the warm surface-waters before it from the east towards the west end of the loch, while colder water from below was drawn up to the surface at the east end of the loch to take its place. The gradual cooling of the water at

* Temperature observations in the surface-waters of some of the lochs under consideration have been taken by Mr. Thomas Scott, and the results published in the *Annual Reports of the Fishery Board for Scotland.*

Depth in fathoms.	Loch Katrine.							Loch Arklet.	Loch Achray.	Loch Drunkie.	Loch Vennachar.		Loch Doine.		Loch Voil.			Loch Lubnaig.
	Jardine. Sept. 7, 1812.	Jardine. Sept. 3, 1814.	June 6, 1897.	June 9, 1897.	Nov. 26, 1897.	June 9, 1898.	Apr. 15, 1899.	June 11, 1897.	June 12, 1897.	June 12, 1897.	June 10, 1897.	Apr. 11, 1899.	July 7, 1897.	Apr. 10, 1899.	July 7, 1897.	July 7, 1897.	Apr. 10, 1899.	Apr. 8, 1899.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
Surface	57·9	56·8	55·9	—	47·4	55 0	41·2	55·4	57·5	57·0	55·8	42·6	54·0	{42·0 42·6}	56 0	55·0	42·0	42 0
1	—	—	—	—	47·4	—	41·2	—	—	—	—	—	—	42·6	—	—	—	—
2	—	—	—	—	—	—	—	—	—	—	—	42·5	—	—	—	—	—	—
3	—	—	—	—	47·4	—	—	—	—	—	—	—	—	—	55·3	—	—	—
5	—	56·7	48 4	52·0	47·4	54·0	42·0	54·4	53·5	52·6	53·3	42·5	53·4	42·1	—	54·0	42·1	42·7
8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	55·3	—	—	—
10	50 9	49·6	44·0	—	47·3	47 8	41·9	—	—	—	48·2	42·5	52·1	{42·0 41·8}	—	—	42 0	41·9
15	—	45·5	—	—	47·4	—	—	—	—	—	47·2	42·7	—	—	—	—	—	42·6
16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	54·5	—	—
18	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	42·6
20	43·5	44·4	42·0	—	47·4	44·0	42·0	—	—	—	—	—	—	—	—	—	—	41·8
23	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	41·8
25	—	43·3	—	—	46·8	—												
30	—	42·3	42·5	—	46·0	43·5												
35	41·5	—	—	—	43·5	—												
40	—	—	41·5	—	43·8	42 6												
45	—	—	—	—	42·9	—												
50	41·5	—	42·2	—	43·2	—												
55	—	—	—	—	42·5	—												
60	41·5	—	41·5	—	—	—												
66	—	—	—	—	—	42·8												
76	—	—	—	—	—	42·0												
80	41·4	41·7	—	—	43·0	—												
82½	—	—	—	—	43·8	—												

the east end of the loch is well shown by the temperatures taken at Trossachs pier from day to day: thus at 6.30 p.m. on June 5 the temperature was 57·8°; at 11.30 a.m. on the 6th it was 56·2°, and at 4 p.m. 55·3°; at 7 a.m. on the 7th it was 49·2°; at 10.30 a.m. on the 8th it was 46·3°; and at 7.15 p.m. on the 9th it was 45·3°. By 9.30 a.m. on the 11th it had risen again to 50·1°. The effect of the wind was also shown by a series of surface-temperatures taken from the steamer on its way from Stronachlachar pier to the Trossachs pier on the evening of June 9: thus at Stronachlachar the temperature was 52·6°; near the waterworks,

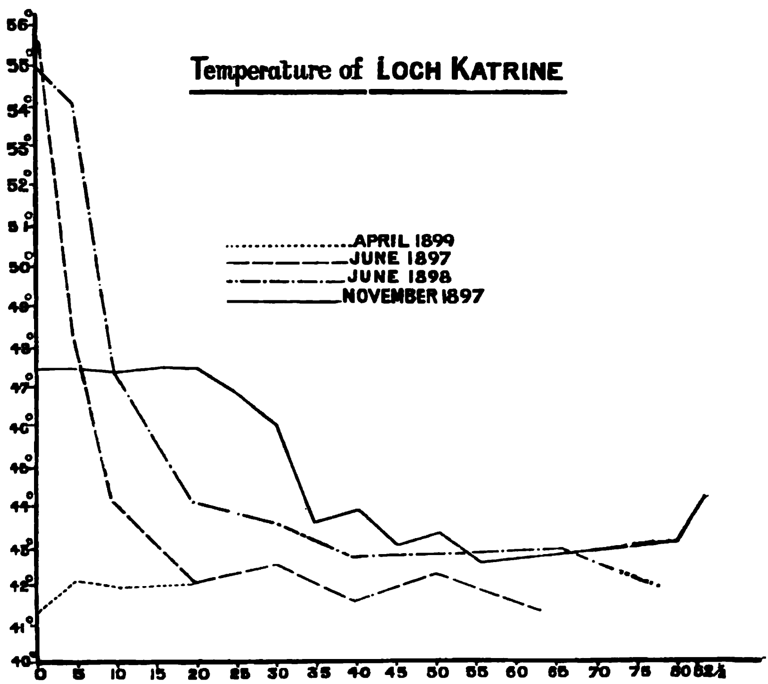

FIG. 11.—CURVES OF TEMPERATURE IN LOCH KATRINE.

52·0°; near Letter, 49·6°; near Brenachoil, 48·8° and 48·0°; near Ellen's isle, 47·4° and 47·0°; and finally at Trossachs pier, 45·3°. It will thus be seen that it is very unsafe to rely on a single observation at one spot, as giving a sure indication of the temperature of the surface-waters of a loch as a whole at any given season. A year later (from June 4 to 9, 1898) the temperature of the surface-waters of Loch Katrine was not observed to fall below 50°. On November 26, 1897, the surface-temperature varied only from 46·8° to 47·4°, and on April 13 and 15, 1899, from 41·2° to 42·7°.

The serial temperatures in Loch Katrine are shown graphically in the accompanying curves (Fig. 11), which exhibit the march of temperature in the waters of the loch throughout the year. The curve for April shows that the water from top to bottom has a temperature ranging between 41° and 42° Fahr. In the two curves for June the heating effect of the sun on the surface-layers is indicated, but in depths beyond 20 fathoms the temperature has not been appreciably effected. In June, 1898, the whole body of water in the loch was apparently slightly warmer than in the previous June. The November curve shows a great accumulation of summer heat in the layers down to depths of 30 and 35 fathoms. By this time cooling has set in, and progresses slowly until the spring, when the whole of the layers assume the nearly uniform temperature indicated by the April curve. The temperature of the bottom of the loch in depths of 400 feet may vary one or two degrees from year to year, this variation being due to the strength of the winds and general character of the climate in different years.* The highest temperature recorded in Loch Katrine is 58·4°, so that the range in the central parts of the loch throughout the whole year is probably about 18° Fahr.

Loch Arklet.—Temperature observations taken in the centre of Loch Arklet on June 11, 1897, gave a temperature at the surface of 55·4°, and at 5 fathoms 54·4°; on April 13, 1899, the surface-temperature was 42·7°. Temperatures as high as 61° have been recorded in this loch, so that the annual range probably exceeds 29°.

Loch Achray.—Observations taken in June and November, 1897, and April, 1899, showed that the temperature of the surface-waters varied from 41° in April to 59·5° in June, the temperature in November being 46°. An intermediate observation at 5 fathoms in the centre on June 12, 1897, gave 53·5°. The highest reading recorded at the surface of this loch is 64·1°, so that the annual range probably exceeds 32°.

Loch Drunkie.—Observations taken on June 12, 1897, showed that the surface-waters had a temperature of 57°, and an intermediate observation at 5 fathoms gave 52·6°. On April 14, 1899, the surface temperature was 42·4°.

Loch Vennachar.—The temperature observations taken in June, July, and November, 1897, and April, 1899, showed that the temperature of the surface-water varied from 41° in April to 56·5° in June, the temperature in November being 46° to 47°, while the water of Blairgarry stream had a temperature of 42·2°. Serial observations in the centre of the loch on June 10, 1897, showed a gradual fall in the temperature from 55·8° at the surface to 47·2° at 15 fathoms; while on April 11, 1899, the temperature was practically uniform from surface to bottom at 42·5° to 42·7°.

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* See Murray, "Some Observations on the Temperature of the Water of the Scottish Fresh-water Lochs" (*Scottish Geographical Magazine*, vol. xiii. p. 1, 1897). At noon on March 10, 1900, in calm and frosty weather, the temperature of the surface-water of Loch Katrine, over the deepest part of the loch, was 40·3°, at 10 feet 40·2°; at all other depths down to 492 feet the temperature-readings were 40·0° and 40·1°. On the same date the readings in shallow water were 39·4°.

Loch Doine.—Observations taken on July 7, 1897, and April 10, 1899, showed that the temperature varied from 42° in April to 54° in July. Serial observations in the centre of the loch in July gave a temperature at the surface of 54°, falling to 52·1° at 10 fathoms, while in April the temperature was found to be nearly uniform from surface to bottom, ranging from 41·8° to 42·6°.

Loch Voil.—Observations taken in July, 1897, and April, 1899, showed that the temperature of the surface-water varied from 41·2° in April to 56·5° in July. Serial observations taken on July 7, 1897, showed that in the centre of the loch the temperature at the surface was 55·0°, at 5 fathoms 54·0°, and at 16 fathoms 54·5°, while further down the loch the temperature appeared to be rather higher, viz. 56·0° at the surface, and 55·3° at 3 fathoms and 8 fathoms. Serials taken on April 10, 1899, showed that the whole body of water was practically uniform in temperature at about 42°.

For the sake of comparison a few surface-temperatures were taken at the head of Loch Earn on July 6, 1897, the temperature of the loch varying from 48·8° to 49·2°, while that of the streams flowing into the loch was 52·2°. On the following day (July 7, 1897) the surface of Loch Voil near the shore had a temperature of 56·4°, and a little distance from the shore 54·6°, while the water of the burn flowing into the loch had a temperature of 53·6°, and higher up the stream 53·1°. It thus appears that the waters of Loch Voil were warmer than those of Loch Earn, and in the case of Loch Voil the stream feeding the loch had a lower temperature than the loch itself, while in the case of Loch Earn the streams were warmer than the waters of the loch.

Loch Lubnaig.—Observations were taken in Loch Lubnaig only on April 6 and 8, 1899, and showed that at that time the temperature of the water was nearly uniform from surface to bottom, the range being only from 41·8° to 42·7°.

From the point of view of temperature, the Scottish fresh-water lochs may be divided into those which freeze during hard winters, and those which never freeze. Those which freeze over in winter are shallow lochs, and when frozen the water-temperature beneath the ice is at the maximum density point of fresh water (39·1°) or lower. In spring the temperature of these shallow lochs rises much more quickly through the heat of the sun, and the whole mass of water attains a higher temperature than in the case of the deeper lochs; they also lose their heat much more quickly in the autumn than the deep lochs, and consequently have a much wider range of annual temperature. In the deep lochs—those with 400 or more feet of depth—the temperature of the water never rises so high in summer, nor sinks so low in winter, as in the shallow lochs, and the range is much less. The temperature of the bottom water in some cases does not change more than 1° Fahr. from year to year, and in the deepest lochs it appears to be practically constant at all times and seasons; 40° is the lowest temperature that has been recorded at the bottom in any of these deep Scottish lochs, so that the maximum density point is never reached. In summer, autumn, and even early winter, it is possible, by observing the temperature of the surface and sub-surface waters, to form a fairly accurate idea of the depth of a loch, the temperature being higher the shallower the loch. The waters from a deep loch—like Loch Katrine—are much the best for the water-supply to a city, for in summer the temperature is relatively low and in winter it is relatively high.

Pelagic and Other Organisms.

Tow-net and other observations show that the nature and amount of the organic life in the fresh-water lochs are subject to great variation in the different lochs when compared with each other, and in the same loch at different seasons of the year. Large numbers of observations are being collected, and we may look for interesting results when these are in a state for discussion. Generally speaking, the pelagic fauna and flora are much more abundant in the warm summer months than at other times of the year, and are also more abundant in the shallow lochs than in the deep ones. In the spring months there is a great development of diatoms and other Phytoplankton, which render the water less transparent than at other times of the year.

Mr. Thomas Scott has lately been comparing the fauna in several of the Scottish lochs at different seasons of the year; some of his results for the lochs now under consideration may be noted.

In Loch Katrine the Entomostraca and other invertebrates were scarcer than in the other lochs examined. Fourteen species are recorded, *Bosmina longispina* being the only species present in all the gatherings; *Leptodora* was entirely absent from the gatherings collected during the colder months. *Cyclops strenuus* and *Polyphemus* appeared to be more frequent in the upper part of the loch, and *Bosmina* and *Leptodora* in the lower part. The sides of Loch Katrine do not generally present conditions very favourable to shore-dwellers, and an examination of the shore about Stronachlachar yielded scarcely anything that differed from the tow-net captures, while at the lower end the shore between the Trossachs pier and Ellen's isle yielded much better results. Here forty species of Crustacea were obtained, as well as one or two species of Mollusca, but they were all individually scarce. The Cladocera were more numerous in species in the warmer than in the colder months, while with the Copepoda the reverse was observed, though the difference was not so great.*

In Loch Arklet, *Holopedium gibberum*, one of the most remarkable species of the Cladocera in Britain, was moderately common in the

* Scott, *Seventeenth Annual Report of the Fishery Board for Scotland*, pt. iii. pp. 148–151, 1899.

tow-net gatherings collected in September and November, 1897, and in June, 1898, it was abundant all through the water, but when the loch was visited in March, 1898, not a trace of *Holopedium* could be seen. In June, when *Holopedium* was so abundant, other species previously observed were either very scarce or absent, as if they had been more or less crowded out by this particular cladoceran. Eleven crustacean species are recorded, *Daphnia* being the only form obtained in all the gatherings; *Bythotrephes* was observed in September and June, but not in November and March, and *Leptodora* occurred only in September. Infusoria (*Ceratium*, etc.) and micro-algæ were much less frequent in June than in the other gatherings. Forty-two species of Entomostraca were obtained by hand-net round the shores of Loch Arklet, including a few comparatively rare forms; very few molluscs were observed in any of the gatherings.*

Twelve species of Entomostraca were captured by the tow-nets in Loch Achray, *Diaptomus*, *Daphnia*, and *Bosmina* being taken in all the gatherings. *Holopedium*, though common in September and June, was not observed in November and March; *Bythotrephes* also appears to be subject to somewhat similar seasonal variation. Fifty species of Entomostraca and four species of Mollusca were obtained by the hand-net, and by dragging the tow-net for a short distance over the bottom of Loch Achray. Three rare species: *Diaptomus wierzejskii*, *Lathonura rectirostris*, and *Monospilus dispar* were obtained, and in June a green fresh-water sponge (*Spongilla fluviatilis*) appeared to be moderately common in some shallow parts of the loch. †

Loch Vennachar contains a rich crustacean fauna, as well as other invertebrates, most of which are suitable for fish food. Of forty-five species of Crustacea recorded from Lochs Katrine, Achray, and Vennachar, thirty-five species were observed in Loch Vennachar; thirteen of the species from Loch Vennachar were not observed in either Loch Katrine or Achray; fifteen of the species were common to the three lochs.‡

Twenty-five species of Crustacea and four species of Mollusca are recorded from Loch Lubnaig, including a new cladoceran (*Alona neglecta*), and one or two species new to Britain.§

Rainfall and Outflow.

An attempt has been made to arrive at an approximation to the total amount of rain falling annually on the drainage areas of the lochs under consideration, although the available records are far from sufficient for the purpose. Dr. Alexander Buchan, F.R.S., has kindly supplied us

* Scott, *Seventeenth Report of the Fishery Board for Scotland*, pt. iii. pp. 143–146.
† *Ibid.*, pt. iii. pp. 153–156.
‡ Scott, *Fourteenth Report of the Fishery Board for Scotland*, pt. iii. p. 167, 1895.
§ Scott, *Thirteenth Report of the Fishery Board for Scotland*, pt. iii. p. 217, 1894.

with information regarding the readings of the rain-gauges at observing stations within, and in the vicinity of, the catchment-basins of these lochs. The positions of these rainfall stations, and the mean annual rainfall, are shown on one of the maps accompanying this paper (see Map III.), and further particulars will be found in the following table:—

Station.	Height of rain-gauge above sea-level.	Years observed.	Mean annual rainfall in inches.
	Feet.		
Ardlui	50	1865–70	115·10
Firkin	100	1866–79	98·38
Arrochar	15	1864–98	81·31
Head of Duchray	1800	1854–98	84·27
Glengyle	380	1854–98	92·25
Top of hill, Loch Katrine tunnel	830	1861–98	77·95
Brig o' Turk	270	1854–98	64·47
Loch Drunkie	420	1861–98	63·62
Loch Vennachar	275	1861–98	57·31
Between Ben Ledi and Glen Finlas	1800	1854–98	53·68
The Gart	230	1872–98	54·47
Leny	345	1861–98	54·23
Blaircreach	460	1893–98	82·63
Stronvar	422	1860–98	75·49
Lochearnhead	320	1866–84	65·50
Tyndrum	792	1858–61, 72–3, 76–7	90·10

Grouping these stations and their mean annual rainfall into those likely to represent the rainfall on the catchment-basin flowing out of Loch Vennachar, and those representing the rainfall on the catchment-basin flowing out of Loch Lubnaig, we arrive at an average rainfall of 76·25 inches for the Loch Lubnaig catchment, the mean height of the rain-gauges being 538 feet above the level of the sea, and an average rainfall of 75·37 inches for the Loch Vennachar catchment, the mean height of the gauges being 528 feet.

The entire catchment-basin flowing out of Loch Vennachar (*i.e.* the combined drainage-areas of Lochs Katrine, Achray, Drunkie, and Vennachar) is about 75·29 square miles, and the mean height calculated from the bulk of land above the level of the lochs is about 704·185 feet; the mean height of the surfaces of these four lochs above sea-level is 331½ feet, so that the mean height above the sea of the entire catchment is about 1035·685 feet. The entire catchment-basin flowing out of Loch Lubnaig (*i.e.* the combined drainage-areas of Lochs Voil, Doine, and Lubnaig) is about 73·39 square miles, and the mean height above the level of the lochs is about 935·129 feet; the mean height of the surfaces of these lochs above sea-level is 412 feet, so that the mean height above the sea of the entire catchment is about 1347·129 feet.

The usual practice among engineers is to add 2½ per cent. of rainfall for each 100 feet of height above rain-gauges. Applying this rule to the Loch Vennachar catchment-basin, where we have an observed rainfall of 75·37 inches at an average height of 528 feet, we must add 12·7 per cent. for the additional 508 feet of mean height, making an average annual rainfall over the entire catchment of 84·94 inches. This would give an annual fall of rain on the entire catchment equal to 14,857,214,000 cubic feet. Applying this rule, in like manner, to the Loch Lubnaig catchment-basin, where we have an observed rainfall of 76·25 inches at an average height of 538 feet, we must add 20 per cent. for the additional 809 feet of mean height, making an average annual rainfall over the entire catchment of 91·5 inches. This would give an annual fall of rain on the entire catchment equal to 15,600,760,000 cubic feet.

There is another method of estimating the rainfall, without taking the mean height of the drainage-area into consideration. Supposing the usually accepted increase of $2\frac{1}{2}$ per cent. per 100 feet of height, and also the mean annual rainfall at the average height of the rain-gauges, to be approximately correct, it is possible to calculate the rainfall at any given height. For the Loch Vennachar catchment the probable rainfall at the same heights and intervals as the contour-lines on the Ordnance Survey maps has been calculated from the starting-point of the mean of the observing stations 75·37 inches at 528 feet. Thus at the surface of Loch Vennachar the rainfall would be about 70·5 inches; at 500 feet above the sea, 75·2; at 750 feet, 79·9; at 1000 feet, 84·6 inches; and so on, adding $6\frac{1}{4}$ per cent. for each succeeding interval of 250 feet. Multiplying the area between any two consecutive contour-lines by the mean of the two figures calculated for the same two lines should give an approximation to the amount of rain falling on that area. The result as obtained by this method for the entire catchment-basin flowing out of Loch Vennachar is given in the following table :—

						Cubic feet.
Level of lochs to 500	feet,	16·53	square miles	×	72·8 inches	= 2,795,710,000
500 „ 750	„	10·67	„	×	77·5 „	= 1,921,117,000
750 „ 1000	„	10·35	„	×	82·2 „	= 1,976,514,000
1000 „ 1250	„	9·46	„	×	86·9 „	= 1,909,847,000
1250 „ 1500	„	10·22	„	×	91·6 „	= 2,174,874,000
1500 „ 1750	„	7·86	„	×	96·3 „	= 1,758,476,000
1750 „ 2000	„	5·94	„	×	101·0 „	= 1,393,784,000
2000 „ 2250	„	3·06	„	×	105·7 „	= 751,422,000
2250 „ 2500	„	0·99	„	×	110·4 „	= 253,917,000
over 2500	„	0·21	„	×	115·1 „	= 56,154,000
					Total	14,991,815,000

This result comes very near to that obtained from the calculation based upon the mean height, which gave a total annual rainfall of 14,857,124,000 cubic feet.

Applying the same method to the entire catchment-basin flowing out of Loch Lubnaig, we arrive at the following result :—

						Cubic feet.
Levels of lochs to 500 feet,	6·82	square miles	×	74·6	inches	= 1,181,982,000
500 „ 750 „	7·15	„	×	77·9	„	= 1,293,991,000
750 „ 1000 „	9·05	„	×	82·7	„	= 1,738,769,000
1000 „ 1250 „	9·70	„	×	87·4	„	= 1,969,568,000
1250 „ 1500 „	9·89	„	×	92·2	„	= 2,118,434,000
1500 „ 1750 „	9·43	„	×	97·0	„	= 2,125 060,000
1750 „ 2000 „	8·06	„	×	101·7	„	= 1,904,337,000
2000 „ 2250 „	6·64	„	×	106·5	„	= 1,642,879,000
2250 „ 2500 „	3·30	„	×	111·3	„	= 879,148,000
2500 „ 2750 „	1·88	„	×	116·1	„	= 507,081,000
2750 „ 3000 „	1·02	„	×	120·8	„	= 286,256,000
over 3000 „	0·35	„	×	126·6	„	= 102,941,000
			Total	...	...	15,750,446,000

Here, again, there is a close agreement between the result obtained by this method and that calculated from the mean height, which gave a total annual rainfall of 15,600,760,000 cubic feet.

A third method of estimating the amount of rain falling on any particular region is afforded by drawing lines of equal rainfall, measuring the areas between the lines, and multiplying by the mean annual rainfall. Where the lines are based upon sufficiently numerous records of the rainfall at various heights, this method should give excellent results; but in the cases under discussion the number of observing stations is small, and the majority of the rain-gauges are situated on the low-lying grounds, only two being placed at heights exceeding 1000 feet, both at 1800 feet: therefore the figures obtained in these cases are most probably below the truth. Nevertheless, we have attempted to lay down the lines of equal rainfall from the available records, as shown on the rainfall map accompanying this paper (see Map III.). The areas enclosed by the lines of rainfall have been measured with the planimeter, and the rainfall calculated for the Loch Vennachar catchment-basin, with the following results:—

						Cubic feet.
50 to 60 inches,	12·35	square miles	×	55	inches	= 1,578,040,000
60 „ 70 „	28·97	„	×	65	„	= 4,374,714,000
70 „ 80 „	18·93	„	×	75	„	= 3,298,372,000
80 „ 90 „	8·55	„	×	85	„	= 1,688,400,000
90 „ 100 „	4·21	„	×	95	„	= 929,166 000
100 „ 110 „	2·28	„	×	105	„	= 556,175,000
		Total	...	...		12,424,867,000

In like manner, the rainfall has been calculated for the Loch Lubnaig catchment-basin, with the following results:—

						Cubic feet.
50 to 60 inches,	3·79	square miles	×	55	inches	= 484,272,000
60 „ 70 „	23·89	„	×	65	„	= 3,607,591,000
70 „ 80 „	21·79	„	×	75	„	= 3,796,700,000
80 „ 90 „	19·02	„	×	85	„	= 3,755,928,000
90 „ 100 „	4·41	„	×	95	„	= 973,307,000
100 „ 110 „	0·49	„	×	105	„	= 119,530,000
		Total	...	...		12,737,328,000

The results obtained by these three methods may be summarized thus:

	Vennachar catchment.	Lubnaig catchment.
First method ...	14,857,214,000	15,600,760,000
Second " ...	14,991,815,000	15,750,446,000
Third " ...	12,424,867,000	12,737,328,000
Mean ...	14,091,299,000 c. ft.	14,696,178,000 c. ft.

Since Loch Katrine has been made use of by the Glasgow Corporation as the source of the water-supply to that city, a record has been kept of the amount of water flowing out of Lake Vennachar—or rather, a record has been taken twice a day of the depth of water flowing over a weir at Coilantogle, from which the quantity of water discharged may be calculated. When the height of the water on the weir exceeded 5 inches, the weir became a drowned weir, so that it was difficult to estimate the outflow, as there was a considerable velocity of approach, especially during floods.

Mr. Gale has kindly supplied us with the readings, taken twice a day during the year 1869, of the depth of the outflowing water at Coilantogle, and from these figures the outflow has been estimated for that year at 9,572,000,000 cubic feet. The year 1869 was the driest year during a period of twenty-four years, and we are not satisfied that this computation can be accepted as a very correct estimate of the outflow from this catchment-basin even for that year. It would have been interesting to have calculated the outflow for twenty-five years in the same way as we have done for the year 1869, and to have taken the mean. However, accepting the above estimate for the year 1869, and adding to it the quantity of water supplied to Glasgow for that year, which, from Mr. Gale's table showing the average amount of water supplied per day during the first six months of the years 1866 and 1871, may be taken at about 1,659,300,000 cubic feet, we find that the mean rainfall exceeds the outflow in this year by

According to the first method	3,625,914,000	cubic feet.
" " second "	3,760,515,000	"
" " third "	1,193,567,000	"
or a mean of	2,859,999,000	"

Leslie * made experiments for twenty consecutive years on the allowance to be made for absorption by vegetation and for loss by evaporation, and he calculated that the average annual amount of water absorbed and evaporated is equal to about 13 inches of rainfall. On this basis, and assuming for the present that the evaporation from the surface of the water is equal to absorption and evaporation from the land, the total amount of water lost through absorption and evaporation over the entire catchment-basin of Loch Vennachar would be about

* See *Jour. Scot. Met. Soc.*, vol. v. p. 108, 1878.

2,273,885,000 cubic feet per annum.* Comparing this figure with the figures given above showing the excess of rainfall over outflow, we observe that, according to the mean of the three methods, the difference between the rainfall and outflow is greater than would be accounted for by absorption and evaporation as estimated by Leslie, there being an excess according to the first two methods, and a deficiency according to the third method.

The foregoing figures, calculated for the year 1869, show that the rainfall unaccounted for by outflow at Coilantogle, and supply of water to Glasgow, is according to the first method 26 per cent., according to the second method 27 per cent., and according to the third method 8 per cent.: this percentage must be referred to loss by absorption, evaporation, and the loss of water through underground channels.

Notes on the Geology of the Loch Katrine District.†

By Messrs. Ben. N. Peach, F.R.S., and John Horne, F.G.S., from unpublished observations made during the course of the Geological Survey of Scotland.

All the lochs referred to in this paper, with the exception of Loch Arklet, lie within the catchment-basin of the river Teith above Callander. Though situated about a mile to the west of Loch Katrine, the small lake, Loch Arklet, drains into Loch Lomond.

1. *Geological Structure of the area embracing these Lochs.*

All the lochs, save the lower part of Loch Vennachar, lie within the territory of the crystalline schists of the Highlands, which are bounded along the Highland border by a powerful fault stretching from Stonehaven to the Firth of Clyde. As shown on the geological sketch-map accompanying this paper, this dislocation extends from Aberfoil north-east by Leny to Luirgeann on the Kelty water. On the south-east side of this fault the strata belong to the lower Old Red Sandstone formation, comprising, next the fault, andesitic lavas and agglomerates well seen in the Kelty water. Further to the south-east there is a broad belt of conglomerate arranged in beds, which are inverted or vertical near the fault, and as the observer approaches the plain they dip towards the south-east and pass underneath the overlying red sandstones.

On the north-west side of this great boundary fault of the Highlands there is a narrow strip of sedimentary rocks about half a mile in breadth, referred provisionally to the Arenig division of the Silurian

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* The evaporation from the surface of the lakes will, of course, exceed Leslie's figures for loss through absorption and evaporation.

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system, and consisting of red and black shales, radiolarian cherts, limestones and grits.

To the north of this belt of doubtful strata, the whole of the area included in the geological map accompanying this paper is occupied by rocks grouped under the general term of the crystalline schists of the Highlands. The latter are arranged in a definite order, but as yet it is uncertain whether it indicates the original sequence of deposition. The groups are here given in apparent descending order—

7. Garnetiferous mica-schists.
6. Loch Tay limestone with sills of epidiorite.
5. Mica-schists with sills of epidiorite.
4. Schistose epidotic grits ("Green Beds").
3. Ben Ledi grits, massive and sometimes schistose.
2. Aberfoil slates with subordinate bands of grit.
1. Leny and Aberfoil grit.

For a distance of about 5 miles northwards from the great boundary fault, the members of groups 1 to 4 are arranged in more or less parallel belts or strips running south-west and north-east, the strata dipping at high angles to the north-west. The groups appear in consecutive order, the Leny and Aberfoil grit being exposed immediately to the north of the doubtful Arenig rocks, while the Aberfoil slates and Ben Ledi grits appear successively to the north. The schistose epidotic grits (group 4), which lie apparently at the top of the Ben Ledi grits, are developed still further to the north, being traceable from a point not far to the south of Ben Lomond, north-east by Loch Chon and the lower part of Loch Katrine, thence across the hills to Strathyre and Loch Voil. From the Braes of Balquhidder they can be followed northwards to Glen Dochart, and they reappear in Glen Falloch in the extreme north-west part of the map. At the head of Loch Lubnaig and in the Braes of Balquhidder sills or intrusive sheets of epidiorite occur at no great distance from the "Green Beds."

In the belt between Loch Chon and Loch Lubnaig the "Green Beds," together with the Ben Ledi grits, form a series of compound synclinal folds, the strata being inclined at high angles. To the north and west of the "Green Beds" the representatives of the Ben Ledi grits reappear and cover a wide area, extending from Ben Lomond north-east by Loch Katrine and the heights surrounding the head of Loch Voil, northwards by Ben More and westwards to Glen Falloch. Throughout this extensive area the strata are inclined at gentle angles: in marked contrast with the structure along the Highland border already indicated. There is here a change, over part of the area at least, in the lithological characters of the Ben Ledi grit group. The strata become more schistose and micaceous, merging in places into mica-schists. The accompanying geological map shows generally where these grits still retain their massive character and where they merge into mica-schists.

The outcrop of the Loch Tay limestone is indicated on the geological map, from which it will be seen that this limestone, together with the sills of epidiorite, is traceable from the upper part of Strathyre, by the Kirkton glen, to Luib, in Glen Dochart.

In addition to the great boundary fault already referred to, separating the lower Old Red Sandstone from the crystalline schists, various faults trending N.N.E. and S.S.W. traverse the south-east part of the area under consideration. These are, in the main, branches of the great dislocation which has been traced across the Highlands for a distance of 60 miles, from Loch Vennachar by Loch Lubnaig and Loch Tay to Glen Tilt. In common with the dislocation referred to, the branch faults have a downthrow to the west or north-west, and they shift for some distance the outcrops of the strata which they traverse. They are truncated by the great boundary fault of the Highlands, and may be of pre-Old-Red-Sandstone age.

The existing valley-system of the basin of the Teith has been carved out of a tableland of crystalline schists of varying hardness. Though there is conclusive evidence of great erosion during the successive glaciations of the region, yet it is clear that the present valley-system must have been developed in pre-glacial time. There is one point connected with the geological structure of this region which has had an important bearing on the evolution of the valley-system. Along the Highland border, as already indicated, there is a great development of conglomerates, coarse pebbly grits, and greywackes, belonging partly to the crystalline schists and partly to the Old Red Sandstone. These strata, being vertical or nearly so, would be much less easily eroded than the gently inclined schistose rocks lying to the north-west. Such an arrangement would naturally lead to the formation of narrow and comparatively flat-bottomed valleys behind rocky gorges, the latter being cut through the vertical beds of hard grit and conglomerate along the Highland border. That this remarkable structure must have likewise contributed to the erosion of rock-basins during the glacial period will become apparent on a closer examination of the geological structure of the area traversed by the larger lakes.

In the case of Loch Katrine, which is the largest and deepest of the lochs under consideration, there is a great rocky barrier at its outlet due to the Ben Ledi grits. Here they form a belt over a mile in breadth, and give rise to the rugged scenery so characteristic of that region. They appear on the crags of the Trossachs at the mouth of the loch, on the crest and slopes of Ben Venue (2393 feet), on Ben Bhreac (2295 feet), and on the heights round Ben An (1326 feet). The strike of these hard and durable strata is E.N.E. and W.S.W.—that is, at right angles to the outlet of the loch, and the beds are vertical or highly inclined.

The potency of the Ben Ledi grits as a rocky barrier must have been considerably increased by the development of epidotic grits or "Green

Beds" lying immediately to the north. The latter, though not so massive as the Ben Ledi grits, are hard and durable; they are repeated by a series of compound folds for nearly a mile across the strike, their northern limit being near Brenachoil Lodge. Their trend is likewise north-east and south-west, and the beds are vertical or highly inclined.

On both sides of Loch Katrine above Brenachoil Lodge the geological structure is widely different, for in this area the Ben Ledi grits, greywackes, and slates reappear in a highly schistose form, the strata dipping generally at low angles to the south-east. Over much of this region, as already indicated, the altered sediments merge into mica-schists owing to the development of mica. It is obvious that these materials would yield more readily to the agents of denudation than the massive pebbly grits of Ben Venue and the Trossachs.

Loch Achray, which lies about a mile to the east of the outlet of Loch Katrine, is only about 88 feet below the level of the latter loch. A powerful fault or dislocation, trending north-east and south-west, crosses the head of the loch near the Trossachs Hotel, which brings the massive Ben Ledi grits to the west in contact with slates to the east. It is a true rock basin which has been excavated mainly in the group of less durable slates.

Loch Vennachar is crossed by the great boundary fault, already referred to, along the Highland border, the floor of the eastern portion being composed of Old Red Sandstone conglomerate, while that of the western part is formed of grits and slates belonging to the crystalline schists. Though there is a covering of drift on both sides of the lower part of the loch, still this sheet of water forms a true rock basin, for the Old Red conglomerate is exposed in the river about 1200 yards below the outlet.

Loch Drunkie presents several interesting geological features. On referring to the map it will be seen that an arm of this loch runs nearly east and west for upwards of half a mile; the northern margin is composed of massive grits, while the southern margin and probably the floor of this branch of the loch is formed of less durable slates. Another arm of this lake runs N.N.E., in the direction of Loch Vennachar, the eastern margin of which nearly coincides with the course of a fault that crosses Loch Vennachar to the east of Lanrick.

The three lakes, Loch Doine, Loch Voil, and Loch Lubnaig, must have formed one continuous sheet of water in post-glacial time. Loch Doine is now separated from Loch Voil by two cones of alluvium, to be referred to presently. Loch Voil is separated from Loch Lubnaig by a narrow plain of alluvium 5 miles in length, the surface of Loch Lubnaig being 9 feet lower than that of Loch Voil. These lochs form isolated parts of a true rock basin. Below the outlet of Loch Lubnaig there is a prominent rocky barrier composed of the massive grit of Leny and Aberfoil, from a half to three-quarters of a mile in breadth. The strike

of this pebbly grit is north-east and south-west, and the beds are i
to the north-west at high angles.

Loch Lubnaig is traversed by several faults, to which special r
will be made in the sequel. The lower part of the loch coincid
the trend of two faults, which, in all likelihood, determined f
distance the course of the river in remote geological time.

2. *Glaciation.*

The glacial phenomena in the lake district of the basin of th
prove beyond doubt that, during the climax of the ice-age, the
lay to the north of the area now under consideration; that
movement was more or less independent of the existing valley-
and that even the highest mountains were overridden by the ice
great development was followed by a period of local glaciatio
the glaciers were confined mainly to the existing valleys, an
the boulder-clay or ground-moraine of the earlier period was
removed. The upper limit of the valley glaciation is frequently
by prominent lines of moraines strewn with boulders, which r
considerable height on the mountain-slopes. The evidence poi
these conclusions may now be briefly summarized.

On the watershed to the north of Lochs Doine and Voil, th
of the ice-movement during the great glaciation, as proved by t
was S.S.E. Again, on the lofty watershed east of Loch Lubn
south of Loch Earn, between Ben Each (2660 feet) and Ben
(3224 feet), there is conclusive evidence that the highest moun
that part of the lake district were overridden by the ice. Th
mountains are composed of grits, and the striæ are well preserv
Ben Each the striæ point S.E.; on the col between that hill an
Chroin, S. 40° E.; on the latter mountain about S.E., and on the
Ben Vorlich, at a height of 2500 feet, the trend of the ice-mar
E. 40° S. In the tract between Loch Lubnaig and Loch Katrine
evidence is obtained of a south-easterly movement at great ele
For example, on Ben Vane (2685 feet), at a height of 2642 feet, t
point S. 15° to 20° E.; on the north and west slopes of Ben Ledi,
and on the crest of that mountain, at a height of 2875 feet, the d
is S.E. In like manner the mountains guarding the outlet
Katrine are glaciated to the summit. Striæ occur on the top
Venue at a height of 2386 feet, pointing S. 40° E.; on Ben A
elevation of 1750 feet, E. 30° S.; and on Ben Bhreac, to the wes
Venue, the direction of the ice-markings is S. 30° to 40° E. A
the watershed between Loch Voil and Loch Katrine, the eviden
cates a south-easterly movement during the great extension
ice. For instance, at various points on Taobh na Coille, at el
between 2000 feet and 2250 feet, the striæ point S. 30° E., and o
Gaothach, S. 30° E. In the tract immediately to the south-

Loch Katrine the trend of the ice-markings varies from S.S.E. to E.S.E. For example, on Maol Mor (2249 feet) about the 2000-feet contour-line, to the north of Loch Arklet, the direction is about S. 15° E.; and on the crest of Ben Uaimhe, to the south of that loch, S. 10° to 15° E. Eastwards, throughout the tract between Loch Chon and the Trossachs, the trend is E.S.E. To the south of the lofty heights stretching from Ben Venue towards Ben Ledi, the direction of the striæ is more easterly, thus showing that the ice, after crossing the high ground, was deflected more towards the east (see glacial striæ on Map II.).

The general south-easterly movement of the ice during the great glaciation, throughout the lake district of the basin of the Teith, is confirmed by the dispersal of stones in the boulder-clay, and by the transport of erratics. Many of the boulders have been carried far from their source, and are now found on the tops of the highest mountains of the district, some even at greater elevations than the parent rock.

To the east of Loch Lubnaig, on Ben Vorlich, at a height of 3000 feet, boulders of garnetiferous mica-schist are found resting on glaciated surfaces of pebbly grit. Again, on the same mountain, at a similar elevation, there are erratics of epidiorite and hornblende-schist—rocks which are associated with the Loch Tay limestone, and which must have been transported from lower ground to the north. Similar boulders are met with on Stuc a Chroin and on Ben Each. Again, in the boulder-clay on the slopes of Ben Ledi, blocks of hornblende-schist occur, which must have been transported for some distance. On the south side of Loch Katrine, between Stronachlachar and the aqueduct of the Glasgow waterworks, boulders of quartzite and garnetiferous mica-schist, which are foreign to the basin of Loch Katrine, are found in the boulder-clay. Eastwards near Brenachoil Lodge, on the north side of Loch Katrine, there are blocks of black schist, like that which accompanies the quartzite of central Perthshire, and which has not been detected within the catchment-basin of Loch Katrine. These examples are sufficient to prove that, during the climax of the glacial period, the ice-movement was independent of the existing valley-system. Indeed, from the evidence furnished by the striæ and the transport of boulders, it may be inferred that the minimum thickness of the ice-sheet during this period must have been not less than 3000 feet in the lake district of Perthshire.

The boulder-clay or ground-moraine, which was laid down during the great glaciation, must have been extensive, for it is found at great elevations, and it sometimes attains a great thickness. For instance, in the lee of the ridge of Ben Vane, to the west of Loch Lubnaig, it reaches a height of 2290 feet, and in places it is over 100 feet thick. But a large part of this deposit was removed during the later glaciation by the valley glaciers, for the relics occur above the limits of the valley-moraines, the latter resting frequently on the solid rock.

Only a brief allusion is necessary to show the developmen later glaciers. The striæ produced by this later movement generally with the trend of the existing valleys. But though true, there is evidence to prove that even the larger valley-glaci thick enough to overflow minor watersheds. For instance, the which descended the basin of Loch Katrine was thick enough to the low col between that loch and Loch Chon, while another passed westwards by Loch Arklet towards Loch Lomond. example of the same phenomenon might be quoted. The glacie descended the basin of Loch Voil towards Loch Lubnaig wa enough to overflow the col between Strathyre and Loch Earn another branch ascended Glen Buckie and joined the Loch glacier at Laggan.

Moraines are well developed in most of the valleys, and quently arranged in concentric lines, as in Glen Finglas, north o Turk. On the south side of Loch Katrine, between the jetty an hoile, the moraines are distributed in parallel lines along the the lake. As already indicated, the upper margins of the valley- are defined by the moraines.

3. *The Soundings viewed in Relation to the Geological History of t and with Reference to the Origin of the Lakes.*

Loch Doine, Loch Voil, and Loch Lubnaig.—Reference has been made to the fact that, in post-glacial time, Loch Doine, Lo and Loch Lubnaig must have formed one continuous sheet o and that their subsequent isolation has been due to the depos sediment.

Loch Doine has been separated from Loch Voil by alluvial co down by two streams, one from the north at Monachylemore, and from the south at Monachyle Tuarach. The 50-feet subaqueous been traced round the Loch Doine basin, and the deepest soundi feet. At the head of this loch there is an alluvial flat that s westwards for $1\frac{1}{2}$ miles, formed by the Lochlarig river and its trib The gradual silting up, which is in constant progress at the head Doine at the mouths of the Lochlarig river and Allt Carnaig, shown by the resultant curve in the 50-feet contour-line.

That Loch Voil is merely a continuation of the Loch Doine further proved by the soundings, for immediately to the eas cones just referred to, the 50-feet contour-line is met with, and h traced round both sides of the loch eastwards to about Lede distance of about 2 miles. From this point eastwards the lake gr shallows towards the alluvial flat at Balquhidder, where morain within 400 yards of Kirkton and Stronvar Bridge. The deepest the lake is enclosed by the 90-feet contour-line at the head of near Monachylebeg, and the deepest sounding within this line is

The trend of Lochs Doine and Voil roughly coincides with the strike of the crystalline schists in that district. It is oblique—indeed, nearly at right angles—to the movement of the great ice-sheet during the climax of glacial conditions, and it harmonizes with the course of the later valley-glacier. Several small faults occur on the Braes of Balquhidder, north of Loch Voil, and on the hill-slope south of Loch Doine, but these are of little structural importance.

The long stretch of alluvium that separates Loch Voil from Loch Lubnaig has been laid down by the Calair burn in Glen Buckie, by the Kirkton burn at Balquhidder, and by various streams on both sides of Strathyre. The silting up now in progress at the head of Loch Lubnaig is well shown by the tongues of alluvium, on both sides of the Balvag river, that project for some distance into the loch and isolate small basins of fresh water. About half a mile north of Loch Lubnaig a moraine rises out of the alluvium, probably a fragment of the adjacent moraine on both sides of the valley. As the top of this moraine probably rose above the level of the ancient united lake, the depth of the latter near this locality could not have been very great.

A glance at the chart of Loch Lubnaig will show that its floor is much more irregular than that of Loch Voil. This may be accounted for partly by the presence of alluvial cones formed by various streams, and by features connected with the geological structure of the basin.

The deepest parts of this lake form two basins enclosed by the 100-feet contour-line, one to the north and the other to the south of Ardchullarie More. The upper one, about 500 yards long, is 146 feet deep, and the lower one, about 900 yards long, is 108 feet in depth. Though now separated by alluvial detritus brought down by the Ardchullarie burn from the north-east, and by the Dubh Shruith burn from the south-west, these basins were probably originally continuous. The powerful Loch Tay fault with a N.N.E. and S.S.W. course, and with a downthrow to the west, crosses Loch Lubnaig immediately to the south of Ardchullarie More, and strikes the west margin of the lake near the spit of sand to be referred to presently (see Map II.). The steep gradient on the west side of the lake to the north and south of this spit of sand coincides with the course of the Loch Tay fault. About a quarter of a mile to the west of the Loch Tay fault a minor dislocation, with a similar trend and downthrow, crosses the lake and follows the channel of the Dubh Shruith burn. Now the lower deep basin lies to the east or upthrow side of the Loch Tay fault, and the upper deep basin is on the west or downthrow side of the Dubh Shruith fault. These dislocations doubtless produced brecciation of the strata along the lines of movement, which led to more rapid disintegration of the materials.

Close to the north-west limit of the upper basin enclosed by the 100-feet contour-line the loch shallows to 20 feet, and from thence north-westwards to a point opposite Bienacreag the depth increases to

62 feet. Here there is a small basin enclosed by the 50-feet co line.

At the lower end of the loch, on the east side, there is a gradient which coincides with a line of fault, having a downthr the west (see Map II.). As already indicated, this dislocation to with the Loch Tay fault may have determined in part the course river in remote geological time. But an impartial consideration evidence furnished by the soundings shows that the faults cannot a for the erosion of the lake basin. The striking fact that the lowe basin of Loch Lubnaig coincides with the upthrow side of th Tay fault—the most powerful dislocation traversing the cry schists of this area—shows that this rock-basin must be ascribe erosive agent acting independently of the lines of fault. It has been shown that Lochs Voil and Doine must have been original tinuous with Loch Lubnaig. The deepest sounding in Loch 98 feet, and in Loch Lubnaig 146 feet, and it is obvious tha erosion must be ascribed to a common cause. The upper part o Lubnaig coincides roughly with the trend of the ice-sheet duri great glaciation, which, from the evidence adduced in the fo pages, must have attained a minimum thickness of 3000 feet. basin must have undergone further erosion by the large valley-g

About half a mile to the south of Ardchullarie More, on t margin of Loch Lubnaig, there is a prominent spit of sand ex into the lake for about 100 yards. It occurs not far to the south bend in the lake, at the meeting-point of the waves produced prevalent westerly winds. By the action of the waves the steadily borne outwards on both sides of the spit, and from the so it is clear that this feature projects far into the lake. Further, have been in process of formation when the loch stood at a highe for a section appears in the adjacent railway cutting, which sh sloping layers of sand coinciding with the form of the spit.

Loch Lubnaig originally extended to a point below Coireach about three-quarters of a mile below its present outlet. This p been silted up by the detritus laid down by the Stank and Anie The original southern termination of the lake touched the rocky formed by the Leny grit. It is worthy of note, also, that the Loch Lubnaig has been lowered about 20 feet by the denuding a the river Leny.

Loch Katrine.—For a distance of 4 miles west from Brenachoi to Stronachlachar—about the half of the total length of the loc lake has a comparatively flat bottom, enclosed by the 400-feet c line. The deepest sounding in Loch Katrine, 495 feet, is at the limit of this basin, nearly due south of Brenachoil. The cha that the soundings throughout this basin gradually increase i eastwards to Brenachoil Lodge. The position of the deepest s is of interest, seeing that the strata which form the floor of the lake at this point consist of schistose micaceous grits, to the north-west of the epidotic grits ("Green Beds") and the Ben Ledi grits, the two latter groups having formed the great rocky barrier at and above the outlet of the lake.

Near the upper end of the loch a rocky barrier crosses the lake from Portnellan by the Black island to Rudha Maoil Mhir an-t Salainn. The deepest sounding along this barrier is 90 feet, and the shallowest is 48 feet. On its lower side the 100-feet contour-line well-nigh crosses the lake. Above it there is another basin over half a mile in length, the greatest depth of which is 128 feet, immediately in front of the rocky ridge just referred to. Westwards the lake shallows, and at its head it has been silted up for a distance of half a mile by the alluvium laid down by the Gyle river.

Below Brenachoil Lodge the soundings show an uneven floor, due probably to ridges of rock rather than to morainic deposits, if we may judge from the geological features on both sides of the lake. Ellen's isle is composed of epidotic grits ("Green Beds"), and the promontories of Am Priosan partly of "Green Beds" and partly of Ben Ledi grits. The promontory between the pier and the sluice is formed of Ben Ledi grits.

During the geological survey of that region several small faults were found to cross Loch Katrine, but these are of minor importance, and have produced locally a slight brecciation of the strata. It is a typical example of a rock basin. The deepest sounding occurs in the front of the great rocky barrier in the lower part of the lake, in accordance with what we might naturally expect on the theory of glacial erosion. Though the soundings prove the deepest part of the lake to be 131 feet below sea-level, yet this depth is in proportion to the vast thickness of the ice during the successive glaciations of the basin.

Loch Achray.—This lake forms one basin, the deepest part being enclosed by the 90-feet contour-line, and the deepest sounding being 97 feet. A fault, with a downthrow to the west, crosses the head of the loch at the Trossachs Hotel, which has produced considerable brecciation of the strata, a feature probably continued along the floor of the loch between the hotel and Achray. The greater part of this lake is on the upthrow side of the fault just referred to, and the basin, as already indicated, has been excavated mainly in slates.

Loch Vennachar.—Between Loch Achray and Loch Vennachar there is a strip of alluvium, the difference in level between the two lakes being 6 feet. The successive terraces show that these two lakes originally formed one sheet of water, which stood at a somewhat higher level. Loch Vennachar contains one prominent basin, about 2 miles in length, enclosed by the 50-feet contour-line. Within this limit there are two smaller basins, which fall below the level of the

100-feet contour-line (see Map V.). The deepest sounding is 1
which occurs to the north-east of Invertrossachs, on the line of th
boundary fault along the Highland border, which has a downthro
south-east. West of this dislocation the floor of the lake rises sh
a level of 20 feet below the surface. Westwards, however, near
the depth increases to 50 feet, a feature which coincides with th
of two faults crossing the loch—branches of the Loch Tay fa
each having a similar downthrow to the west. Doubtless wh
deep soundings coincide with lines of fault, the strata have be
shattered and crushed, which has led to the more rapid disint
of the materials. But though these faults may have led to loca
cations of the floor of the lake, they obviously do not account
excavation of the basin. The long, narrow hollow, crossing o
these lines of dislocation, points to glacial erosion.

Loch Drunkie.—Reference has already been made to the g
features of this basin (see p. 345). In the western portion
west branch, where the hollow has been scooped out of slates,
part of the floor is enclosed within the 50-feet contour-lin
deepest sounding, 97 feet, occurs in the north branch of the
front of a ridge to the east, which rises to a height of about
above the loch. The direction of the striæ at Loch Drunkie is
and the deepest sounding is found where the erosion must h
greatest.

Loch Arklet.—This lake lies across the path of the great i
and coincides with the trend of the later movement (see pp. 347 a
Both the north and south shores of this loch are surrounded by m
but though such is the case, the stream flows over solid rock,
leaves the alluvial flat $1\frac{1}{2}$ miles west of the outlet, and cont
flow for half a mile over solid rock. Originally the lake m
extended westwards to this barrier, for the intervening strip of a
has been laid down by the burns joining the Arklet water not
the outlet. On this flat there are moraines rising up in the
the alluvium. The greatest depth of the loch is 67 feet. At th
or east end, where the loch is shallow, two islets appear, one fo
solid rock and the other of moraine matter.

The soundings of the various lakes in the basin of the Tei
Callander, when viewed in connection with the geological s
and glacial phenomena of that area, furnish strong evidence in
of the theory of their excavation by ice-action. It is proba
though the lakes lie, as a rule, across the path of the great *mer*
they may have been partially eroded by that ice-sheet; at t
time there can be little doubt that their final modification m
been produced by the large valley-glaciers.

A FRAGMENT OF THE GEOGRAPHY OF ENGLAND.

SOUTH-WEST SUSSEX.*

By HUGH ROBERT MILL, D.Sc., LL.D., F.R.S.E.

Woodlands and Agriculture.—No data have been found to show that there is anything distinctive in the flora or fauna of the district under consideration which would single it out from the neighbouring parts of the south of England. White of Selbourne believed that the wheatear, a bird much sought after as a delicacy and extraordinarily abundant in eastern Sussex, was never taken west of the Arun; but this has been shown to be a mistake. The quality of the fish of the district was formerly renowned. Izaac Walton said there were four good things in Sussex—"a Selsey cockle, a Chichester lobster, an Arundel mullet, and an Amberley trout," all four coming from within the limits of these sheets. There are extensive parks containing a large number of deer. In his 'Deer Parks and Paddocks of England,' published in 1892, Mr. Whitaker enumerates the following which occur in the district under consideration: Arundel Park, 1150 acres, with 600 fallow deer and 30 red deer; Cowdray Park, with 800 acres and 350 fallow deer; Petworth Park, 675 acres and 550 deer; Parham Park, 450 acres and 250 deer; and Burton Park, with 300 acres and from 150 to 180 deer. Probably no equal area in England contains so great a number of deer.

The Agricultural Returns published by the Board of Agriculture deal with whole counties only, and the Board is pledged not to publish the statistics of any individual parish. By grouping the parishes, however, it is possible so to arrange the statistics as to distinguish the main natural divisions of soil from one another in a general way. This cannot be done completely, because one parish frequently extends over several different geological formations, and round the borders of the sheet there are portions of many parishes which have to be left out of account. The central group of parishes includes those lying wholly on the Chalk, and only invaded at one or two points by small tongues of drift in the valleys. This group is flanked to the north by a belt of parishes, each including a narrow strip of Chalk, a narrow strip of Upper Greensand, a narrow strip of Gault, and usually some of the Lower Greensands, but beyond them is a group lying wholly on the Lower Greensands. Similarly, to the south of the Chalk there is a transition belt of parishes partly on Chalk and partly on the drift-covered Tertiary strata; whilst south of these the largest division of all lies wholly on the Tertiaries and drift. Altogether 251 square miles are included in the areas grouped for agricultural statistics out of the 270 square miles of land in the sheets. The totals are given in Table V.; but for purposes of

* Read at the Royal Geographical Society, February 5, 1900. Continued from p. 227.

comparison the ratios in Table VI. will be more useful. Only t
crops and the principal kinds of live stock are considered, while
sake of comparison, the population in the several groups is adde
In the region as a whole there is rather less permanent past

FIG. 11.—THE SOUTH DOWNS FROM CHANTRY FARM, NEAR STORRINGT
(Photograph by Mr. J. Vincent Elsden.)

arable land, although the grasses grown in rotation with oth
increase the total pasturage to rather more than the area of la
grain and root crops. In 1898 nearly one quarter of the arable
under wheat, one fifth under oats, and only one-fourteenth unde

Group of Parishes.	Area of group. Acres.	Square miles.	Arable land. Acres.	Pasture. Permanent grass. Acres.	Mountain and heath pasture. Acres.	Clover, etc., as rotation. Acres.	Total pasturage. Acres.	Woods and plantations. Acres.	Grain crops. Wheat. Acres.	Barley. Acres.	Oats. Acres.	Potatoes. Acres.	Yield per acre. Wheat. Bushels.	Barley. Bushels.	Oats. Bushels.	Potatoes. Tons	Live stock. Cattle.	Sheep.	Swine.	Population.
I. Wholly on the *Chalk*	35,732	55·8	10,634	10,194	2,937	2,918	16,049	7,624	2,083	650	2,066	25	36·2	31·1	56·8	3·79	1,904	23,905	609	6,551
II. Partly on and *partly south* of the Chalk	12,975	20·3	6,857	4,901	382	1,673	6,956	1,218	1,639	352	1,220	7	39·8	38·5	64·0	4·25	1,375	17,553	717	2,603
III. Wholly *south* of the Chalk	56,444	88·2	33,099	16,339	50	7,024	23,413	1,522	8,188	2423	6,837	157	41·4	40·0	65·0	6·55	7,906	36,432	5745	34,446
IV. Partly on and *partly north* of the Chalk	33,477	52·4	9,062	13,035	2,965	1,697	17,697	4,738	1,795	778	1,590	74	35·3	32·3	53·7	3·44	3,478	14,159	1336	5,765
V. Wholly *north* of the Chalk	21,910	34·1	7,827	7,045	178	1,601	8,824	1,843	1,598	724	1,267	52	35·0	35·0	54·0	3·60	2,846	6,213	1530	6,184
Whole area ...	160,538	250·8	67,479	51,514	6,212	14,913	72,939	16,945	15,303	4927	12,980	315	39·1	37·2	61·0	5·06	17,509	98,262	9937	55,549

TABLE VI.—AGRICULTURAL STATISTICS. CALCULATED RATIOS. 1898.

Group of Parishes.	Per 100 acres of arable land. Permanent pasture, including mountain and heath.	Clover and rotation grass.	Woodland.	Wheat.	Barley.	Oats.	Per 100 acres of wheat. Permanent pasture.	Clover, etc.	Barley.	Oats.	Potatoes.	Per cent. of total area. Woodland.	Per 100 acres of total pasture. Cattle.	Sheep.	Per 100 head of cattle. Sheep.	Swine.	Per square mile. Population.	Water area. Acres.
I. Wholly on the *Chalk*	124·0	27·4	71·7	19·6	6·1	19·4	630	140	31	99	1·2	21·3	11·9	148·9	1255	32	117	27·7
II. Partly on and *partly south* of the Chalk	77·3	24·4	17·8	23·9	5·1	17·8	322	102	21	74	0·4	9·4	19·7	252·3	1279	52	128	17·1
III. Wholly *south* of the Chalk	49·5	21·2	4·6	24·7	7·3	20·6	200	86	29	83	1·9	2·7	33·8	155·6	467	74	391	144·5
IV. Partly on and *partly north* of the Chalk	176·5	18·7	52·3	19·8	8·5	17·5	891	94	43	83	4·1	14·1	19·6	80·0	407	38	110	118·9
V. Wholly *north* of the Chalk	96·1	20·4	23·5	20·4	9·6	16·2	452	100	45	80	3·3	8·4	32·3	70·4	218	54	181	105·4
Whole area ...	86·0	22·1	25·1	22·6	7·3	19·2	380	98	32	85	2·1	10·5	24·0	134·7	561	56	221	413·6

The acreage under rotation grasses and clover was almost the sam that under wheat.

The three chief classes of live stock were kept on the averag the proportion of one pig, two cattle, and ten sheep. By comparin different groups, an interesting relation will be observed betwee geological character of the land and the nature of its productions.

The rich soils of the drift and Tertiaries south of the Chalk a far the most fertile and the most farmed. They yielded in 1898 ov bushels of wheat or barley per acre, 65 bushels of oats, and 6½ to potatoes, while every hundred acres of pasturage fed 34 cattle an sheep. The country entirely underlain by the Lower Greensand i north yielded only 35 bushels of wheat or barley per acre, 54 bush oats, and 3½ tons of potatoes, and every hundred acres of its past supported 32 cattle and 70 sheep. This is, in fact, the part of the di where there are fewest sheep, although the number of cattle is less than in the south. On the Chalk the yield of crops is abou same as on the Greensands, but oats yielded nearly 57 bushel acre, and were cultivated to the same extent as wheat. The pa which was, relatively to area, twice as extensive as in the sou division, fed on every hundred acres only 12 cattle, but 149 sheep.

Summarizing the results, it may be said that in every particul farms of the southern district were best, the largest proportion of a land, the smallest proportion of woodland, the heaviest crops, an largest number of every kind of live stock to the acre of pastu On the Greensands north of the Chalk the ground was almost eq divided between arable and pasture land, agriculture was poore extent of unenclosed commons much greater, and the proportional of land under barley and potatoes greater, though the yield was p On the Chalk the pasture land far exceeded the arable land in am the number of sheep kept in proportion to cattle was three tim great as on the coastal plain, and four times as great as on the G sands to the north; while the proportional area under wheat, b and potatoes was the smallest, and that under oats the largest.

Generalizing more broadly still, the coastal plain in the south be said to be mainly agricultural and grazing country, the Chalk D almost wholly pastoral, and the Greensand valley in the north m devoted to grazing. The cause of these differences is to be found i soil, both as regards its composition and its behaviour towards the water which falls on it.

The areas of woodland were calculated in two ways. By d measurement the woods marked on the map (1895 edition) cover square miles, while from the Agricultural Returns for 1898 they a only to 26·5 square miles. The latter figure only accounts fo square miles of the land, the former for 270. Deducting 2·6 s miles which lie, according to measurement, on the 19 square mile

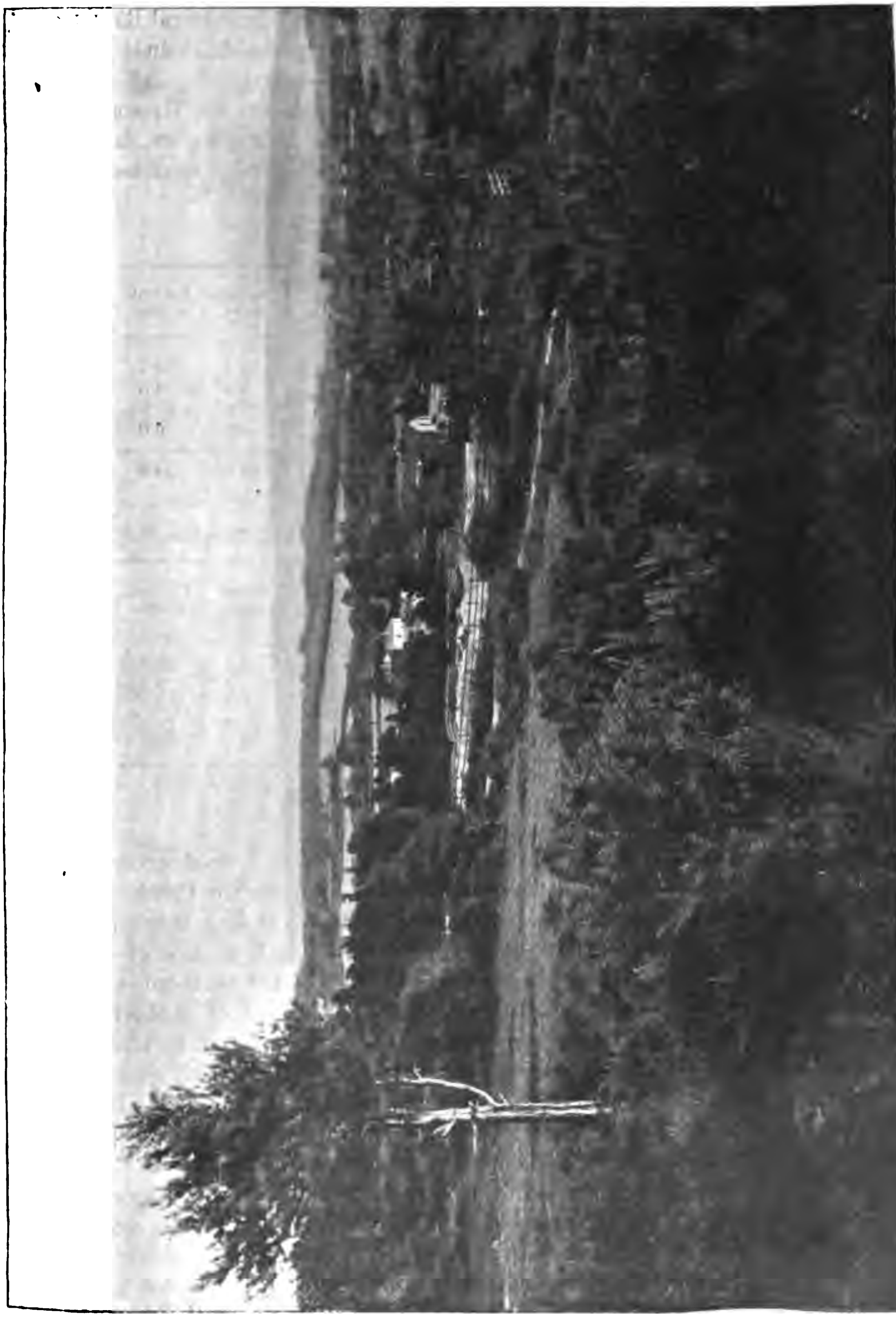

FIG. 12.—THE ROTHER VALLEY AND SOUTH DOWNS, FROM MIDHURST.
(*Photograph by F. Frith & Co., Reigate.*)

out of account in the Agricultural Returns, the measured w cover 35·4 square miles on the area included in the Agricultura —a fair agreement, as the Agricultural Returns probably incl woodlands as pastures, and do not take account of parks.

Pine woods cover only about one square mile on the Gr north of the Chalk. All the rest of the wood is deciduous beech, and is distributed on the various geological forms follows :—

TABLE VII.—WOODLANDS IN 1895 FROM MAP.

270 square miles considered.	Square miles.	Per of a
On the Chalk	23·5	2
On the Tertiaries and drift	3·9	
On the Lower Greensands	10·6	2
On Alluvium	0·0	
Total	38·0	1

TABLE VIII.—WOODLANDS IN 1898. AGRICULTURAL RETURNS.

251 square miles considered.	Square miles.	Per of a
In parishes wholly on Chalk	12·0	2
" partly on and partly south of Chalk ...	1·9	
" on Tertiaries south of Chalk	2·4	
" partly on and partly north of Chalk ...	7·4	1
" on Lower Greensands north of Chalk ...	2·9	
Total	26·6	1

The summit line of the Downs is usually bare of wood, e wind-swept bushes, and so are most of the valleys in the Ch rounded summits which rise in the centre of the Downs bet dry valleys are characteristically crowned with small clumps A broken line of plantation runs along the face of the norther ment — the "Hanger" of White's 'Natural History of Se but the real forest is found on the long southern slopes. The nowhere large, but often very close. The little wood which the Tertiaries is close up to the northern border near the Chal the altitude of 50 feet above the sea it is rare to see a tree the hedgerows and about the houses: few parts of England are cultivated as the coastal plain of West Sussex. There are, some remarkable vestiges of old woods, including a venerabl South Bersted churchyard said to be 800 years old.

North of the Chalk escarpment there are no woods on t Greensand, and scarcely any on the Gault. The plantation

Lower Greensands as a rule are small and scattered; oaks abound, and the trees are fine.

Parishes.—The combined sheets 317 and 332 include 83 *complete civil parishes* (Chichester being united into one), and portions of 26 other

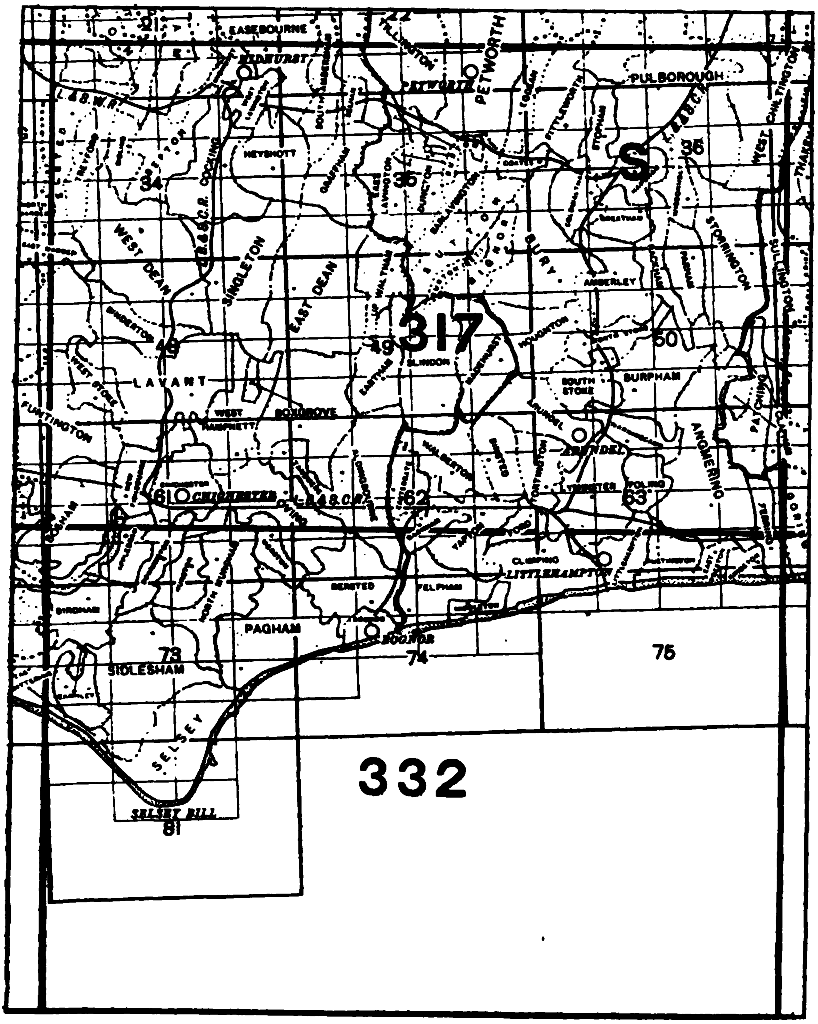

FIG. 13.—INDEX MAP OF SHEETS 317 AND 332, SHOWING SHEETS OF 6-INCH AND 25-INCH MAPS AND THE BOUNDARIES OF PARISHES.

parishes (Fig. 13). These correspond closely with the ancient or ecclesiastical parishes, but it would appear that the parishes used as units for the Census returns are not quite coterminous with those on which the Agricultural returns are based. It would take too much space to go into the difficult question of changes of parish boundaries, and follows the parishes referred to are those laid down on the 18 of the one-inch map. Most of the parishes are now entire, but a detached portions lying considerable distances apart. The b of the parishes have remained substantially unchanged, in spit alterations, from a very early period, and normally each paris a single village grouped round the parish church. The parish to have grown naturally until they filled up the county; it said that the county has been *divided* into parishes, as the r the boundaries to natural features shows. The parishes ar into thirteen larger divisions—*hundreds*—and these in turn f of larger divisions peculiar to Sussex, and called *rapes*. T run from south to north, and are approximately equal in are represented on the sheet are the Rapes of Chichester, Aru Bramber. The Rape of Chichester includes seven hundre respectively Aldwick, Bosham, Box and Stockbridge, Dumpf bourne, Manhood, and Westbourne and Singleton. The Rape o includes five hundreds, viz. Avisford, Bury, Poling, Rotherbr West Easwrith, and all of these are represented on the shee the twelve hundreds which compose the Rape of Bramber, parts of only three, Brightford, East Easwrith, and Patchi divisions are not marked upon the Ordnance Survey maps. important, but also unmarked, grouping of parishes into re districts and subdistricts is used for statistical purposes.

On the coastal plain the parishes have remarkably irregul aries as marked on the map. For a considerable part they are by rivers or streams, hence the borders are winding. In th South Bersted and Felpham the parish boundary leaves the two points, describes a curve, and returns to the stream. These perpetuate former river windings which have been deserte water since the boundaries were fixed. East of the Arun th and western parish boundaries are, as a rule, nearly straight lin at right angles to the coast. In the flat gorge of the Arun cuts through the Downs, the curious alternate allocation of t flats to parishes on the east and west is the result of using as a a river which in its windings runs close against the steep the valley alternately on the right and left (Fig. 14). This m one of the reasons that prevented a north and south road from through the Arun valley; it would have had to pass throu parishes in 5½ miles, and there are signs in many of the pa these sheets that the roads were originally constructed for the of the parish alone, and seem reluctant to cross from one to In the south of the Chalk area the parish boundaries frequ down the crest-lines of ridges, leaving a whole valley or valleys to form the parish. Occasionally, however, the boun

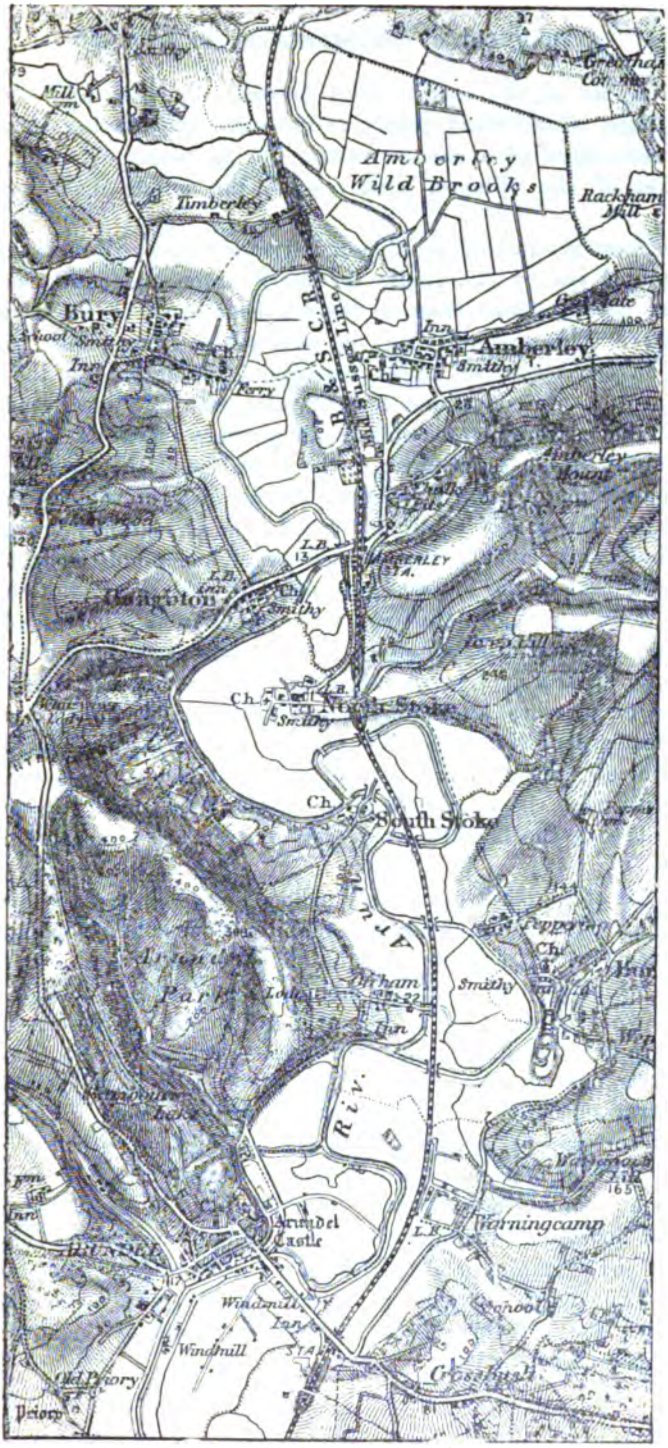

FIG. 14.—THE ARUN GORGE, SLIGHTLY ENLARGED FROM THE ORDNANCE SURVEY 1-INCH HILL-SHADED MAP.

valley-line, as in the case of that between Patching and C
two villages which stand nearly at the same level, facing ea
on opposite sides of a narrow valley, up the centre of whic
the level of the villages, runs one of the minor roads
Downs.

The most interesting relation of parishes to geological str
that pointed out by Mr. Topley for the Wealden area as a w
nowhere better shown than on the northern slope of the I
Sheet 317. The central village of each parish from Elsted
stands on the terrace of Upper Greensand at the base of tl
escarpment, a site convenient for obtaining water by means
As the villages were planted closely, the parishes are all narrow
run straight up the escarpment to the crest-line of the Down
to each a portion of pasture ground; but they also run each as
strip across the belt of Gault and the Lower Greensands dov
valley-line of the river, giving to each parish a share of the ar
grazing lands. In the Bignor embayment, the parishes radiate
ribs of a fan, gradually shifting their length from a north-s
to an east-and-west direction, so as to cross the strike of the
right angles (see Fig. 13). North of the Rother the sheet on
portions of parishes alternately broad and narrow, but al
their greatest length from north to south. Indeed, in the whol
under review, the predominance of north-and-south lines
boundaries, and the relatively great length from north to
compared with the breadth from east to west, are noticeabl
teristics.

The list of parishes completely included in the sheets is
Table IX., with the number of inhabited houses and popu
the census of 1891, and the population at the census of 18
parishes which are only partially included are given in Table

The whole district is in the ancient county of Sussex
formerly a detached area in the north-west—the parish of Sout
sham—was part of Hampshire. The whole now forms pa
administrative county of West Sussex and of the diocese of Ch
while it corresponds closely in area and population with th
mentary division of Chichester or South-west Sussex.

Of the complete parishes, the least populous is Middleto
inhabited houses and 40 inhabitants; it is situated on the coast
Felpham and Climping, and has lost much of its original area
erosion. The most populous was South Bersted, with 995 i
houses and 4953 inhabitants; it included the town of Bogno
now forms a parish by itself.

TABLE IX.—PARISHES WITH POPULATION.

	Inhabited houses. 1891.	Population. 1891.	1881.
Midhurst District—			
Elsted	40	191	208
Treyford	23	114	147
Didling	14	61	85
Bepton	49	263	269
Cocking	90	449	574
Heyshott ...	91	393	448
Graffham ...	84	407	413
East Lavington ...	36	191	221
Selham	8	48	49
West Lavington ...	47	218	151
Midhurst ...	334	1674	1615
Petworth District—			
Egdean	17	75	76
Fittleworth ...	159	761	696
Stopham	32	151	156
Coates	15	84	61
Bury	114	531	517
Bignor	25	127	154
Burton	11	57	73
Sutton	63	325	310
Barlavington ...	32	175	182
Duncton	55	259	268
Thakeham District—			
Coldwaltham ...	83	338	389
Greatham ...	12	66	59
Hardham ...	23	124	101
Wiggonholt ...	7	52	38
Amberley ...	114	525	570
North Stoke ...	21	100	103
Rackham ...	29	134	161
Parham	12	58	88
Storrington ...	246	1293	1351
East Preston District—			
Houghton ...	38	174	196
South Stoke ...	24	131	133
Arundel	550	2644	2748
Tortington ...	58	288	165
Ford	20	102	100
Climping ...	54	251	270
Burpham ...	52	280	286
Warningcamp ...	34	159	128
Lyminster ...	357	1693	1587
Poling	43	178	180
Angmering ...	210	1014	982
Patching ...	55	270	274
Ferring	54	226	232
Kingston ...	12	43	34
E. Preston District (*cont.*)—			
East Preston ...	57	414	420
Rustington ...	91	434	360
Littlehampton ...	851	4452	3926
Westbourne District—			
West Dean ...	120	611	734
New Fishbourne	79	323	316
Chichester District (complete)—			
Chichester (10 parishes) ...	1553	7887	8529
West Hampnett District (complete)—			
West Stoke ...	20	103	95
Lavant	157	787	805
Binderton ...	21	110	100
Singleton ...	121	579	555
East Dean ...	73	303	343
Up Waltham ...	16	67	82
Slindon	113	539	507
Madehurst ...	31	176	190
Binsted	20	103	135
Walberton ...	126	628	607
Eastergate ...	34	174	161
Aldingbourne ...	171	798	743
Tangmere ...	45	164	185
Boxgrove ...	162	699	708
Eartham ...	27	138	154
Oving	443	1973	1662
West Hampnett	79	505	521
Rumboldswyke ...	358	1497	902
Hunston	43	187	176
Appledram ...	31	144	159
Birdham ...	95	458	455
Earnley	26	140	132
Sidlesham ...	199	920	946
Selsey	228	1039	901
Donnington ...	36	191	188
North Mundham	86	373	401
Pagham	197	887	874
Merston	24	108	96
South Bersted ...	995	4953	4166
Barnham ...	46	230	184
Felpham ...	167	724	565
Middleton ...	7	40	44
Yapton	139	660	556
Total	10,531	51,183	49,429

TABLE X.—PARISHES PARTS OF WHICH ARE INCLUDED IN SHEETS 317 AND 33
ASSUMED POPULATIONS.

	Inhabited houses (estimated). 1891.	Population (assumed). 1891.	1881.
Midhurst District—			
Terwick	2	10	10
Trotton	46	230	206
Iping	21	105	105
Stedham	50	250	242
Woolbeding ...	12	60	60
Easebourne ...	40	240	170
South Ambersham	30	160	106
Lodsworth ...	12	60	64
Tillington ...	105	525	534
Petworth District—			
Petworth ...	520	2600	2670
Wisborough Green	19	95	96
West Hampnett District—			
East Wittering ...	16	80	86
West Wittering ...	6	30	33

	Inhabited houses (estimated). 1891.	(1891
Thakeham District—		
Pulborough ...	286	143
West Chiltington	100	50
Sullington ...	26	13
Thakeham ...	25	12
East Preston District—		
Clapham	28	14
Goring	8	4
Westbourne District—		
Bosham	80	40
Funtington ...	70	35
Stoughton ...	2	1
East Marden ...	5	2
Total for portions	1509	759

There are also very small parts of the following parishes, b
no population: Finden, North Marden, Harting, Rogate, and Chi

Place-Names.—The names on the sheets under notice are ty
and almost exclusively Anglo-Saxon. The two commonest termi
are *-ton*, which occurs in forty-seven cases, and *-ham*, which o
fifty. Both these suffixes signify an enclosure or dwelling-pl
other terminations of nearly identical meaning, such as *-worth* and
or *-bury*, are not uncommon. The termination which comes thir
list is *-ing*, of which there are twenty-four examples. This is the
Saxon equivalent to the Keltic *Mac* or *O'*, and indicates the set
of a family or clan, equivalent nearly to the possessive case so
in the farm-names of the district at the present day. Persona
for places prevail; terminations descriptive of natural featu
much less common. There are fourteen *-dens* or *-deans*, eleven
and a few *-holts;* referring to the woods, ten *-wicks* or *-wyke*
-fords and five *-bournes*, referring to the waters. The names
the early and complete settlement of the district by the Sax
old Roman names, which must have been numerous at one time,
earlier Keltic names having almost entirely disappeared.

Distribution of Population.—The sheets under consideratio
sent an area of 270 square miles of land, and the population
census of 1891 is estimated as follows:—

	1891.	1881.	I
83 complete parishes (counting Chichester as *one*)	51,183	49,429	+
Portions of 23 parishes (estimated)	7595	7606	—
Total probable population on sheets ...	58,778	57,035	+

This gives an average density of population of 218 per square mile in 1891, and 211 in 1881. But if the uninhabited part of the country is defined as any part more than an eighth of a square mile in area, the border of which lies more than a quarter of a mile distant from the nearest dwelling, there are 34 square miles of uninhabited country in the sheets, leaving 236 square miles of inhabited country, the average density of population upon which, in 1891, was 249 per square mile, that of all England being nearly 500.

TABLE XI.—DISTRIBUTION OF POPULATION IN 1891 BY ELEVATION.

Zone. Feet.	Area. Sq. miles.	Population. Total.	Density of Population per sq. mile.	No. of towns.	Villages.
Over 600	6·0	6	1	—	—
600–500	9·5	20	2	—	—
500–400	15·5	175	12	—	1*
400–300	20·0	518	26	—	2†
300–200	9·0	3,067	341	—	16
200–100	66·0	10,959	166	1	23
100–50	43·0	7,455	173	1	21
Below 50	101·0	36,634	361	4	77
Total ...	270·0	58,834	218	6	140

According to altitude, the population is distributed as shown in Table XI. This shows that the upper part of the Downs above 500 feet are practically uninhabited, and that only one very small village, or rather hamlet, Madehurst, stands at an elevation exceeding 400 feet, and only three villages above 300 feet.

It is remarkable to observe how the density of population suddenly increases from 26 per square mile for the zone between 400 and 300 feet to 341 per square mile for the narrow belt between 300 and 200 feet. The reason of this is found partly in the configuration and partly in the geology. On the southern slope of the Downs there are only two villages, Eartham and Slindon, within this zone. Three of the important villages of the central valley (West Dean, Charlton, and East Dean) help to swell the population, together with the scattered farms which the coating of drift makes possible between the bordering hills of Chalk. But the distinguishing feature is the terrace of Upper Greensand at the base of the great Chalk escarpment. The western half of this terrace occupies the zone of height between 300 and 200 feet almost exactly; farther east, where the Greensand has been worn down lower, the villages it carries stand below 200 feet. The zone includes part of Elsted, the whole of Treyford, Didling, Bepton, Cocking, part of Heyshott,

* Madehurst. † Up Waltham and Elsted.

Graffham, Barlavington and Sutton. They are all agricultural v without industry, and, as indicated when speaking of the pari which they are the centres, they are placed on the water-bearing and arable soils between the pastures of the Downs and the lands of the Gault and Lower Greensand valley.

The next zone, from 200 to 100 feet, contains one or two Upper Greensand villages, especially Bignor and West Burton; on the northern side of the Rother valley, including Petworth, worth, Stedham, and Trotton; and a good many on the southe of the Downs, viz. West Stoke, the three Lavants, Waterbeach, Ha Patching, and Clapham. The main development of this zone of is in the valley north of the Downs, on the Gault and the infert of the Folkestone Beds of the Lower Greensand, where farms are scattered, and from which the villages have been attracted eithe Upper Greensand terrace, or to the left bank of the river.

The zone of elevation between 100 and 50 feet contains Midhurst and Pulborough on the north, and a few villages n high-road between Chichester and Arundel on the south; bu practically the same density of population as the zone above.

Below 50 feet the density of population comes to a maximum because it contains the largest towns—Chichester, Littlehampton, and most of Arundel—but partly also because of the great fer the coastal plain, the absence of woodland or commons, and t number of small farms into which it is divided. The Arun val has a double chain of villages, one, as a rule, encircled by each the river, and each built upon a fragment of an old river-ter higher and remaining dryer than the swampy meadows throug the stream meanders (compare Figs. 7 and 14).

The uninhabited areas include three small patches of ve lying alluvium (compare Figs. 7 and 9). One stretches f reclaimed ground of Pagham harbour round the north of th ridge on which Selsey stands, and this recently reclaimed tida is crossed by only one high-road. Another of smaller area lie depression—much of which is below high-water level—betw disused Chichester and Arundel canal and Bognor, and is cr no road at all, although the Bognor branch-line runs thr western margin. The third uninhabited alluvial tract lies Wiggonholt and Pulborough, on the great expansion of th valley bottom, which is subject to floods every winter.

The main body of uninhabited land is formed by the Dow which it is possible to walk from one end of the sheet to the ot even to cross the Arun valley, without passing within a qua mile of an inhabited house. Thus the population may be sa separated by the uninhabited Chalk Downs into a densely i plain on the south, and a much less densely peopled valley on th

In attempting to get actual statistics for these regions, the groups of parishes employed for the discussion of agricultural statistics yield the following result:—

TABLE XII.—POPULATION GROUPED IN AREAS.

Group of parishes.	Area of group. Sq. miles.	Total population. 1891.	Density of population per sq. mile.
Wholly on the Chalk	55·8	6,551	117
Partly on and *partly south* of Chalk	20·3	2,603	128
Wholly south of the Chalk	88·2	34,446	391
Partly on and *partly north* of Chalk	52·4	5,765	110
Wholly north of the Chalk	34·1	6,184	181
Total	250·8	55,549	221

In this grouping, the parishes "wholly on the Chalk" include the tongues of Tertiaries and drift that run up into the valleys from the south, and the alluvium of the Arun gorge where it crosses the Downs, and it is on these, and especially in the town of Arundel, that the population is found. The interesting contrast is between the fertile coastal plain, which supports a population of nearly 400 per square mile, the Chalk, which, if Arundel be excluded, has a population under 10 per square mile, and the less fertile valley of the Rother, where the population is under 200 per square mile.

Vital Statistics and Movement of Population.—The population increased by 1743 inhabitants, or 3 per cent., in the ten years between 1881 and 1891; the rate of increase for the whole county of Sussex in the same period was 12 per cent. Hence it would appear that, taken as a whole, this district is nearly stationary as regards population. The difference between births and deaths (on the basis of the year 1897) would produce an increase of 0·8 per cent. per annum, and as the average increase was only 0·3 per cent. per annum, the emigration from the area in question must amount to about 0·5 per cent., or say 300 persons every year. A definite decrease in population is found in most of the parishes in the Rother valley and on the Downs, the increase being mainly confined to the parishes on the coastal plain (Fig. 15). The greatest increase is found in the parishes of Littlehampton and South Bersted (which included Bognor at the time of the census), and also in Rumboldswyke and Oving, which contain suburbs of Chichester lying outside the municipal boundaries. The actual population of both Chichester and Arundel showed a decrease of about 4 per cent.

The Registrar-General's Report gives for each year the number of births, deaths, and marriages arranged for each county according to registration districts and subdistricts, but the parishes are grouped to form these in such a way that it is very difficult to bring the

statistics into relation with the natural divisions. Table XII
the statistics for 1897 relating to the subdistricts, which most
fill up the region under consideration, and represents a total of
inhabitants living on 221 square miles, *i.e.* with a mean density

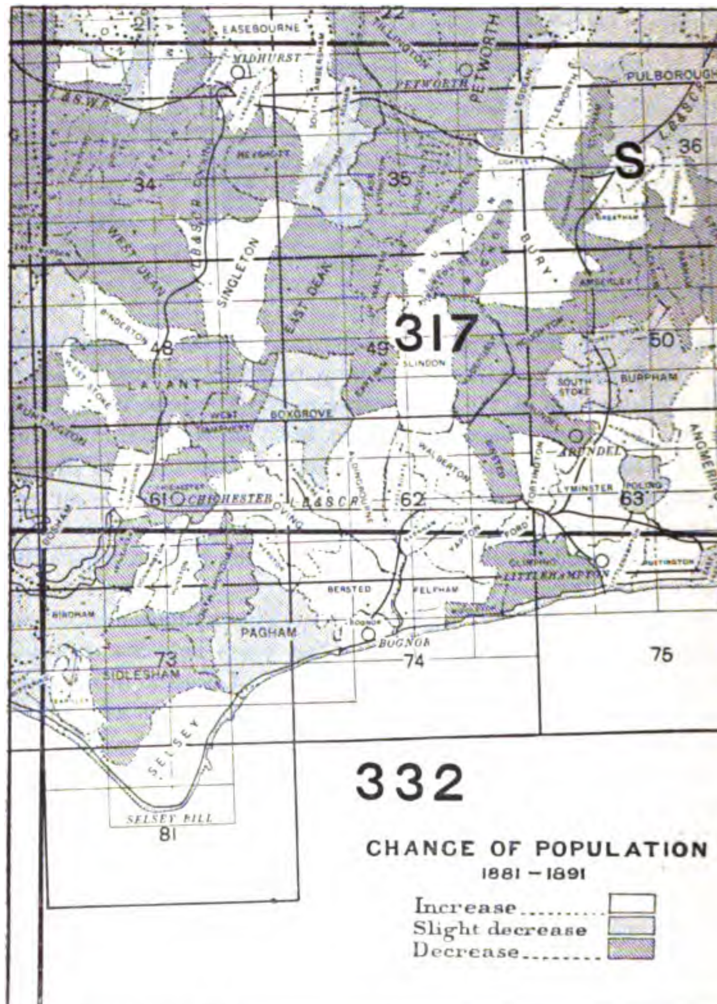

FIG. 15.—MAP SHOWING INCREASE OR DECREASE OF POPULATION BETWE
1881 AND 1891.

Table XIV. shows the same figures calculated as ratios of the po
in 1891. These ratios are, of course, not quite accurate fo
although in most cases the divergence from accuracy is probabl
as the changes in the population are slight except in the growin
on the coast.

TABLE XIII.—POPULATION STATISTICS FROM REGISTRAR-GENERAL'S REPORT FOR 1897.

Registration District.	Registration Subdistrict.	Area, acres.	Square miles.	Popn. 1891.	Births. Total.	Births. Illeg. No.	Deaths. Total.	Marriages.
Petworth ...	Petworth, South	20,456	32	5,412	110	5	54	31*
East Preston	Littlehampton	8,927	14	7,899	240	18	163	53*
" ...	Arundel	16,007	25	4,628	138	1	70	31*
Westhampnett	Oving			5,434	122	5	75	
" ...	Bognor	40,501	63	4,953	123	6	78	
" ...	Yapton			4,064	87	1	60	145
" ...	Boxgrove	17,641	27	2,304	43	5	58†	
" ...	Singleton	12,618	20	1,949	41	2	27	
Chichester ..	—	1,888	3	10,815	297	15	221	83
Midhurst ...	Midhurst	23,810	37	6,835	161	10	99	32*
Total ...	—	141,848	221	54,298	1362	68	905	375

TABLE XIV.—POPULATION RATIOS, 1897.

Registration Subdistrict.	Density of population 1891, per sq. mile.	Per 1000 of population in 1891. Births.	Per 1000 of population in 1891. Deaths.	Per 1000 of population in 1891. Marriages.	Excess of Births over Deaths. Number.	Excess of Births over Deaths. Per 1000 population in 1891.	Excess of Births over Deaths. Per cent. of total births.	Illegit. Per cent. of total births.
Petworth, South	169	20	10	6	56	10·3	51	4·5
Littlehampton	564	30	21	6	77	9·7	32	7·5
Arundel ...	185	30	15	7	68	14·7	49	0·7
Oving		22	14		47	8·6	38	4·1
Bognor... ...	229	25	16		45	8·3	36	4·8
Yapton ...		21	14	8	27	6·6	31	1·2
Boxgrove ...	85	19	25		−15	−6·5	−35	11·6
Singleton ...	97	21	14		14	7·1	34	4·9
Chichester ...	3605	27	20	8	76	7·0	25	5·0
Midhurst ...	131	23	14	5	62	9·0	39	6·2
Average ...	245	25	17	7	457	8·0	33	5·0

The relatively high birth rates and death rates of the subdistricts Littlehampton, Arundel, Chichester, and Bognor are possibly due to increase of population since 1891, and the low rates in the other districts may similarly be to some extent due to the drift of population from the country. The remarkable excess of births over deaths in Arundel and Petworth (practically 50 per cent.), and the low excess in Chichester (only 25 per cent.), have possibly some cause connected with the conditions of hygiene in the towns of the districts. The excess of deaths over births in Boxgrove is probably an accident of the year, the small population of that subdistrict depriving it of any statistical value.

* The marriages being only given for registration districts, those of the subdistricts are estimated on the assumption that the rate was the same for the whole district.

† Of these forty were of males and eighteen females. In no other division did the proportion of the two sexes dying differ sensibly from equality.

Perhaps the most remarkable regional distribution shown b
tables is in connection with the proportion of illegitimate to total
The average for the whole area is 5 per cent. (that of the co
Sussex 5·3 for 1897, and 5·4 as an average of ten years), and on
subdistricts vary significantly from this proportion. Of thes
grove, with 11·6 per cent., may be disregarded on account
small population. But Littlehampton, with 7·5, stands in mark
trast to the adjoining districts of Arundel and Yapton with 0·7
respectively. It is unfortunate that no statistics of religiou
exist, but it is known that a very large proportion of the inh
of Arundel are Roman Catholics.

Towns and Villages.—The city of Chichester is built on th
plain, near the head of the riverless inlet known as Chichester C

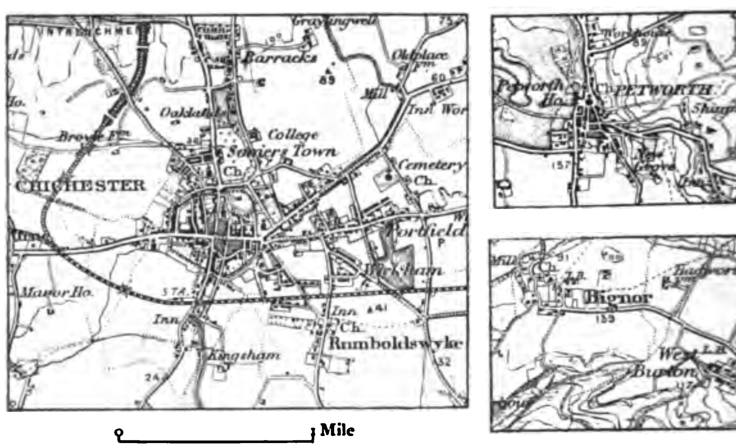

FIG. 16.—PLANS OF TOWNS AND VILLAGES FROM THE 1-INCH ORDNANCE SURV

which formerly furnished a harbour for small vessels, but Chi
can now scarcely be viewed as a maritime town. Its position du
of the opening of the Lavant valley can hardly be due to the road r
through it to the north, because the Romans built the road fro
station at Chichester (Regnum) in a straight line to the north-ea
the Downs. The original plan of the city is outlined by a nor
south road crossed at right angles by an east-and-west road, a
rounded by a circular wall, beyond which the roads diverged.
building has carried the streets beyond the old wall, but the o
plan remains (Fig. 16). As a cathedral city (since the time when
cathedral was abandoned in 1078), Chichester has a certain am
general business, but there are no manufactures. The city is s
with water derived from wells sunk in the Chalk at Old Fishb
and pumped up to a reservoir just north of the town, whence the
is distributed by gravitation.

It is curious to note that, except for Old and New Fishbourne, which are now practically suburbs of Chichester, the high-road along the coastal plain does not run through a single village.

Arundel probably owes its existence as a town to the fine site it afforded for a castle in ancient times by commanding the break in the Downs at a point where the navigable tidal river ran close against the Chalk hillside. Here the river was first bridged, the village named Ford, halfway to the sea, marking what may have been the only other crossing-place on the coastal plain. Even now no roads cross the Arun below Arundel, whence one road runs on the right bank to Ford, Climping, and Atherington, and another, at least a mile east of the river, to Lyminster, Wick, and Littlehampton.

Littlehampton, at the mouth of the Arun, is the one actual seaport in the district under consideration, but it is only accessible at high water, vessels taking the ground as the tide falls. The river was formerly of importance for steamer trade with France, but since 1880 the volume of shipping entering the port has been reduced to less than one-half. Although over 400 vessels entered and cleared in 1894, their average burden was under 90 tons, and no vessel of over 500 tons can enter. The town is supplied with water from deep wells sunk in the plain to the north. The present importance of Littlehampton arises less from its shipping than from its beach (Fig. 5), which makes the town attractive as a bathing-place and summer residence. The track of sand-dunes west of the river has given rise to golf-links, which increase the attractions to visitors.

Bognor has also become a town by taking advantage of its fine beach to attract summer visitors. The beach is protected by a promenade and sea-walls for over a mile. Connected already by a good and direct road with Chichester, its development had well begun before the branch railway brought it into rapid communication with the outside. The water-supply is derived from wells sunk in the Chalk at Eastergate, 5 miles to the north.

Many other points along the coast might, but for the difficulty of access due to the indirect roads, have formed the sites of similar watering-places. Pagham, originally a fishing village with a large tidal harbour, has dwindled in importance, and the site of the harbour has been reclaimed. Selsey is built on a ridge of marine gravel, which rises above the general level, and is separated from the mainland on the north by a broad stretch of low alluvial ground, once a tidal lagoon connected with the sea on both sides, hence the name of the parish, Selsey, or Seal-island. The village is still of some importance for fishing, a number of boats being employed in catching lobsters. Selsey enjoys a unique position on the south coast of England for exposure to sea-air. From every point of the compass round three-quarters of the horizon the wind blows from the sea, only between

N.E. by N. and N.W. by W. does it come over the land. Hence, as t is a good and direct road from Chichester, Selsey was growin rapidly in importance that the Hundred of Manhood and Selsey s tramway was constructed from Chichester to Selsey beach in 1897.

While there are no villages on the east-and-west high-road bet Chichester and Arundel, or on the railway line, it is interestin notice that the disused Chichester and Arundel Canal runs throu chain of villages—Donnington, North Mundham, Merston, Colw Lidsey, Barnham, and Ford, each being situated at the point wh north-and-south road crosses the canal.

The general plan of all the villages in the district is a clust houses about the meeting place of local roads; they are as a rule pact groups, not straggling along the highway as villages which grown round inns or halting-places on through roads usually do. most cases the roads which meet do not run through the village join a rectangle or ellipse of roads, this being typically show Bignor and West Burton (Fig. 16). The advantage of a site o Upper Greensand terrace is sufficient to explain the garland of vil which surrounds the northern face of the escarpment of the D In the Arun valley the want of a through road except by water en the long isolation of the villages built on the fragments of old terraces between the steep chalk hills on one side and the sw bottom-lands on the other (Fig. 14). But in the Lavant valley, th of communication afforded by the road between Chichester and Mid is undoubtedly the cause which gave importance, if not existen Cocking and Singleton. The former naturally arose on the Gree terrace at the foot of the steep ascent to the pass in the Downs, men and horses would naturally rest before tackling the most ar part of the journey. Singleton would naturally form a halfway both for traffic on the main road and on the less-frequented branch by Up Waltham. The traffic on these roads no doubt owed mu the establishment of a racecourse by the owner of Goodwood Park.

Pulborough has also a position rendered important as a cros place of roads. The ancient Stane Street crossed the Lower Greer escarpment, as it crossed that of the Chalk, ignoring the Gree gorge of the Arun, which remains without either a road or railw this day. Where Stane Street was crossed by the road along the nor bank of the Rother, that road had to keep close to the side of the and-west ridge which looked out over the widened portion of the valley bottom which is subject to floods, and here Pulborough the position being given a fixed value in railway days by the jun between the main line and the Midhurst branch.

Petworth (Fig. 16) and Midhurst are both formed by a cluster of h grouped round two main roads converging from the south so as to one passing northward, and they have thus a roughly triangular

Probably both towns owed their importance to the castles surrounded by great parks, which must have served as a nucleus for settlements afterwards made prosperous as market-places for the surrounding agricultural district. Midhurst may also have derived some advantage in pre-railway days from being the head of barge-navigation on the Rother, the trade on that river having been sufficient to lead to its canalization.

Industries.—Agriculture, and the rearing of live-stock, especially sheep and cattle, are almost the only occupations of the district. The various towns have all markets weekly or twice weekly, and next to farming most people are employed in local trade, the supply of agricultural requirements, and such necessaries as are not worth bringing from London to the various country seats whose parks occupy a considerable area on the Downs and in the northern valley. Mineral resources are worked for local purposes. Iron in the Folkestone Beds, formerly a source of prosperity, has not been worked for a hundred years. Chalk-pits gleam amongst the green turf of the escarpment of the Downs and on the walls of the Arun gorge (Fig. 10); phosphatic and siliceous deposits are dug in the Upper Greensand for use as fertilizers. The Lower Greensands supply stone adapted for road metal and for building purposes. Flints are collected from the chalk-pits and from beneath the turf on the Downs and utilized for road-metal and for building purposes, along with bricks made from the brick-earths of the coastal plain at Rustington and elsewhere. The flints when first dug are too brittle for use, but after a few years' exposure to the weather become tough and durable. Large heaps of flints spread out to weather are to be seen on the Downs. Many of the buildings on the plain are constructed of brick and flint, the brick forming a sort of framework which is filled up with flints set in cement, while in the Rother valley timber and brick houses prevail. The common roofs are thatch, and very often the slope of the roof is carried down nearly to the ground on the windward side, as a protection against rain.

Windmills are common on the coastal plain, and it seems reasonable to expect that the exposed crests of the Downs might be utilized for the erection of wind-engines of modern type, which might at reasonable expense provide electric light for Chichester, Arundel, and many other villages, and thus make up for the absence of water-power and of coal.

Fishing is only pursued on a small scale, the catch of lobsters being the most important.

Probably a leading source of employment is now the catering for summer visitors in the watering-places of the coast, and during the annual race-meeting at Goodwood. Several almshouses and convalescent homes, supported by metropolitan charities, are situated near the sea-coast.

Before the reading of the paper Sir CHARLES WILSON, Vice-Presid
Some seventy years ago, when the 6-inch Ordnance Survey of Ireland co
a very elaborate scheme of parish memoirs was devised, I think on the
of Sir Thomas Larcom, for the whole survey. A great deal of inform
collected throughout the whole of Ireland, but unfortunately, after the
one parish had been published, the Treasury got frightened at the expens
whole scheme was abandoned. However, in the mean time a great deal o
information had been obtained, nearly every object of archæological i
Ireland had been carefully drawn and planned, and the data then collect
officers of the survey now form not the least of the valuable collectio
Royal Irish Academy. A few years ago, on the completion of the surv
suggested that memoirs should be published for each sheet of the Ordnan
map, partly on the lines of the memoirs of the Irish survey. A comm
appointed by this Society, and Dr. Mill kindly undertook to prepare a
memoir. It is this memoir, which I am sure will be most interesting, th
to listen to to-night.

After the reading of the paper, the following discussion took place:—

Colonel JOHNSTON (Director-General of the Ordnance Survey): I ha
but few remarks to offer on the excellent paper you have heard from
He has managed to give you a most interesting account of the geogr
geology, and the various other facts connected with this part of Englan
as the work of the Ordnance Survey is concerned, he has been good enoug
in flattering terms, and I can only say the Survey is anxious to do the b
in the way of mapping out the country generally, and if we could only get
amount of interest shown in the survey in the way Dr. Mill has indicated
the maps would be very much more useful than at present. The great
as far as one can judge, is that in the country generally there is a
amount of ignorance as to what the Survey does and what it ought t
this can be remedied in no better way than by the reading of such exc
interesting papers as Dr. Mill has prepared, which I feel certain will do
increase interest in the survey.

Prof. LAPWORTH: Dr. Mill has spoken so clearly and so eloquentl
subject, that he has left me very little to say; but I understood that I
to hear a geographical paper read; on the contrary, I have listened t
should call an exceedingly interesting geological lecture. I don't com
I have asserted again and again in public and private that geology and
are one. Dr. Mill shows us distinctly that it is impossible to fully unde
configuration of the country, its scenery and the distribution of its p
its history, or indeed many of its characteristics, unless you have first g
of the geology. Once you get that, everything falls into its place, and al
clear. As Dr. Mill is present, I may tell you a secret. I have read
paper this evening with the greatest pleasure, but not a word of the
introduction is in the paper. Now, the plan, which has been sketched o
committee, purports, I take it, to be a geographical description of th
survey maps of England for the benefit of the inhabitants of the dis
the survey map illustrates. I take it that the committee propose
first paper, which will be published soon, I hope, in the Geographical
Journal, is the model upon which the others will be framed. Dr. Mill
to the occasion, and has shown us what kind of guide we want. His le
alive with interest and enthusiasm, and it taught us the reason why of
graphy and statistics of the country. His paper bristles undoubtedly
and statistics, but I must confess that I should like to see that paper c

with an introduction like that which Dr. Mill gave us to-night, and I would urge that every guide should commence with such an introduction. The Geological Survey of North America has been issuing lately a series of areal maps giving the geography and geology of certain districts. At the commencement is a description of each, giving a summary of those geological principles which enable the reader to understand the map. I would urge the committee to do this in the case of the publication of every one of their guides. It may be said that many will repeat themselves; this is not so. The illustrations brought forward by Dr. Mill were peculiar to the district he was describing; there are, of course, geological principles that affect all the world equally, but they are illustrated in every case by the geographical area under description, and they do not apply in quite the same way to any other geographical area in their entirety. Perhaps, if you will allow me, I may give an example. In my own district of Birmingham, we, as in Sussex, have three distinct geological formations. We have our coal measures, our red sandstone, and our marl, answering to the three in Dr. Mill's paper; but how differently do they behave, how differently do they affect the history and characteristics of the people! Our lowest formation forms the great coalfield of Staffordshire, then follow the pebbly beds and waterstones, and answering to your plain is the plain of central Warwickshire, a plain of marls. All three are intimately bound up with the whole history of the midlands. The old forest of Arden, the plain of marls, in the ancient times was sparsely inhabited, overrun by deer, the district had very few villages, but at the edge of it the waterstones were everywhere rich in springs, exactly as in the sandstones of Sussex, and they were the sites of the ancient villages and the old castles. At the present day the chief towns of the midlands are built upon them. Curiously enough, this marly plain had a very great influence upon our literature. It was in that quiet wooded plain that Shakespeare lived and wrote. It was the district of George Eliot. I might go on to show you how to the existence of the great coal-measure sheet the pushing and forward movement of the midlands at the present day is due. But to come back to the point of departure, it appears to me in Dr. Mill you have the very man to work out your most excellent scheme. If he could be persuaded to give a public description like the one which he has given to-night before publishing a guide to each district, and were a reporter engaged to take it down, the diagrams copied, and the whole summarized as an introduction, the cost need not be great, and I have no doubt that the guides would sell well and do a great amount of good.

Mr. J. E. Marr: I beg to differ from my friend, Prof. Lapworth. I cannot think Dr. Mill's paper pure geology. There are no two sciences more strongly welded together, and, in a way illustrating what biologists term commensalism, each science receives support from the other: that is shown in a general way in the very district described to-night. The structure of the curious valleys of this area was illustrated and rightly from the purely geological point of view; it was supposed by many that that structure was exceptional, but it was subsequently for geographers to prove that this was an illustration of one of the most important laws of geography. Dr. Mill has shown you in detail that the two sciences must work together in future. Two years ago Dr. Keltie, the president of the Geographical section of the British Association at Montreal, by his presidential address, brought a blush to the cheeks of geologists and geographers when he pointed out that the geography of the Mother Country was not yet worked out. Dr. Mill has begun this work, and I hope that now it has been so successfully begun it will be carried out through the country. I can assure geographers that geologists will give every assistance in their power. Lastly, I must congratulate Dr. Mill on the admirable way he presented his paper. We have heard papers in which the language was so technical as to remind us of the remark made by the late head-master of a public school, who, where a master would remark, "Don't laugh quite so loudly," said, "Young gentlem inclined to risibility, let your cachinnation be like the corruscations o electricity—lambent, but innocuous."

Major CRAIGIE: I attended with the greatest pleasure to hear the lectur has given us, and was interested in discovering how far the results of our ag statistics tally with other information derived from geology and other source before Dr. Mill in his preparation of the general scheme of the guide; certainly very satisfactory to see that the results reflected in the returns hav the general details of the country, especially as indicated by its geological with very great precision, and perhaps the crop yields have reflected mo than any other feature the dominating character of the geology of weste in its three great divisions on their agricultural characteristics. I hop work proceeds, that Dr. Mill will find such statistics as we may be abl from the Agricultural Returns more and more increasingly useful, and Colonel Johnston expressed it, we may popularize both these and the maps of the country, in the way we have heard to-night, as indispensable for our local geography.

Mr. G. G. CHISHOLM: I came unprepared to say anything, but I hav very greatest pleasure in being present on this occasion to hear the first i of an important work that was planned by Dr. Mill a few years ago. I those who are, like Mr. Marr, unable to coincide with Prof. Lapworth i that geography and geology are exactly the same science, that geography nothing but one of the aspects of geology. The fact is, of course, that g must bring into account the facts with which geologists provide us, b same time, perhaps unfortunately for geographers, they have to take int a great deal besides—facts from climatology, mineralogy, chemistry, sciences; in fact, I am often reminded, in thinking of the ideal equipn geographer, of the description given of Dr. Whewell by Sydney Smith, was his forte; omniscience was his foible." Now, it would almost s geographers were compelled to profess omniscience, so much is embrac study. To illustrate the difference between geography and geology, I ma one fact suggested to me in the course of this paper, that distinctly b geography and not geology. In describing the town of Chichester, Dr. the two main streets were exactly at right angles with each other. Now, i to me, seeing that Dr. Mill had suggested that Chichester was probably t city of Regnum, and I believe that is generally admitted, that these t have followed the original alignment of this Roman foundation, because that when the Romans founded colonies in various parts of the world, t civilized power, had learned the great convenience of having straight right angles, and they did exactly as we are in the habit of doing at the pr laid out the streets in that way. Every Roman colony had one main str direction, and another of a certain relative breadth at right angles to it other streets parallel to these, with the same regularity as we see in Wa Adelaide, Melbourne, Buenos Aires, St. Petersburg, and other towns la modern civilized peoples.* I do not know whether Prof. Lapworth will a

* An illustration of the regularity of building of cities deliberately p distinguished from such as, so to speak, grew up of themselves, from an ea than the colonizing days of the Romans, is given by Strabo, who mentions t in Bithynia, founded by Antigonus, was built in the form of a square, and regularity that one standing on the middle stone of the gymnasium could four gates at once.

trifling illustration of the difference between us, but I am at least sure that he will excuse the difference of opinion, when I add that on what is the main point for this evening, the great interest and value of the paper we have just heard, I heartily agree with him, as I am entirely at one with Mr. Marr as to the admirable and really fascinating manner in which that paper has been laid before us.

Mr. G. J. Symons: I think we have had a treat; in fact, we always have a treat when Dr. Mill reads a paper, because it is made so much more interesting by his facility of speech; he illustrates his paper so well, and I quite understand why Prof. Lapworth reckons upon coming here four hundred times to hear the remainder of the papers on the other sheets of the survey, but I fear I cannot undertake to attend on all these occasions. With respect to the meteorology there is little to say. Of course, this is, as Dr. Mill told us, only one four-hundredth part of the kingdom, and it is not very remarkable that there is not one complete station such as would be required to give details of temperature and pressure, but with very slight exceptions observations in the adjoining sheets would apply perfectly well. The difference between Bognor and Hastings is not probably greater than the difference between one part of the metropolis and another, and therefore complete stations are not required close together; but, in respect of rainfall, it is necessary to have the stations fairly close together. I should like to say it is no light undertaking to collect the statistics of the rainfall of the whole country; in the total it looks all very nice, but there is an enormous amount of work to be done. Before this is arrived at, for the United Kingdom, it would take a considerable number of clerks some years.

There are two small points in the paper I would like to mention, one with respect to the view of Bognor with the waves breaking on the rocks and shooting up higher than the houses. This reminded me of a story of my grandfather, who was at one time a great deal in that part of the country engaged in constructing those devices known as martello towers. He was building one near Bognor one day, when he saw a boat come in from Bognor rocks a little distance out, with a load of stones for building purposes. He said to the boatman, "Do you know what you are doing? You may depend upon it that Neptune will come along and fetch those rocks back again some day;" and I am inclined to think the old man was not so very far wrong. There is another point which is a mystery to me, and I am sorry Dr. Mill did not explain it; perhaps Sir Charles Wilson will do so. How did the Romans lay out these roads with such marvellous accuracy and absolute straightness, sometimes over 100 miles long?

Dr. Mill: There is little left for me to say, except to thank very heartily those who have spoken for the kindness of their remarks. I particularly appreciate the co-operation and sympathy of experts and specialists in the different sciences, but I am not going to allow that I have read a geological paper. It was a mere accident of the country that the dominating features happened to coincide with the geology; in another case the dominating feature might be the meteorology, in another simply the configuration of the ground. We could have a perfectly complete and purely geographical paper, descriptive of a region that lay entirely on one geological formation, and it would not matter whether it happened to be granite or slate. Then, again, this paper did not give a fair example of what I hope will be one of the most important features of the survey, *i.e.* the natural resources of the country, because there are many districts with immense natural resources not yet fully investigated. I refer more particularly to the great reserve of water-power in uninhabited parts of the country; all these will one day become of great value. Colonel Johnston said that treatment of this sort would help people in the country to understand what the survey maps can do. I remember the first interview I had with a native upon these hills; he was a shepherd, and evidently a pure S his "yes" was a "ja" as perfect as any I have heard in Germany. I showe 1-inch map, and though he had never seen a map before save in schoo minutes he had fairly grasped the whole thing, but the application he m little surprising. "I have often seen people on bicycles with these m ask the way, then look at the map and go the right way; you can never t the wrong way with a map like that." That episode gave a little in what we may perhaps call the "slimness" of the Sussex peasant.

Sir CHARLES WILSON: I hope you will allow me to convey to Dr. very warm thanks for the paper that he has been kind enough to give us. is one of the most suggestive and valuable that I have heard for a long ti room, and the manner in which it has been delivered must have been ag all of you. I think that Prof. Lapworth is rather inclined to lay upon Dr heavy a burden. I am afraid if he were to attempt the 400 memoirs to sheets of the Survey, he would have more than his work cut out for hi natural life. I hope and believe, however, that this scheme will go on Mill will be able to undertake some of the memoirs, and that we shall be enough to obtain the co-operation of other gentlemen who will write m the sheets in the admirable way in which Dr. Mill has treated this one read the memoir in its written form, and I can assure you that you w extremely interesting; you will miss the excellent delivery, but there is interest which Dr. Mill has not had time to touch upon this evening many of his admirable illustrations will be published with the paper. ways the sheets selected for the specimen memoir are interesting; but I point out to you that there are equally, if not more interesting, sheets memoirs might be written—for instance, those which cover the develo parishes in a district originally covered with forest.

I hope you will allow me to return Dr. Mill a very cordial vote of than labours and the interesting way in which he has communicated them to

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NEW LIGHT ON SOME MEDIÆVAL MAPS.

By C. RAYMOND BEAZLEY, M.A.

III.

IN this paper we are concerned with various inter-connected of mediæval maps, which have hitherto suffered from un neglect even more than those of the Beatus family, but are not surpassed in interest by the latter. For nowhere do we survival of ancient geographical ideas in the mediæval time mo ingly than in the allied designs of Lambert of St. Omer, the M and Sallust map-illustrations, and the "Climate" and T-O sk

I. Lambert, Canon of St. Omer, was the compiler of an encyc called *Liber Floridus*, composed of extracts from 192 differen In this he has left us a chronicle which reaches down to A.D. 1 must have been finished before 1125. This chronicle contain over, various maps, including a mappemonde, which has sur three different forms—to name only the principal—in the manuscripts of Ghent, Wolfenbüttel, and Paris.*

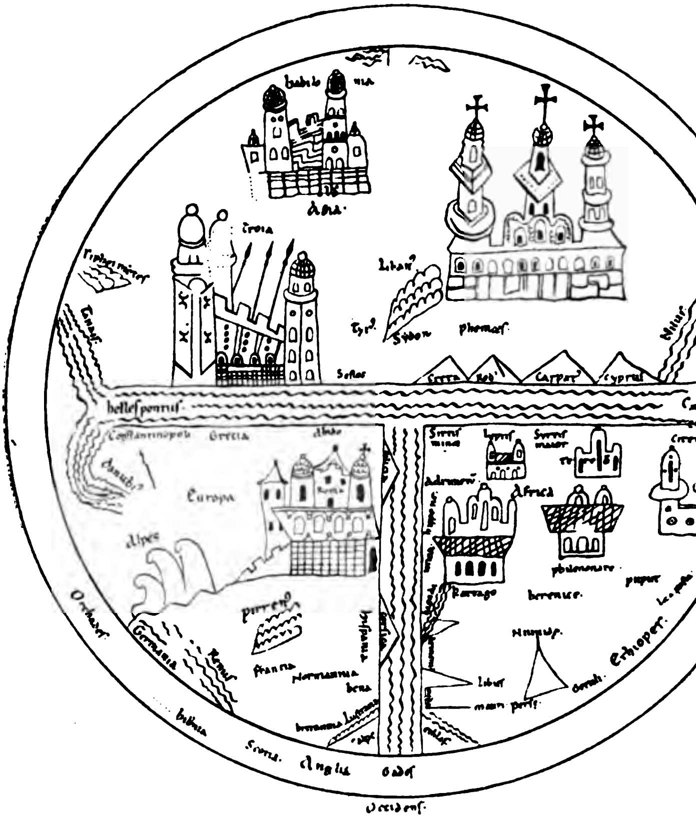
That of Ghent seems to have been written by Lambert himself; but it only gives us Europe, among the three continents of the world's scheme. The lesser map-sketches include a chart of the winds, one of the chief towns of the Oikoumenê, two Macrobian zone-maps, four astrological schemes, and a T-O map. The intention is clearly expressed (but not realized) of supplying a complete mappemonde, to remedy the deficiencies noticed above in the world-map.

The Wolfenbüttel manuscript is closely related to the Paris example: both are probably copies from the same original, and may be dated about A.D. 1150. In both, moreover, the mappemonde is complete (although the Europe of these designs is less detailed than in "Ghent"), and both possess a feature of peculiar interest. Nowhere else in mediæval cartography do we find a greater prominence given to the Unknown Southern Continent, the Australian land of the "fabled Antipods," than in the Wolfenbüttel and Paris redactions of Lambert's mappemonde. The Paris map is, however, much more imperfect than the other copies. All names of seas are wanting, the Mediterranean appears no broader than a river, and there is a want of all clear distinction between the various continents and countries. Here, too, the writing is exceedingly difficult; and Lambert's material has been greatly altered from the stage we find in the Ghent copy.

On these maps the seas and rivers are usually green, the mountains red. Each of the three copies has peculiarities of its own; thus, while Wolfenbüttel and Paris both give the Southern Continent beyond the equator, Paris alone contains the inscription explaining the same, and throwing so much light on mediæval ideas of the world. These ideas, as here expressed, are in close agreement with, and are obviously derived from, certain views of ancient Greek geographers, especially Krates of Mallos. According to this theory, the Oikoumenê, formed in the shape of an ellipse, was only one of four earth-masses, or quarters, which lay as it were like small islands in the vaster expanse of an ocean encircling all and dividing the various lands from one another. Of these four lands, the first, of course, was our Habitable World, the *terra cognita* of Europe, Asia, and Africa. The second was the southern continent just referred to, south of the equator, and separated from Africa (as then conceived) by a torrid strait of sea. The other two were on the reverse side of the earth-globe, and corresponded in some respects with the North and South America of later discoveries.

* The Ghent MS. is in the University Library, once in Library of St. Bavon, see fols. 28 and 241; the other two MSS. are numbered respectively Wolfenbüttel, 1 Gudiana Lat.; Paris, Bib. Nat., Suppl. lat. 10 bis. On Lambert's map Konrad Miller is especially admirable.

These land masses were divided by a tropical arm of ocean, in
same way as the first two. Among these four earth-islands,
clearly delineates the two on our side; while he suggests t
and perhaps also the fourth (on the other side) by the lit
placed in the margin of the Oikoumenê, or Roman world, at th
east and west. These circles are referred by the draughtsman
dise and "our Antipodes" respectively; and here the latte



A T-O MAP.
(Sallust type, Leipzig, Eleventh Century, City Library, No. xl.)

clearly used, not in the ordinary and more restricted sense
scientific manner. The "land of our antipodes" is to be u
as the continental mass exactly opposite to Europe, on the
of the globe; and the Paradise-Island is also (probably) to
preted as precisely antipodean to the southern continent of
sphere. It is possible that the expression of this theory in
map was derived immediately from Macrobius or Martianus
in any case it was widely diffused in the later imperial tim

occurrence here is another proof of the close dependence of mediæval geography upon classical antecedents.

The exact language of our present examples must be noticed. First, in the Terrestrial Paradise, we have the customary sources of the four sacred rivers, the Tigris, Euphrates, Gihon, and Pison. Like Kosmas, "the Indian traveller," Lambert evidently intends these rivers to have a subterranean course between Paradise and our World; but there is no indication in Kosmas of the fourfold scheme, or even of the Southern continent, partially reproduced by Lambert. Secondly, as to "our antipodes," marked by the little circle to the west of Europe, Lambert expressly declares this land to be inhabited by living, though not necessarily human, beings; and assures us that these beings have their day and night in an opposite relation to ours. Thirdly, as to the Southern, Australian, or trans-equatorial land of our hemisphere, below Africa, Lambert defines it as "A region of the south, temperate in climate, but unknown to the Sons of Adam, having nothing which belongs to our race." The equatorial sea* which here divided the land masses was not visible, he adds, to human eye, since it was always heated by the full strength of the sun, which prevented any approach of mankind, and allowed not of any passage across to this southern zone. But herein, proceeds Lambert, "as some philosophers believe, there is a race of antipods who are quite different beings from ourselves through the difference of regions and climates. For when we are scorched with heat, they are chilled with cold; and, whereas we are allowed to discern the northern stars, this is entirely denied to them. Days and nights they have of one length; but the haste of the sun in the ending of the winter solstice causes them to suffer winter twice over."

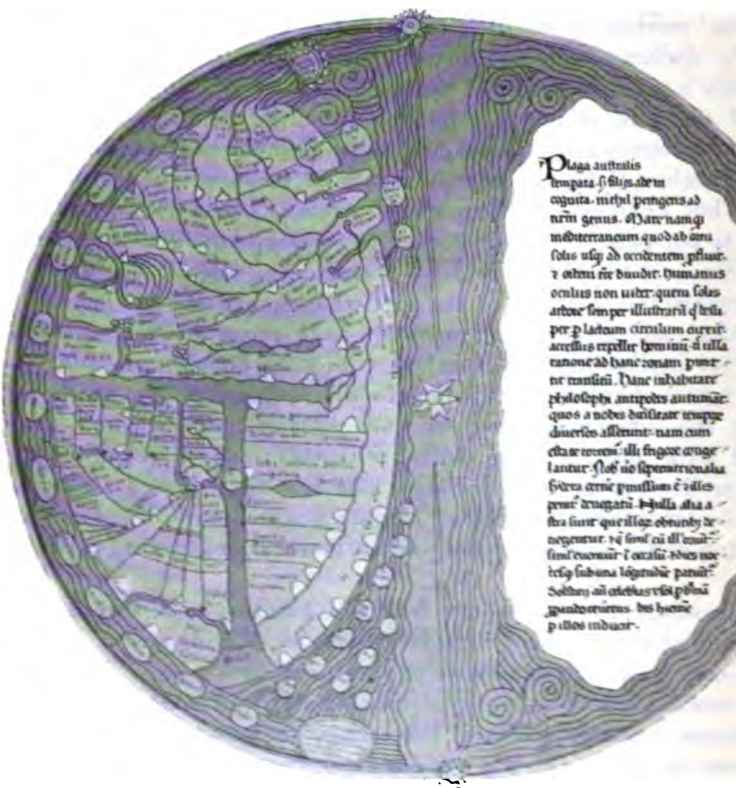
To the south of this temperate Australia, Lambert adds, with a true understanding of the climatic gradations of our World, was a zone of extreme cold, uninhabitable by living creatures.

The crooked line, running over the Equator, and marked by three star pictures, probably indicates the ecliptic or apparent path of the sun, whose obliquity is clearly suggested; just as the traditional T-O form of "Our World," the Northern or Roman Oikoumenê, is plainly indicated.

From all this it will be expected, as a matter of course, that the content and detail of Lambert's map, like his general conception, will be markedly antique in character, and this expectation does not mislead us. Though elsewhere realized to a greater or less extent, the relationship between the latter classical cartography and that of the middle ages is seldom to be found in such complete expression as in the case of Lambert. Of the one hundred and eighty legends in this

* "Mediterraneum mare."

map a great number are entirely ancient; the modern names such as Norway, Flanders, Bavaria, and some others; even with there are not many points of agreement; and the connection with and Julius Honorius is not much more definite. With the Ano Geographer of Ravenna, there are, on the other hand, some su points of contact; the relationship, as far as names go, with M Capella, with Solinus, with Beatus, with Aethicus of Istria, or Aethican Recension of Julius Honorius does not extend beyon



THE WORLD MAP OF LAMBERT OF ST. OMER.

small and sometimes doubtful points. Even with the Bible t not many links; among the chief of these is the mention of and Elias in Paradise, a feature found nowhere else in m maps.

The fact thus remains, that the detail, as well as the ground- Lambert's mappemonde is not to be found in earlier works of m character, and must be referred for the most part to a lost desig ancient world. The chief additions to this pre-medieval work a by Lambert himself, and refer to the geography of his own time. We must not suppose that the present example is a compilation from the writings of a large number of authors. Plenty are named in the *Liber Floridus*, but they are only used in the way of extract, and do not much affect Lambert's map, except, for instance, in the natural history details, which he has there inserted,—such as the fauna of India, the apes of Partha, and the parrots and elephants of Arabia, to which, by a strange omission, he has not added the snakes of Ireland. Lambert's "Hyrcanian tigers" are perhaps from Ammianus Marcellinus; his "Arabian lions" from Strabo; his "Indian pygmies" from Isidore; his "trees of the Sun and Moon" from the Alexander Romance of the Pseudo-Kallisthenes; while his "Griffins of the North" might be derived from many authors. But there is no evidence, either in the text or in the map of Lambert, that he had any deep or thorough knowledge of the ancient writers whom he names, and from whom some have supposed that he derived his geography. The geography in question, on the contrary, was probably taken almost bodily from a map-design, closely similar to that used or designed by Macrobius.

II. The connection between the map of Lambert of St. Omer and the writings of Macrobius extends also to the zone- or climate-maps, of which one group is often known as "Macrobius designs." From Lambert's picture of the Oikoumenê, it is also clear that the so-called T-O maps are not unrelated to his work. Among the climate-maps (which all illustrate the various, usually five, zones or belts or chief climatic areas of the world) there are, as we have said, a number which add to this a special reference to certain passages in Macrobius. Ambrosius Aurelius Macrobius, who filled high offices of state under the Emperor Honorius, was probably a Greek by birth, and a pagan by religion. In his famous commentary on the Ciceronian Dream of Scipio, he discussed (at the fifth chapter of the second book) the question of the terrestrial zones; and to this passage the Macrobian sketches chiefly refer. They also draw some of their material from certain paragraphs at the end of the first book of the same commentary, where Macrobius deals with the attraction of the earth, and the question of antipodes; and from the seventh chapter of the second book, where the celestial zones and the currents of the ocean are explained. Macrobius shares with Sallust the peculiarity of special map-illustration, arising out of specific passages in the works of each; but whereas the Sallust maps stand comparatively apart, these Macrobian sketches, as we have seen, are clearly members of a large and interesting family.

Among the sketches in question, some give us nothing but the five zones; others picture the two earth islands of the eastern hemisphere, which we have noticed in Lambert of St. Omer. Here the encircling and dividing ocean, as in the maps of the 'Liber Floridus,' covers most of the Earth's surface; and the land masses are reduced, in Cicero's words, to the position of "specks" upon the water. Here, m the ocean currents, from the equator to the poles, are clearly in and apparently conceived as the principal cause of the tides.

It is doubtful whether the Macrobius plans were soon alt mediæval copyists to the uncertain orientation which we find manuscripts. But there is no doubt that Macrobius himself north at the top, for in the fifth chapter of the second book expressly that the *upper* temperate zone is inhabited by men of c In one of the zone maps here referred to, a distinction is also between the domesticated folk of this same temperate zone wild men of the woods who inhabited arctic and torrid lands.

We have already alluded to the fact that in the 'Liber Flo Lambert of St. Omer there are, besides the mappemonde, Macrobian designs; and indications of the same character, w sketched, may be found in many other mediæval authors. T venerable Bede, in his 'De temporum ratione,' discusses the fiv and this work is accompanied by a Macrobian map, which is from the pen of the famous Northumbrian scholar of the eighth On this map the equinoctial belt is described, and the four g ments of the Earth's circuit are defined, in strict agreement original Macrobian language. Again, Honorius of Autun, 'Imago Mundi' (of the early twelfth century), reproduces M ideas, as Bede did before him, both in his text and in an illu sketch-map. Once more, William of Conches (de Conchis), wh at Paris in the middle of the twelfth century, wrote a work 'Philosophy of Nature,' which contains three Macrobian maps. these merely sketches the five zones and the zodiac; another s two earth islands of the eastern hemisphere, as in Lambert; t is more like a simple T-O design. Each of these has a orientation. Yet again, the Abbess Herrade of Landsberg, 'Garden of Delights' (of about 1180), gives us a slight zone m the ecliptic, after the manner of Macrobius; while another of kind is to be found in the 'De sphæra Mundi' of John Halifax wood, in Yorkshire, the celebrated "Sacrobosco," who flouris wrote in Paris about 1220. Lastly, we may notice in certai scripts of Hyginus, one of which is perhaps of the sixth ce zone map which depicts the four land masses, not merely in M but in full Kratesian fashion.

III. The remaining climate-maps are not always easy to dis except by the absence of definite Macrobian reference, and the of non-Macrobian matter, from the zone schemes just noticed. sketch of Petrus Alfonsus of Huesca (of about 1100) is c designed with the special purpose of illustrating the Arabic co of the world-centre called "Arym." This was sometimes vie mathematical centre-point for the Oikoumenê, or in a wider the whole earth-circle or eastern hemisphere; sometimes as a home of accursed spirits; and sometimes as a mysterious and lonely mountain in the midst of the Indian ocean. In the eleventh-century writings of Gerard of Cremona, if not earlier, it passes into Latin thought; it is very prominent in Roger Bacon; and here in Petrus Alfonsus and other examples of mediæval cartography it is adopted as a geographical axiom of equal importance with the chief climates and celestial directions.

Undoubtedly these climate maps, both Macrobian and non-Macrobian, had their origin in Greek speculation and science. The type represented by them was a favourite with the Arabs; thus Masudi tells us he had often examined such works, and among them he distinguished those of Marinus of Tyre as the best. The genesis of the climate schemes was apparently as follows. *Klima* meant first the supposed slope of the earth from a higher north to a lower south, or *vice versâ*. Secondly, Hipparchus the astronomer, about B.C. 160, gave to the term the special meaning of different belts, or zones, of the curved or spherical earth surface, as determined by the different lengths of the longest day at Syene, Alexandria, Constantinople, and so forth. Thirdly, this conception passed into ancient cartography, and was embodied with an immense body of other matter on the maps of Ptolemy, and the "scientific" school. Lastly, the climate scheme was abstracted, so to say, from all else, and sketched in rough outline maps intended for the use of beginners. It is the works of this latter class which concern us here.

IV. The map of Lambert of St. Omer connects us not only with the Macrobius maps and the climate designs, but also with that curious variety of mediæval cartography known as the T-O schemes. These are very numerous, though at the same time very similar in character; at least eighty manuscripts, reaching from the eighth to the fifteenth centuries, contain designs of this type; and the conception of one and all is fully expressed in the lines of Dati—

> "Un T dentro a un O mostra il disegno
> Como in *tre parte* fu diviso il mondo."

In some of the earliest examples, however, the T and O formations are not combined; thus, in the oldest Isidorian analogues, we have the T formation associated with square and oblong, as well as with round, *enceintes*.

As early as the fifth century before Christ, some of the Ionic philosophers hit upon this as a convenient form for indicating roughly the chief divisions of the habitable world; and, in spite of Aristotle's contempt, it survived as a popular favourite. For along with the more scientific geography of the ancient world, there was also a popular system represented in some of its phases by the zone or climate sketches, and the fourfold Kratesian schemes we have already referred to; another side of the same comes out in the T or T-O designs. In the execution of these, Greece was placed by some in the middle of t Oikoumenê, and Delphi, or Delos, in the middle of Greece. But wh ever the differences of detail, the T or T-O maps were always meant simple pictures of the grouping of the great land masses of the kno world; and were usually associated with the allied conception o centre for the "circuit of the earth," the infinitely extended hori Thus they did not necessarily deny the theory of a globular earth; they were concerned, and only concerned, with its aspect as a surf flat or slightly curved, as apparent to the ordinary observer. T execution of the T plan was by no means uniform; some mak Europe, some Asia, the largest of the continents,* though no one g the predominance to Africa, then usually believed to end in its sou ward direction on this side of the equator.

The "threefold division" (*trifaria orbis divisio*) of certain ea geographers is probably expressed in some of the Sallust maps be than in the T-O plans of the usual type, and was less rigidly sym trical and more reconcilable with scientific views. Here we hav threefold division of the Oikoumenê into fairly equal continent Europe, Asia, and Africa; but in this type Asia has a certain tho slight preponderance, the T has lost its rigidity, the idea of a cen point is not expressed, and the general conception seems rather to upon the great fact of three land masses, than upon any exact tripar division of the same. In some of the T-O family, we may also perh see traces of the three-cornered world pictures, or descriptions, wh according to Orosius and others, were in favour in ancient schools, were used along with fourfold or quadripartite presentations, ba upon the four great quarters of the heavens and the four chief wind convey rough ideas of geography to learners. A clear description o T map is given by St. Augustine, who must certainly have seen, probably used, a work of this kind; and that at a time when schol politicians, and men of affairs were provided with representations o wholly different character, resembling the type of road-map in rib form which has come down to us in the Peutinger Table.

The more important of the T and T-O maps which have survi are the following: Two in the works of St. Isidore; one of the ni century (now at Madrid); the similar Strassburg map of the same a the St. Omer design of about 1010; the plans in Lambert; one in eleventh-century chronicle of the Six Ages of the World, by Herman Contractus; and, most elaborate of all, the Byzantine Oxford Exam of 1110.† Besides these, there are many others, eleven of which oc

* Thus Pliny, out of sixty parts, gives Europe twenty-eight, Asia nineteen, Africa thirteen. Orosius refers to a reckoning which made Europe exactly equ the other two continents, while he also notes the views of others, which made Asia eq to Europe and Africa together.

† St. John's College Library, Cod. membr. fol. xvii., fol. 6.

in Isidore alone, but we need not do more than add a word about some of the chief examples already mentioned. Among these the two main Isidorian designs are found in the treatise of that Father, commonly known as the 'Etymologies' or 'Origins' (xiv. 2, 3). These are, perhaps, the best examples of the family as a whole, and are often spoken of as archetypal. Here, beside the three continents, we have the names of the three sons of Noah, one for each continent. Hence these are also called Noachic maps. The east is at the top, and the "Great" or Mediterranean sea occupies the whole of the T-formed intersection of the continents. Other schemes of this kind develop the simple titles (*Asia*, *Shem*, and so forth) by explanatory inscriptions, which declare, for instance, that Asia has its name from a Queen Asia, and is inhabited by twenty-seven peoples; that Africa is derived from Afer, a descendant of Abraham, and has thirty races with 360 cities; and that Europe, named after the Europa of mythology, is overspread by the fifteen tribes of the sons of Japheth, who possess 120 cities.

The Strassburg plan, of about 870, attempts rather more of detail, giving us, in Europe, the names of Greece, Italy, Frisia, and four divisions of Germany; the Amazons, India, and some scriptural names in Asia; Carthage and some other places or regions in Africa. Jerusalem is marked by a Greek cross, but not in the centre of the circle.

The St. Omer sketch of 1010 accompanies a collection of Homilies, and gives us the newer names of England and Hibernia, Thule, and Scandinavia; but the so-called "Oxford" of 1110 is fuller still. In many ways this is the leading example of the T-O family. Of course we must not here expect anything more than a simple and slight presentation of Earth-knowledge; its content is mainly Biblical, but it contains some features suggesting a high antiquity (such as the inclusion of Africa under Europe) and other clear marks of Greek or Byzantine origin. Thus, the four quarters of the heaven have the Greek titles of Anatolê, Disis (δύσις), etc., combined with Latin equivalents, Oriens, Occidens, and so forth. Here also is one of the first examples where Jerusalem appears with the cross and the hill of Zion as the centre of the Earth. The beginnings, moreover, of some other favourite mediæval traditions are roughly sketched—such as the 72 races of greater Asia, the 27 tribes of Shem, the 15 of Japheth, the 30 of Ham, the 33 of Armenia, as well as the 12 tribes of Israel, and the *Divisio Apostolorum*. We are not surprised to find an utter misplacement of many of the chief names; thus Constantinople is in Asia Minor, Armenia in the south of Asia, Palestine and Judæa in adjoining plots of what is labelled "Europe," but which, as far as the drawing goes, belong to Africa. The 72 * races of Great Asia are based perhaps on

* Cf. Gervase of Tilbury, 'Otia Imperialia,' ii. 1.

the 70 of the Mosaic table, and the whole design may b
ascribed to a copy of a Byzantine work brought home by
Crusaders.

V. Many of the Sallust maps conform in every respect to t
model, and may be considered a variety of the latter, but with
tion of distinct reference to the 17th, 18th, and 19th chapter
'Jugurtha;' just as the Macrobian section of the climate-map
reference to certain passages in the first and second books of th
mentary on the Dream of Scipio.' The Sallust examples are
already suggested, rather less symmetrical and conventional t
ordinary specimens of T-O cartography. The relationship
group of designs was first noticed by Spohn and Wuttke;
Philippi, and Konrad Miller have greatly developed the stud
same; but it is probably capable of still further expansion. A
know of eight larger and five smaller Sallust maps; of these th
and three of the most important are now at Leipzig; one
Görlitz is of special interest. The oldest example, of about
occurs in a fragment of a Catilina manuscript, once used for bo
ing. It is faded and obscure, but the traces of a city picture c
some smaller sketches, and various names are still discernibl
map conforms to the regular T-O type, employing the Medite
Tanais, and Nile in the usual manner to divide the three co
Another Sallust design of the eleventh century, also at Leipzig
most elaborate of this family, giving us pictures of Rome, Tro
lon, Carthage, Cyrene, and Jerusalem; together with indication
Nile, Danube, Tanais, and Rhine, among rivers; and of th
Lebanon, the Riphæan hills, Mount Atlas, and the Pyrenee
mountains. In the general design a rather free handling of t
conception is adopted, as in the Görlitz of the twelfth centur
is one of the best and least conventional specimens of this t
marred by an inclination to centralize Jerusalem, more pro
than in the earlier members of this group. In another tenth
Sallust design, otherwise of no interest, we have the chara
note, "Julius the Emperor divided the whole world into it
parts."

It was probably at an early date, long anterior to our oldest s
Sallust *manuscript*, that the normal Sallust *map* was inserted to i
the 17th chapter of the 'Jugurtha.' This special plan, adapted
ticular text, was however replaced in most manuscripts by a sim
sketch, lacking all definite reference to Sallust materials. Th
example shows us, perhaps, the original type, a pre-Christian m
out Jerusalem and with an overshadowing Rome. From this
view we shall be led to push the archetype further back than

* In a manuscript containing Lucan and Capella as well as Sallust

who is satisfied with the authorship of a priest in the north of Italy, between A.D. 600 and 700. According to Konrad Miller's view, the two oldest Leipzig copies, including the show specimen of about 1060, already noticed, belong to one family; the Görlitz and thirteenth-century Leipzig to another. He would maintain, and no doubt rightly, the separate existence of both these families as early as about 850; and the common original may fairly be referred to a time before the destruction, if not before the conversion, of the Roman Empire in the West.

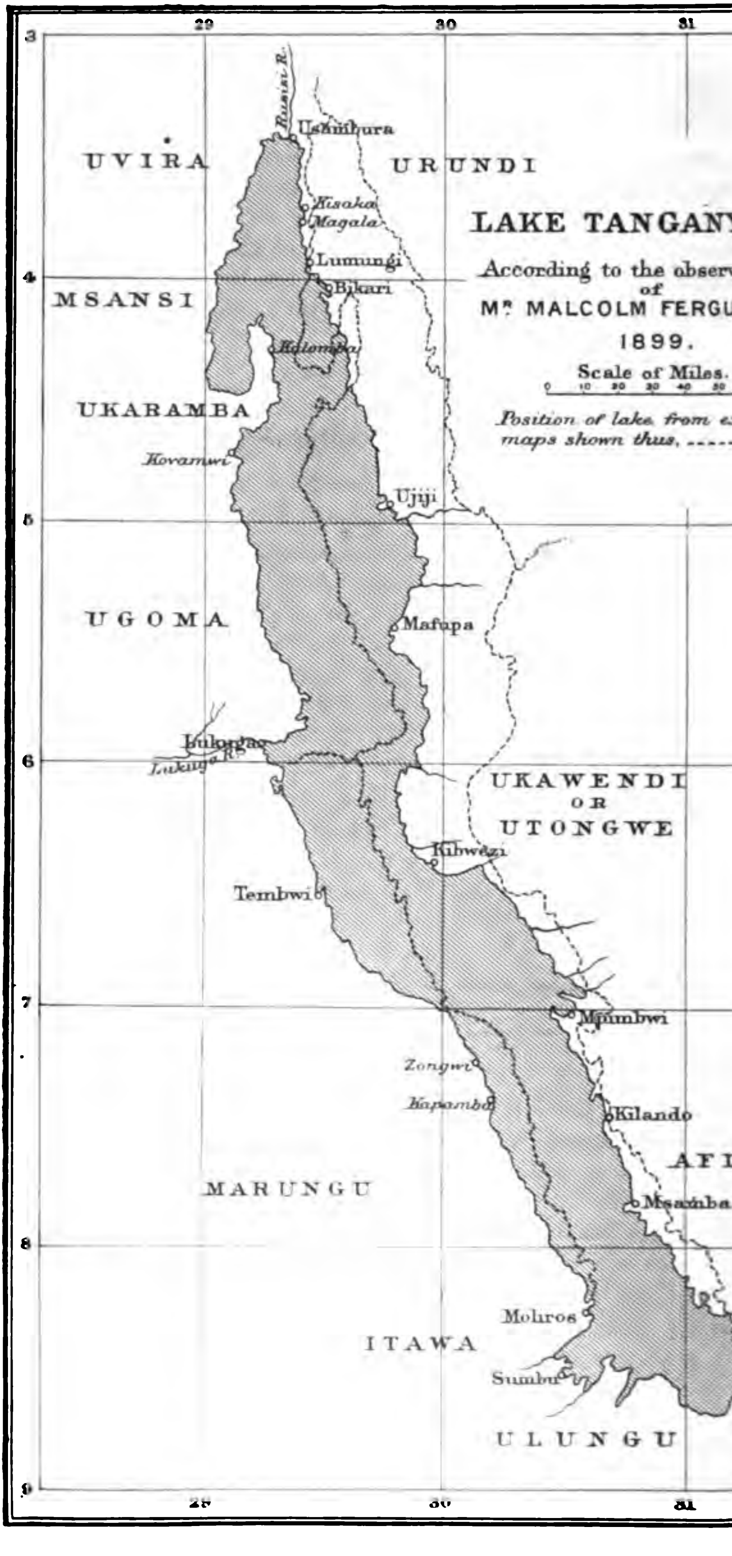
MOORE'S EXPEDITION TO TANGANYIKA.

THE following communication has been received from Mr. Malcolm Fergusson, the surveyor to the expedition, dated November 10, 1899:—

"I beg to send you a statement of our movements and work up to date.

"We arrived at Blantyre on June 28, and proceeded thence to Zomba, Fort Johnston, and Lake Nyasa, arriving there on July 11. We stopped about the lake till August 15, when we left for Tanganyika. Dr. Gill, the Astronomer Royal of Capetown, very kindly wired up the time to me at Blantyre, making all arrangements for this with the Cape Government. I was also enabled to find the error of my watches at Nkata bay, on Nyasa, and Kituta, on Tanganyika, from bearings taken by the Boundary Commission. We arrived at Tanganyika on September 20, and proceeded up the lake on September 28, calling at certain places, whose bearings I took by astronomical observations, and which I append later. I enclose a tracing of an existing map which I managed to obtain here, from which you will be able to see the approximate positions of places on the shore where I took my observations. I am unable to send you a new map, owing to the lack of materials for drawing, etc., but the coast-line seems fairly correct, and only the positions of places require alteration. The exact position of my places of observation are marked by a dot within a red circle.

"We arrived at Usambura on October 21, and landed some of the loads, whence we returned immediately to Kituta to pick up Messrs. Berridge and Mathews, who had remained at Sumbu, and we are now on our way up again, expecting to arrive at Usambura to-morrow. We visited the mouth of the Lukuga outlet of Tanganyika. The mountains, which are very high all along the western shore of the lake, slope down gradually from Tembwi on the south, and from Mtowa on the north, towards the Lukuga valley, which near the shore is a sandy delta with low sandhills, and through which the river flows sluggishly in several small streamlets, uniting about a mile inland. It then flows between soft red sandstone cliffs, being from 50 to 100 feet wide. The natives say that it increases considerably in size in the rains.



LAKE TANGANY
According to the observ
of
MR MALCOLM FERGU
1899.
Scale of Miles.
0 10 20 30 40 50
Position of lake from e
maps shown thus.
UVIRA
URUNDI
MSANSI
UKARAMBA
UGOMA
UKAWENDI
OR
UTONGWE
MARUNGU
ITAWA
ULUNGU
AFI
Rusisi R.
Usambura
Kisaka
Magala
Lumungi
Bikari
Kalemba
Kovamwi
Ujiji
Mafupa
Lukugao
Lukuga R.
Kibwezi
Tembwi
Mpimbwi
Zongwi
Kapamba
Kilando
Msamba
Mohros
Sumbu
29
30
31
3
4
5
6
7
8
9

Far back from the lake, perhaps 15 miles, the high mountains can be seen to continue, with a gap, which is evidently the course of the river.

"The mountains, which are high all along the western shore, increase very considerably at the north-west, by Uvira, attaining an altitude of, I should imagine, about 8000 feet. They form a parallel range with the mountains on the north-east shore, which are also of considerable height. The Rusisi valley lies between these ranges, which continue away beyond the northern shore of Tanganyika.

"Usambura, where we finally land, is a German station on the northern shore of the lake, being about 6 miles south-east from the Rusisi mouth. The Germans have also formed stations on the Rusisi river, and two at Lake Kivu.

"We expect to leave Usambura within a week, and proceed thence to Kivu."

BEARINGS OF PLACES ON LAKE TANGANYIKA.

Name of place.	Lat. S.	Long. E.
Sumbu	8° 32′ 20″	30° 30′ 15″
Moliro's	8° 16′ 14″	30° 36′ 15″
Msamba	7° 48′ 0″	30° 46′ 30″
Kilando	7° 27′ 18″	30° 40′ 15″
Kibwezi	—	29° 56′ 30″
Tembwi	6° 33′ 40″	29° 29′ 15″
Lukuga	5° 55′ 44″	29° 14′ 15″
Mafupa	5° 25′ 0″	29° 48′ 15″
Ujiji	4° 56′ 57″	29° 40′ 30″
Usambura	3° 24′ 0″	29° 22′ 30″
Lumungi	3° 56′ 14″	29° 25′ 30″

NOTE.—The hitherto adopted delineation of Lake Tanganyika, shown on the map by a dotted line, is that resulting from the careful compass survey of Mr. E. C. Hore, combined with the longitude of Ujiji, as fixed by Cameron from lunar observations (30° 4′ 30″ E.). By dead reckoning the latter obtained the longitude of 29° 59′ 30″ E., or slightly nearer the position as now fixed. Speke also placed Ujiji slightly west of 30°. Mr. Hore's observations for variation (by which the inclination of the axis of the lake was determined) gave the former as 11° W. at Ujiji and 14° W. at the south end of the lake, while Cameron seems to have taken the variation to be 17° W. throughout ('Across Africa,' ii. 303), thus obtaining a still greater inclination of the axis of the lake from the north and south line than is shown by Mr. Fergusson. His longitude for the north end was nearly accurate, but for the south end was 1° too far east. The German officer, Captain Ramsay, whose observations for latitude in the districts east of the lake have been published from time to time in the *Mitteilungen aus den Deutschen Schutzgebieten*, does not appear to have determined the longitude of Ujiji, but he obtained a value (20° 58′ 45″) for that of the mouth of the Rugufu, south of the Malagarazi, which agrees fairly well with Dr. Fergusson's results (*Mitteilungen*, etc., vol. x. p. 232).

THE RUINED CITIES OF CENTRAL AMERICA.—RE

By Colonel G. E. CHURCH.

UNDER the modest title, 'A Glimpse at Guatamala, and Some the Ancient Monuments of Central America,' * we have a beauti artistically illustrated quarto volume by Anne Cary Maudslay a Percival Maudslay. It is a book of travels and archæological in that region of the New World, the ruined cities of whic often challenged the scholar to read upon their extraordina ments something of the history of the strange effort at ci which they indicate.

Leaving London, the travellers reached Guatamala city by of San Francisco and the Pacific coast, and at the beginning of 1894, had prepared their outfit of mules and attendants, a themselves *en route* eastwards. The general description of t appears to have been left to the pen of Mrs. Maudslay, and t towns and cities to that of Mr. Maudslay. Judging from re work could not have been better apportioned, and we know to admire most. Mrs. Maudslay at once makes the reader o party. We accompany her along the road to Mixco, to Antig attractive coffee-fields, ascend with her the volcano de Agua, remarkable lake and volcano of Atitlan, wander into the qu of San Antonio, see the primitive school and its more primitive and the religious Indian ceremonies. We wind along the m among old mounds, ruins, and ancient Indian strongholds; views of lakes, rivers, hillsides and mountains, sunsets, clo shadows, while strangely costumed men and women gaze upo wonderment. We revel in riotous tropical scenery and its surr and, over all that we see, the writer has the rare gift of spre lazy, dreamy atmosphere of the country, while not neglecting her pages with valuable historical and other data. At Coban, Ytza, and Palenque, we are entertained with the everyday li travellers in a way to make us feel that we have contribut success of the expedition. Here and there among the chapte Maudslay are found notes of an archæological character Maudslay. A chapter by him on the Quichés and Cachiqu great interest, but we wish he had told us more of them barbaric civilization, which so nearly approached that of t Toltec and Aztec peoples. Mr. Maudslay vastly increases o ledge of the ruined cities of Central America, and gives us what we may find in his forthcoming monumental work Centrali Americani.' Maps, views, plans of ancient edifices, mural paintings of battle scenes, ancient strongholds, carved mo

* Published by John Murray. 1899.

inscriptions of Maya hieroglyphics crowd the volume, and attest to the indefatigable, intelligent, and patient labours of the author, and how far he has left behind all previous explorers in his chosen field. After eight years of voyages and studies among these ruined cities, he is probably better equipped for controversy regarding their origin and that of the people who inhabited them than any other archæologist and traveller. He thinks it "probable that the Mayas and so-called Toltecs were originally the same people."

Sufficient evidence exists to warrant the assertion that the Nahuatls originally occupied British Columbia and the now Pacific coast states of the United States; and, as their territory failed to meet the increasing demand for food products, they pressed southward—horde following horde, at long intervals of time, into the rich and inviting valleys of Mexico. The Toltec branch appears to have been one of the first to reach the vicinity of the valley of Anahuac, and to commence the civilization of the district by building the city of Tollan at its northern entrance. Here are now found those ruins and monuments which are believed to be quite as remarkable, in an architectural sense, as those of Central America, and to give silent testimony that the Toltecs were the most skilful workers in stone, metal, and rude industrial arts of all the Nahuatl race, and that they reached a higher grade of barbaric civilization than any of the tribes which followed them from its northern hives. If, finding their position untenable, they migrated southward from Tollan, they probably sought that portion of the Mexican peninsula which they thought would afford the greatest security—the region where we now find the ruined Maya-Toltec cities described by Mr. Maudslay. Although Mexican tradition has it that their migration was voluntary, it may be possible that they were completely overthrown by the invasions of their Nahuatl kinsmen, and forcibly removed beyond the isthmus of Tehuantepec, to Yucutan and its vicinity, to become an outlying Mexican colony; as it is not natural for a highland people like the Toltecs to willingly migrate to a tropical, lowland country but little above sea-level.

Some hold that the Nahuatls never subjugated the region south of the isthmus of Tehuantepec; others, with considerable evidence, maintain that they had colonies even in Costa Rica; and Mr. Maudslay says that tribes of "distinctly Nahuatl origin are found in Nicaragua." We are inclined to the belief that the Mexicans pushed their conquests south-east nearly to the isthmus of Panama, spreading their language among the Indian tribes as they reduced them, and locally applying great numbers of Nahuatl names, notably those of numerous plants, animals, and geographical localities, which still remain. Their language was also sufficiently powerful and dominating to weave itself largely into the colonial Spanish of Mexico and Central America, and some traces of it are found even in South America.

In an illustrated and final chapter on hieroglyphic inscriptio Maudslay points out the considerable difference between Mexican writing and Maya hieroglyphics, translates the month signs, nu signs denoting periods of time, great cycles, etc. What he has accomplished leads us to hope that, ultimately, much of the relating to the history of a lost and interesting race will be di and that a key will be given to us to unlock many of the ethn secrets of the New World.

NARRATIVE OF A JOURNEY TO THE LAKES RAKA AND MANASAROWAR, IN WESTERN TIBET, U TAKEN IN SEPTEMBER, 1848.*

By Lieut.-General Sir RICHARD STRACHEY, R.E., G.C.S.I., F

As we went along the edge of the lake we saw many water-birds; am were ducks and gulls, and two species of heron, one large and grey, smaller and brown. The waves that roared as they rolled towards us, and, in long lines of foam, receded over the shingly beach; the broad expan sea-green water; the gulls riding on the swelling waves, or skimming white crests of the breakers; and the high fresh wind blowing across produced a series of impressions such as are so naturally associated with of the ocean, that it would have called for but little exercise of the fancy us from the banks of this mere mountain lake to the stormy coasts of some sea. The great snowy masses of *Gurla* formed an appropriate backgrou picture, while the peaks of the Nepal Himalaya stretched away in a long s to the east as far as the eye could reach. Looking to the south, we sa narrow line of beach thrown up into several parallel mounds, running distance along the foot of the steep bank of the alluvial isthmus over had come. A projecting point cut off our view of the south-west corner of A Buddhist monastery, *Gusur*, stands there, but it was not visible. Our at length came to a halt about 2 miles south of *Ju*, on a narrow flat strip between the beach and a low line of cliffs which here flanked the lake; and the majority of the party behind to pitch the tents, etc., Mr. Winterbott went on to examine the place where the stream that flows from *Manasarow* the lake. We passed some dry stone hovels, but they bore no signs of ha inhabited lately, and near the same spot we were shown some holes said been old gold-pits, now abandoned. These are alluded to by my brother his way round from the north shore of *Rakas-tal*, passed over the same g we had done from *Tung-kong* to this place. He mentions that the wo these pits was stopped in consequence of the ghostly advice of the monk of the neighbouring monasteries, and I was told that their objections w on the fact of pieces of gold having been discovered having the forms of m was considered portentous to a high degree. It is worthy of note that the alluvial deposits of Tibet generally are auriferous, though the quantity them has hitherto been very small. The gold seems to be found in t manner as is usual in other alluvial deposits, in grains and nuggets o sizes; and is therefore to be distinguished from the scales or spangles

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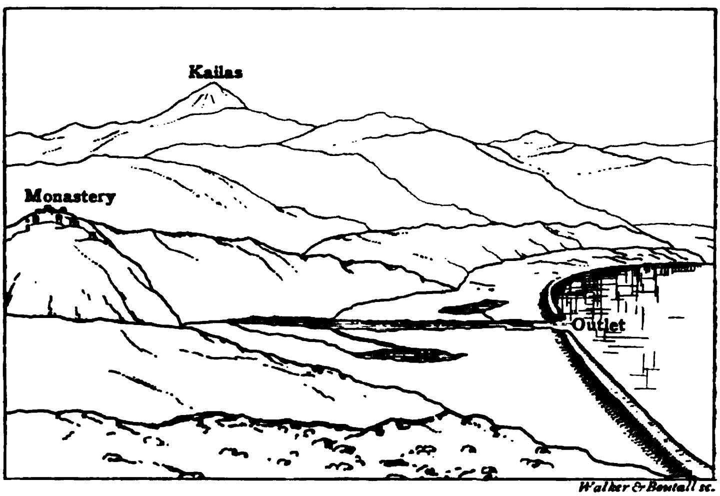
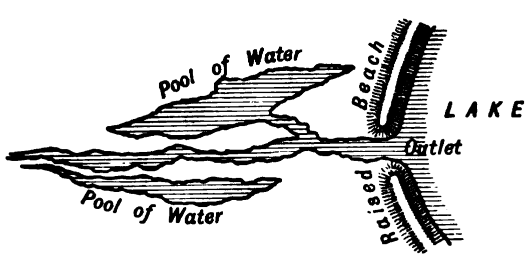
* Continued from p. 264. Map. p. 204.

frequently obtained from washing the sands of the Himalayan rivers. The Tibetan gold-pits are worked with shafts and galleries in the alluvium, and the remains of them are to be seen in many parts of the country. The working of the pits is a Government monopoly, and considering what a Tibetan Government is, and what Tibetan workmen are, the small amount of gold now produced is no proof that the alluvium of Tibet may not be rich in gold.

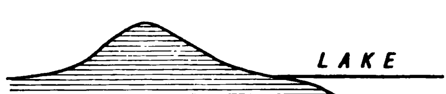
As we approached *Ju*, a steep rocky point rising abruptly from the lake forced us to ascend. From the height to which we climbed we looked down on the



SKETCH OF OUTLET FROM MANASAROWAR, SEEN FROM THE SOUTH.



PLAN OF OUTLET FROM MANASAROWAR.



SECTION OF RAISED BEACH.

stream that connects *Manasarowar* and *Rakas-tal*. The rocks on which we stood formed one flank of the ravine through which it flowed; on its opposite bank was the monastery of Ju, looking very mean, apparently a collection of ruined mud buildings on the top of a hill, with an inhabited portion somewhat lower down towards the lake, the whole oddly stuck about with poles, decked out with rags. The ground at the bottom of the ravine was quite flat, and about on a level with the surface of the lake. A raised beach, which swept in a well-rounded curve along the edge of the lake, was cut through by the effluent stream. This was of no great breadth, and apparently shallow and connected with several pools of still water that looked like old channels. It is strange that Moorcroft, deliberately going to look for the point of efflux, should not have noticed it. His account is as follows: "As the bank approached this angle (*i.e.* the north-west angle of the lake) it declined to gentle elevations leading to interrupted tableland, and at its base was a large bay, from the bottom of which rose a pyramidal red rock, connected with a line of ridge of high land to the higher flats to the north, and steep towards the south. Upon this was the house of a *Lama* and many *Gelums*, pitched in situations which produced a romantic effect, not a little heightened by streamers of various-coloured cloth and hair, floating from high poles, fixed on the corners and roofs of the houses. Leaving this and diverting my steps to the south, I went along the base of granite rocks amongst such troublesome, rugged, and slippery stones as had interrupted my progress in the outset, till I reached a high, level, and firm bank, which separated the water of the lake from that which accumulated by the slope of the surrounding upland directing the melted snow into it. At the end of this natural barrier I saw a point of rock running into the lake, from the top of which I flattered myself I should have a prospect that would command the whole of the shore to the south-west corner, and put an end to a task which I now found somewhat too much for the little strength I possessed." From this it would seem that he passed over the identical beach I have mentioned, and that he describes the pools of water under the monastery outside of it. The illness from which he tells us he was suffering may have interfered with his powers of observation, but for the rest it must be presumed that the water in the lake was lower than usual when he passed, or that the bar was higher, so that no water was then actually running over it; and as he walked along the edge of the lake, his eye would have been so near the level of the water that a very small irregularity of the beach might have concealed the course of the stream from his view.

There were a few small buildings on the low ground near the lake, and men moving about among them, so we did not venture down to make a closer scrutiny; it was, besides, getting late, so that I could not wait longer than was necessary to make a slight sketch of the locality. The level of the surface of Manasarowar is, of course, something above that of Rákas-tal, but my barometric observations were not sufficiently nice to enable me to determine the difference of elevation with any certainty. I have consequently thought it better to throw together the whole of the observations of the barometer made at the level of the two lakes, and to calculate the altitude above the sea as though they were on the same level.

We had started rather earlier than usual this morning, without having any proper breakfast, intending to stop on the road for this meal; but we did not do so, and before I got back to the tents I was so utterly exhausted that I could hardly drag myself along. I felt for the first time the sensations of weariness and drowsiness that are said to seize on unfortunate travellers who are overcome by cold or fatigue in crossing snowy passes; but I somehow managed to get to the end of my walk. At 8 p.m., thermometer 31°·2.

September 17. *Manasarowar back to Rakas-tal*, 14 *miles.*—At 6 a.m., thermometer 23°; at 8 a.m., thermometer 34°·4. The north-west angle of *Manasarowar* having been the furthest point to which we thought it expedient to extend our journey, we to-day began to retrace our steps towards Milam. Several causes led us thus to conclude our expedition. The most important was the lateness of the season, for it would have been rash to delay our passage of the Indian watershed later than the beginning of October. The necessity for avoiding intercourse with the people of the country prevented our obtaining fresh supplies of food, and the risk of detection increased as we increased our distance from home. But though it was prudent on the present occasion to return when we did, yet the population is so exceedingly scanty that an expedition might, I believe, successfully penetrate to a far greater distance into this part of Tibet without interruption, if properly organized.

While the tents were being packed up, we went on to the high ground over the spot where we had encamped, and from a slight eminence on its undulating surface we saw across from one lake to the other, and could trace the hollow through which the stream that connects them runs. The peak of *Kailas* stood out prominently among the mountains that flanked the lakes on the north. The greater part of these outer ridges, among which *Kailas* is situated, were not snowy; but a mass of very high mountains was visible to the north-west of *Kailas*, and a long way behind it, thoroughly covered with snow. The peak of *Kailas* rises from a transverse outlier of a range the axis of which is much further back. The peak forms a most conspicuous object from all the southern shore of *Rakas-tal*, and from this point of view the valleys by which the snowy mass of *Kailas* is cut off from the other prominent ranges to the right and left are very distinctly seen. I have already noticed a hollow that we crossed on our way to *Manasarowar*, terminating at a little bay about halfway down the west side of this lake, into which it drains. By way of varying our homeward route a little, we turned up this towards *Rakas-tal*, and we found that its watershed was almost close to the edge of *Rakas-tal*, and hardly so much as 100 feet above the level of the lakes. It was through this depression that we had seen the water of *Manasarowar* when we first came within view of *Rakas-tal*.

Early in the day we saw a fox; later another of the small antelopes and many hares, one of which, being foolish enough to squat within 8 or 10 yards of us, was cut nearly in two by a ball from a pistol carried by one of our people. A pack of donkeys, into the middle of which we walked when suddenly turning a corner, fared better, for no firearms were forthcoming until they had got safely away. It is, perhaps, worth while for me to say that this animal, the *kyang*, is a decided ass, and not a horse. Not only is his external appearance in all respects that of an ass, but his disposition also, of which I have myself seen sufficient proof, in a young animal obtained from people at Milam, which was sent to Calcutta, but died on its voyage to England. A distinction has been drawn, I think, between the markings of the skin of the *kyang* and the common ass; but the transverse stripe across the shoulders, which is said to be wanting, is often as strongly marked as in the donkeys of these mountains.

We struck upon *Rakas-tal* close to the commencement of a great raised beach that stretches along the south-eastern angle of the lake. It has a breadth of 200 or 300 yards from the present edge of the water, and seems to be composed entirely of granitoid detritus. Several interior lines, forming a series of steps or parallel roads, lie between the present high-water level of the lake and the uppermost of the beaches, which rose above all in a great mound of very remarkable height. These features were here most strikingly developed, a consequence, no doubt, of the violent south-westerly winds which blow so regularly in the afternoon, and constitute this a permanently dead lee shore. There is no evidence available to show whether there is any considerable variation in the level of these lakes from year to year, or from one season to another; but I think that such variations as must have taken place to explain the existence of some of these beaches are hardly compatible with existing conditions, and it is probable that these lakes have been gradually drying up, as seems to be the case in most of the lakes that have been observed in other parts of Western Tibet.

As we reached the border of the high land overlooking *Rakas-tal*, we s far before us a considerable party of travellers with horses, cattle, and she we halted a little to allow them to get ahead. The view of the snowy m *Gurla* across the bay was savage and grim. The wind had begun to blo great force, and was gradually rising, and the whole surface of the lake wa with foam; but, as in the forenoon the direction of the wind is south-w no waves now broke upon the shore on which we were.

In our progress along the beach we came to a place in which the surf been levelled, and a rough pavement had been made with the rounded divided into several compartments, some of which seemed to have served s for tents, others to have formed small open courts. We were informed tha the spot where a Tibetan grandee from *Lhasa* had encamped not long befo was, I think, the officer called *Zhipchet*, a sort of special commissioner, a been into *Purang* on some public business.

As we reached the corner at *Lagan Tunkong*, we saw that some of the p Tibetans had pitched a tent near the ruined *Dharmsala*, but the wind n blowing so furiously that no one would remain exposed to it who could p find shelter, and accordingly not a soul was to be seen outside the tent, clos which we passed. As a precautionary measure, and to find out the news, o headmen, *Bachu* and *Boru*, went into the tent to pay the Huniya traveller He turned out to be a landholder of *Purang*, and had some slight p acquaintance with *Boru*. His teapot being already on the fire, they were tea-drinking and gossiping, and the Tibetan squire was amused with the com ment of a mock bargain for sheep and wool, which was to be pursued furt following day on the road to *Purang*. Their worthy host must have been puzzled the next morning to find that his Bhotiya customers had alt vanished. Another division of the Tibetan travellers had selected a more sh place for their camp a little further on; they turned out to be servants Tibetan abbot of *Darchin*, a monastery at the foot of *Kailas*, to the n *Rakas-tal*, who had been sent to look after the getting in of the crops on lands in *Purang* belonging to his convent. There was no suspicion afloat in quarters of the intrusion of a "Feling," as the Tibetans term all Eur making a further change from the name "Feringi," the usual Asiatic cor of the word Frank. Our Bhotiyas had accordingly become mightily courag

We halted about half a mile beyond the ecclesiastics in a retired little the edge of *Rakas-tal*, not far from where we had stopped on our outward j There was here again one of those raised beaches already so frequently se of no great extent.

At 8 p.m., thermometer 30°·5. The vegetation along the souther of *Rakas-tal*, and between this lake and Manasarowar, was most scanty following will, I think, include most of the larger plants: *Caragana p* *Potentilla sericea*, *Thylacosperma cæspitosa*, *Silene Moorcroftiana*, *Dracoc heterophyllum*, *Nepeta Tibetica* and *supina*, *Oxytropis Stracheyana*, *Ast liusculus*, *Senecio coronopifolius*, *Artemisia Stracheyi*, a *Tanacetum*, *Lactuc tiana*, *Androsace villosa*, *Sedum fastigiatum*, *Draba lasiophylla*, *Delp cœruleum*, and *Allium Jacquemontii*. The addition of a few grasses and c to the above list would nearly complete the enumeration of the flora of thi region.

September 18. *Along the South Shore of Rakas-tal to the Camp tember* 14, 10 *miles*.—At 6 a.m., thermometer 22°·8; at 8 a.m., 34° first part of our journey to-day lay over the ground we had passed bef ultimately we kept rather more away from the lake, following a mor ourse, and at times approaching the watershed between the lake and the *Karnali* ver. It was during this day's journey, I think, that we had the finest views of *akas-tal*, its long islands and deeply indented bays, varying in apparent form ith every change of position, while the eye never wearied in gazing on the avenly blue of the water, or on the magnificent snowy dome of *Kailas*, which conspicuously crowned the rich purples of the distant mountains. In crossing me of the ridges on our way, we looked down into the upper part of the valley the *Karnali*, and the positions of some of the chief places were pointed out to . This appears to be in every respect a normal Tibetan valley. It is flanked either side by the remains of alluvial deposits, the flat tops of which are ry far raised above the existing river-bed, and are manifestly nearly on a level ith the general surface of the great plain of *Guge*. It is difficult not to conclude at the lower part of the hollow now forming the valley of the *Karnali* must at e time have been entirely filled up with deposits, continuous with those of the eat plateau, and caused by the same agencies, and that the deep channel in hich the *Karnali* now flows was subsequently cut out by the river, after some eat change had taken place in the conditions of the surface and the arrangements the drainage. The mountains of the Indian watershed along the frontier of *yans* and the north-western angle of *Nepal* looked very fine, thickly set with owy peaks. We now, too, obtained an instructive view of *Gurla*, which was en to be composed of a series of masses of mountain, their north-eastern ends ing precipitous, and their southern faces dipping at rather high angles to the uth-west towards the Himalaya. From what I saw of the rocks myself, and om my brother's accounts, it appears certain that *Gurla*, like most of the highest aks of these mountains, is chiefly made up of gneiss or mica schist, with a mparatively small quantity of granite. On our return to our old encamping-ound, we found that during our absence a party of Huniyas had passed along e road which I mentioned as having been seen a little below our camp, and ey had been not a little alarmed at finding a party of men halting in so secluded spot, thinking, with some degree of justice, that people who had no cause for con-alment would not have selected such a place to stop at. They were, however, last much comforted when they discovered that our men were peaceable Juhari hotiyas, and not the redoubtable *Kampa*. At 8 p.m., thermometer 30°·2.

September 19. *From Rakas-tal to the Valley of the Karnali*, 7 *miles.*—At 8 m., thermometer 38°. We now prepared to cross over the range separating *akas-tal* from the *Karnali* river, and accordingly set off straight up the ravine in hich we had been encamped. To the summit of the watershed the hills were of e same eruptive rocks, with the same rounded forms and with the same miser-ly barren aspect, though bushes of diminutive growth succeeded in reaching e crest of the ridge, which we crossed at an elevation of about 16,850 feet. The nall stream that gave life to a narrow fringe of verdure along the bottom of the vine up which we came was now frozen into an almost solid mass by the severity the night frosts, and at the head of the ravine lay a small patch of snow, the cond, I think, that we had anywhere noticed since we crossed the *Balch* pass. t 11 a.m., thermometer 46°·5, we crossed the ridge, and finally took leave of e lakes, not at all sorry to be once more fairly on our way out of this desolate untry. A steep descent brought us very soon upon some less inhospitable-look-g ground than we had seen for many days, where a Huniya tent was established. eeping clear of this, we crossed some hills of no great elevation intersected by eep ravines with flat bottoms of cheerful green herbage and small clear streams ll of small fish. The bushes and herbage seemed to show, by their luxuriant owth, that these retired valleys were but little frequented by the Tibetan epherds.

Among these hills we once more got into stratified rocks, consisting and limestones, in which no fossils could be seen, much shattered and c but on the whole dipping to the north-west. We encamped in a sheltere about a couple of miles from the *Karnali*, having made a short march in give the cattle a little rest, for their feet had suffered a good deal from t constant marches over the sharp angular fragments of stone that everywh the surface of this region of igneous rock.

The hills close along the south bank of the *Karnali* west of *Khardam* s generally to dip to the south, but they are of no great height, quite snow generally very uninteresting in their aspect. The flat shelf-like surfac parts of the alluvial valley-floor of *Purang* that have survived the erodi of the rivers, were here very distinctly seen. They vary greatly in exte is not possible to doubt that they have been originally continuous with plateau up to which we traced them in the next two days of our jou observed near the place of our encampment a very granitic or sienitic greenstone that I had not seen among the eruptive rocks we had before p

September 20. *Up the Karnali to Sing-lapcha*, 14 *miles*.—At 8 a. mometer 37°·5. Our route lay over rounded hills of slates and limestone ing no definite signs of fossils, as barren as ever, and altogether very interest. An occasional patch of greener grass than usual gave our j opportunity of eating a little, an occupation in which they had been ver able to indulge for the last few days, so utterly barren had been the coun as it turned out, during the remainder of the journey they were to fare st We at length fell into a track said to be that from *Kangri* to *Darma*, and it into the valley of the *Karnali*, which river was here as large, or perha than any of the streams we had before crossed during our journey in Ti main supply we could see to be derived from tributaries that rise on the slopes of the Indian watershed, in the neighbourhood of *Mangshang-Lek* the western passes of Byans. These feeders join the *Karnali* nearly at rig just opposite to *Sing-lapcha*, above which the stream in the main lon valley is a very insignificant one, and no doubt occasionally dry altogeth circumstance gives additional weight to the views I have before propound nature of the alluvial deposits along the *Karnali*. For those deposits m follow the great longitudinal hollow which extends from *Khardam* to *C* beyond which they cannot be distinguished from the general mass of the p *Guge*; and they cannot, therefore, be derived from the present feeders of t which enter this valley at right angles at about the middle of its lengt a point where no change of physical character is to be observed.

Sing-lapcha is so called from two or three piles of bits of stick, raised, a described, by travellers to form a "*lapcha*," the ordinary word for such pile, *sing* or *shing* being the Tibetan for "wood." These piles, 4 or 5 feet i stand by the roadside on a prominent shoulder of mountain, which t crosses about 500 feet immediately above the river.

In coming into the *Karnali* valley over the last of the hills we had we looked upon a flat alluvial terrace some height above the river itself, one of those optical illusions, to which I have before alluded, displayed an e picture of a Tibetan encampment. There were the black yak-hair tents, figures of men and cattle, and the white sheep scattered over the grass. B I had reached the green pasture, the spell was dissolved; the tents were into great square blocks of stone, the men and cattle had shrunk into d and bushes, and where the sheep had been grazing just before, only whi boulders were now to be seen. Nor could I help thinking how easily, u fluence of these or similar delusions, half-savage shepherds might accept as unoubted truths the wildest fables of wizards and enchanters, when in spite of my eason, and in the least romantic mood possible, I could hardly avoid giving a omentary reality to my vision.

As far as *Sing-lapcha*, hills of considerable height rose immediately from the outhern bank of the *Karnali*, but to the west of this place they are somewhat rown back, and a plateau, the surface of which seemed, on the whole, pretty level, ough considerably intersected by ravines, bordered the *Chujia-Tol* valley, which, s I have already said, forms the prolongation of that of the *Karnali*. The foot of e hills on the north of the *Karnali* still kept close to the river, but their height bove it gradually diminished.

The only object now remaining for us to accomplish was to return to *Kumaon*. Ve were satisfied that the Tibetan authorities, if by any chance they now disovered us, would simply assist us in carrying out this intention, and our people eeling, that they were by this time beyond the reach of the enemy, had no scruple going boldly along the valley, and in encamping at a short distance from some 'ibetan shepherds about a mile beyond *Sing-lapcha*.

The food of our Bhotiyas was by this time very nearly exhausted, so an expeition was at once undertaken to try to obtain a fresh supply, and at the same time endeavour to buy a sheep or two, and, if possible, a goat with milk, the latter eing a luxury that we had long been without. We were soon informed that lmost all the men had gone from these tents to *Darchin*, in attendance on the 'ibetan *Zhipchet*, then returning to *Lhasa* from *Gar*, which place the Bhotiyas ore commonly call *Gartok*, and that only women and old men were left behind. heep were produced, but some difficulty was made about a goat; and we were reerred to the headman of the community, whose tent was said to be 3 or 4 miles p the valley, for a supply of grain.

September 21. *Sing-lapcha to Camp near Lama Chorten*, 14 *miles*.—At 8 .m., thermometer 33°; at 9 a.m., thermometer 47°. As we were preparing to tart this morning, the flocks belonging to the Huniyas near us came down the alley close past our tents, escorted by a wonderful-looking shepherd dressed in heepskins, and altogether the most uncivilized-looking creature conceivable. His leas were evidently rather limited in their range, and though he thought it rather dd, he was perfectly satisfied when he was informed that we were a peculiar sort f Juhari. He only wished to know whether we had been on a religious pilgrimage o *Manasarowar*, his education not having got so far as to make him aware of the xistence even of his "*Feling*" neighbours. An attempt was made to induce him o let us have a goat. This he totally refused to do, and when our people insisted, e went back, in a violent state of indignation, to his camp to report their misconuct, and, when the matter was at last settled, returned to his flock still quite npacified. Our road led us right up the valley, and we passed the tents where our heep had been kept for us, and after a great deal of talk, the purchase of the goat vas amicably arranged by our being allowed to carry it off at an exorbitant price.

Chujia-tol, the name of this part of the valley, was the greenest place that we ad seen since we left *Gyanima*. The word *tol*, which, however, does not appear o be classical Tibetan, is applied, as well as I could make out, not merely to the ocality, but to the whole pastoral establishment by which it is occupied, something s the term *village* designates a settled agricultural community, with their abodes. 'he population here was not by any means numerous, and we may have passed ifteen or twenty tents at the outside. The people were exclusively nomadic and astoral, having no homes but their tents, pitching these at such distances from one nother that their cattle should have grazing-ground enough, and moving their

encampment to other ground as the grass was eaten up, or as the season
This community, we were told, went northward in the winter towards
or beyond the lakes, all the country along the Indian watershed and so
lakes being then uninhabitable from the great depth of the snow. Th
regular routine of grazing-grounds, which they occupy to the exclusion o
persons, and in which they are held to have a hereditary property.

With the exception of the monasteries about the lakes, *Kyun*
Khardam are the highest permanently inhabited places in this part of
they are between 14,000 and 14,500 feet above the sea. The fixed po
these places, other than the monks, is, as usual, agricultural; but the

TIBETAN SHEPHERDS.

of the secular inhabitants of the regions we had traversed are entirel
and pastoral in their habits.

As we passed up the valley we at length reached the tent of the
who, with his wife and children, came out to receive us, he presenting t
ceremony, and the lady a bowl of milk. After a short preliminary co
carried on through the medium of our Bhotiyas, for I did not underst
of Tibetan, we proposed to go into his tent, and he was most happy
We were soon joined by some of the *élite* of the society of *Chujia-tol*, bu
being absent, our visitors were nearly all women.

The men wore a loose gown tied round the waist, which, if not black l at all events become so by dirt. They had high cheek-bones, oblique eyes, k complexions, and their hair was worn with long tails, their rough and tered looks showing the hard life they must lead. Among the more prominent the various parts of their costume and its accessories were a grey felt cap, the es of which are turned up all round; cloth boots, called *lam*, of various bright ours, mostly red and green, with leather soles; and a belt, from which is hung reat array of purses, pouches, knives, pipes with apparatus for striking a light, . Also should be mentioned the brass box almost invariably hung round their ks or over their shoulders, containing either charms or, maybe, their Penates the form of a clay figure of *Buddh*, made at Lhasa and blessed by the great na. These figures, however great may be their spiritual value, do not bear extravagantly high price in the worldly market, for I found that a Tibetan was y willing to overcome his scruples and part with his consecrated *Buddh* for a tter of some four or five rupees.

The women—I cannot call them the fair sex—were gowned and booted much as men; but they were chiefly conspicuous for their peculiar head-dress, apparently riangular board covered with cloth, which is fixed on the top of the head, the x turned behind and prolonged down the back into a tail of leather decorated h a profusion of pieces of brass, turquoises and other stones, and bits of glass, h rows of little silver coins hanging from its edges. The hair under this ious apparatus is plaited in front in many separate little braids, and a grand ural tail hangs down behind, which produces, with the artificial one, an effect ich would not a little surprise the coiffeurs of Paris. The ladies' toilet was npleted by a tremendous chatelaine, which seemed to contain all conceivable plements ever invented for the use of a Tibetan household.

The tent was made of black yak-hair cloth, 15 or 20 feet long, and half as wide pported on three upright poles connected by a horizontal ridge piece. The ridge s open at the top, all along the middle, to let out the smoke, the fires being anged between the poles on the ground below. The doorway was at one end, l closed by blankets that hung before it. At the opposite end, on a little sort table, were set up the household gods, having a number of small brass cups anged in front of them to contain their food, which is a mixture of butter and al. The head of a goat lately killed lay in front of the deities for their use, ; the eatable legs and shoulders had judiciously been reserved for the mortals. large assortment of pots and pans, of wood, iron, and copper, stood along the rth-range, and amongst them I need hardly say was a kettle of tea, with a mess porridge of buckwheat flour.

Literature and the fine arts appeared not to be altogether neglected in the betan camp; writing materials, ready for the man of business or the scholar, l a stringed instrument of the guitar fashion for the poet or musician, formed t of the furniture of the tent. Outside was a large wooden shovel, used to clear ay the snow.

Our host's name was *Angchu*, an oldish gentleman, and as we sat in his tent, . Winterbottom was engaged in sketching the inmates, while with the help of interpreter I carried on the conversation. Although head of this community, gchu said that he had no perquisites in that capacity—nothing, indeed, but the nour of the thing, and that he was only kept in this position for the purpose of ing the authorities some one through whom they could act in their dealings h his people. This statement of Mr. Angchu is, I fear, not strictly correct, but emoluments, no doubt, are not very great, and there was probably some ground his grumbling. These nomads appear to pay no regular taxes to the state, t to be generally squeezed. Thus they supply food and carriage to the Lhasan officers when they move about the country; they are compelled to buy their te[a] and the scarfs of ceremony, and perhaps other things of which a Governmen[t] monopoly is established, from the Tibetan officials, paying for them prices whic[h] they aver are three or four times what they ought to be. They also have to gi[ve] up to the Government one load in ten of the salt or borax which they collect.

They are altogether dependent on barter for their supplies of grain; parti[es] with sheep and goats are sent to the mountains north of *Kailas* to collect salt an[d] borax, and they exchange these for the cereals which they require.

Their domestic animals comprise sheep, goats, yaks, ponies, and dogs. The[y] make butter and a sort of cheese from the goats and cows' milk. The best butt[er] would be very good if it were not ruined by dirt, and filled with an unlimit[ed] quantity of hair. The coarser hair of the goats is used for making ropes; th[e] down under the hair is the shawl wool, or *pashm*, and its growth is altogeth[er]

TENT OF ANGCHU, WITH HIS WIFE AND CHILDREN, RECEIVING OUR VISIT.

dependent on the cold of the climate in which the animal is bred. The she[ep] produce wool only. The hair of the yaks is employed in making the coars[e] cloths, such as those used for tents.

The goats are usually branded in the horn. The sheep are marked with re[d] ochre, much as in England, but not quite so neatly. Unlike the Hindu agricu[l]tural people, they only keep one bull yak in each village or nomad communit[y], and we saw him on our way up the valley, looking very large, fierce, and shagg[y], high in his fore quarters, and low behind—very much resembling the form of th[e] bison. The young bull reserved to replace the old one was also pointed out; h[e] was marked by a tassel fixed in his ear.

We stopped about an hour at the Huniya's tent, during which time sufficie[nt] grain had been purchased to last till we fell in with the convoy ordered to meet u[s] at *Tazang*, where we hoped to arrive in two days' time. Starting once more, w[e] again followed up the valley as before, its depression below the highest level o[f] the alluvial deposits, which here had a considerable development on our righ[t], gradually diminishing, till at length we once more found ourselves on a level wit[h] the surface of the extreme south-east angle of the great plateau itself. W[e] encamped not far from *Lama Chorten*, about 200 feet above the plain, at the foo[t] of a spur from the Indian watershed, which rose steeply on the south above ou[r] tent. On the north the hills terminated nearly opposite to us, so that we looke[d] across the plain without interruption for many miles in the direction of the lak[e] of *Gyanima*.

We had now returned to within a short distance of the *Darma Yankti*, o[n] which we had encamped some miles lower down on the 11th of the month o[n] our way to *Rakas-tal*. This river rises from glaciers on the north face of th[e] Himalaya, and the roads from the *Kach*, *Nuye*, and *Lankpya* passes all lead dow[n] ne one or other of its feeders. It appears as if there were here some suppres-n of the ordinary outlying spurs of the watershed ranges, and perhaps even a pression in the ridge itself. Up the *Darma Yankti* we looked into a wild and astly gorge, filled with snow and ice, down which howled a furious wind, pour-g out a great fan-shaped mass of cloud over the gap, at the mouth of which we camped. A little snow fell near us, but the cloud was dissipated before it spread y far over the plain, reabsorbed under the influence of the greater heat and ness of its open barren and arid surface.

September 22. *From Camp near Lama-chorten to the Gunda-Yaukti*, 7 *miles*. At 6 a.m., thermometer 21°·5; at 9 a.m., 43°·3. The man sent this morning usual to bring water for our use, returned with it in a blanket, in the shape of nps of ice, the stream from which a supply had been got the evening before ving been frozen solid during the night. The cold by this time had become her severe at night. The contents of our teapot, which we used the last thing the evening, were usually found to be frozen hard before morning, lying on the ound beside us as we slept; and to-day we had an additional example of the reme cold. We had filled a bottle with milk got from the Huniyas of Chujiya-, and it was left in a basket outside the tent. During the night it froze into a id mass and broke the bottle to pieces, but as this was discovered before it gan to melt, no harm was done, and we were more careful in future. Our tent, ng made to open all along the top to let out the smoke, as I before explained, in a great deal of cold air, in spite of all attempts made to fasten up the chink, l the temperature inside in the morning was nearly that of the external air; but spite of the cold we got on pretty well.

In approaching the *Darma-Yaukti* we came upon an elevated mound of detritus origin of which was at first difficult to understand, but I was soon satisfied t it must have been the moraine of an old glacier. The breadth of this remark-e mass of detritus was about 3 miles where we crossed it, divided down the centre the river, to which it forms what at first sight were two ordinary alluvial banks. extends 3 or 4 miles below the point where the river quits the mountains, and its hest points are perhaps 200 or 300 feet above the plain, from which it rises eply. The summit was covered in a striking manner with small hollows of more less circular outline, in no way communicating one with another, their sides ping steeply inwards to a flat muddy bottom, such as might have been formed the gradual melting of ice covered by moraine detritus. In other respects, also, material of which the mass was made up had all the characters of a glacier raine, and was certainly neither drifted gravel nor water-worn shingle. I had satisfied myself of the true nature of these mounds, when to my surprise I nd another accumulation of precisely the same nature, along the Gunda Yaukti, which river we halted for the night. The interval between the two old moraines— such they certainly are—is precisely on the same level as the great plain, or, more rectly, is actually a part of it, and it hence became evident that the mounds r which we had passed must have been formed along the rivers, and the agency glaciers readily suggested itself. A very similar mass of detritus to that we nd here would be formed now by the dissolution of a glacier such as that of lam, the lower part of which is for many miles entirely covered with great antities of rocky detritus, with isolated hollows and pools of water scattered r it. The disappearance of the ice from beneath this detritus would leave a dition of the surface in no way differing from that observed on the top of these unds, the formation of which it would otherwise be difficult to explain. I ortly afterwards noticed something of the same description on the flank of one of mountains near *Unta-dhura*, on our way back to *Milam*, where an accumulation of rubbish, with several small pools of water on it, blocks up the end of a ravine —the result, no doubt, of the destruction of a small secondary glacier.

A very cold and violent wind again blew to-day from the recess in the mountains at *Lama-chorten*, and we saw that a fall of snow was taking place at the entrance of the gorge from which the *Darma-Yaukti* issues into the plain of *Guge*. To-day as we went along the plain we noticed the *Ephedra Gerardiana* in considerable quantity, with its red fruit now quite ripe.

September 23. *From the Gunda-Yaukti to Tazang*, 9 *miles*.—At 6·30 a.m., thermometer 15°·5; at 7 a.m., 23°·2. There was a good deal of ice on the *Gunda-Yaukti* as we crossed it this morning, and the stream was considerably less in volume than it had been when we came to it in the afternoon yesterday. We were here visited by a pair of great ravens, which had managed to find out our tent in the middle of this wilderness. Exhibiting the ordinary impudence of such birds, one of them fell a victim to Bachu's gun. He turns out to be identical with the great European raven. So, also, it is curious to find that the common magpie of Tibet is the ordinary English species. The simultaneous discovery, on crossing into Tibet from the Himalayan watershed, of so many European forms, whether in the animal or vegetable kingdoms, is manifestly no mere accidental coincidence.

Leaving the ancient moraines of *Gunda-Yaukti*, we again descended to the level of the plain near the origin of the ridge called *Temba-dhar*, which separates the headwaters of the *Gunda-Yaukti* from those of the *Chu-naku*. We here managed to catch one of the rat-like animals we had seen at Gyanyima. The only new plants were *Biebersteinia emodi*, *Euphorbia tibetica*, and *Scirpus caricis*, with *Agropyron longe-aristatum*, a grass which is found at all elevations above 5000 feet. The botanical and zoological curiosities of this barren region were by this time well-nigh exhausted, and the tedium of our last few days was chiefly relieved by the consciousness that we were very speedily to be released from the discomforts of our Tibetan journey.

The *Chu-naku* was a small clear stream sunk only 20 or 30 feet below the general level of the plain, and shortly after crossing it we once more entered the outer ranges of the Indian watershed, and, following up a ravine with low hills on either side, we encamped at last at *Tazang*. This is one of the chief places where the Juhari Bhotiyas carry on their traffic with the Huniyas, bartering grain for salt and borax. It is said to be a good grazing-ground earlier in the season, but not a vestige of anything for the cattle to eat was now to be seen. The men were more fortunate, for we found that the provisions we had ordered had been waiting for us for the last day or two, and as the weather seemed quite settled, it looked as though our expedition would end with complete success. A little anxiety had at times been evinced by our Bhotiyas lest bad weather should come on, in which case we might have got into difficulties, for the passes from *Milam* into Tibet are sometimes permanently blocked up with snow for the winter by a fall late in September. In that case we might have had to go round by the *Niti* pass, which can be crossed in fine weather all the year round, but this would have been excessively inconvenient, as we could not then have got back to *Milam*, where we had left our servants, tents, and other effects, under three weeks or a month, there being no passage from *Niti* to *Milam* after *Unta-dhura* is closed, except by making a *détour* to the south of 150 miles.

It will serve to show the somewhat indefinite character of the names of places in these regions when I mention that the term *Tazang* is applied to three distinct localities in this vicinity, within 2 or 3 miles of one another. To prevent confusion they are distinguished by the Juharis by the additional affixes *Sukla*, "dry;" *Lam*, "snow-boot;" and *Huniya*, Tibetan. That at which we encamped was *m Tazang*, where the tents of the *Patwari*, or headman of Milam, are commonly ched. Others of the Bhotiyas go to *Sukha-Tazang* or to some intermediate point the ravine between these two places, and the *Huniyas* frequent the spot called er them. It will be easily understood that, with the numbers of sheep employed this trade, it is necessary that there should be a certain amount of elbow-om allowed between the different camps.

As we arrived at the end of our march rather earlier than usual, the following tes were made of the temperature :—

p.m.	Air.	Wet Bulb.
At 4·0	42°·7	29°·8
„ 5·0	35°·4	25°·1
„ 6·0	30°·2	24°·6

This indicates the extreme dryness of the air.

September 25. *Tazang to Chirchun*, 10 *miles*.—At 8 a.m., thermometer 32°; at a.m., 35°; at 10 a.m., 40°·5. We had now again fairly got among the moun-ins, and the road gradually became more rugged as we proceeded. The rocks

Chor-hoti pass, 18,000 feet. Malchak peak, 19,800 feet.

RAJ-HOTI VALLEY, 14,900 FEET.

ere chiefly of limestone, and the greatest confusion prevailed in the disposition of e strata, though, as usual, on the whole they dipped northerly.

In our way along one of the ravines we came upon the remains of an old dry one wall, which we were told was a traditional boundary between Tibet and *Juhar*, ough regarding the time or manner of its construction nothing was known. I do ot think that our Bhotiya subjects have any definite ideas as to the boundary tween the British possessions and those subject to Lhasa; nor indeed am I aware at any boundary has ever been settled between the two powers. We English in umaon affirm that the watershed is the boundary, and I think no one will dispute e assertion. I was indeed told that *Hoti*, a pasture ground north-east of *Niti* ithin the watershed, was considered by the Tibetans to be a dependency of *Daba*. ut as it was convenient for me to consider it British ground when I was geologizing ere in the following year, I did not find any one, either Bhotiya or Tibetan, inclined to deny my positive assertion that it was British. A dispute about a few square leagues of snowy range will hardly give rise to a *casus belli* between us and the Government at Lhasa, and the geographers on both sides may, I think, be safely left to put the boundary in their maps where they please.

In descending into the most eastern of the main feeders of the *Chirchun* river, we crossed limestone strata filled with fossil shells. These were probably the Cretacean beds overlying the Jurassic strata, which immediately afterwards we came upon in the Oxfordian black shales, which continued up to the main branch of the river. This runs in a very wide shingle bed, probably a mile across, through these disintegrating strata, and, following it up about a mile further, we reached the halting-ground on its left bank called *Chirchun*. A second feeder of the Chirchun river, rising from a glacier that we saw about 2 miles off, joins the main stream just where we crossed it.

Chirchun is about as miserable a place to stop at with cattle as can be well imagined. The flat ground is covered with loose rotten shale without a particle of vegetation on it, and on the hills around there is an almost total absence of vegetable life. At this season the leaves of the few stunted plants that were to be seen had already become parched up by the severe night frosts, and our wretched cattle had to pass another day with nothing to eat but the dry twigs of the *dama* bushes. The feet of nearly all the jhobus were getting affected by the rough ground we had been going over, and one of them to-day fell so lame that, on coming to a green bit of ground, it resolutely resisted all attempts to drive it on, and was there left for the winter, as we supposed, to perish. I confess I was rather astonished the following year, when I was told that the animal had been found again in capital condition near the place where it had been left by us. What it had found to eat during the interval is more than I can imagine, but it was, I suppose, as well off as the wild sheep and yaks and other animals of Tibet at large.

In the course of the evening a considerable commotion took place in our camp, caused by the appearance of a solitary dog, who was on his way from Milam back to his fatherland Tibet. It was supposed that he had been sold or given to some Bhotiya, but that he declined to remain at Milam, a thing said often to happen. As it was probable that the animal was hungry, there was no little alarm lest he should come and eat up anything he could find during the night; to such an extent, indeed, was the anxiety of our Bhotiyas carried, that they thought it worth while to post a sentry to keep him off.

At 9 p.m., thermometer 25°·5.

September 25. *Chirchun to Shelong*, 17 *miles*.—Having a long day's work before us, which included the crossing of three passes between 17,500 and 18,500 feet in altitude, we started this morning soon after seven o'clock. The ascent commenced immediately, and was pretty easy the whole way up the first pass we had to cross. At first we went over solid limestone rock, but as we rose we again came to the Oxfordian shales, which continued to the summit of the ridge, where parts of them were quite filled with belemnites. We reached the crest of the first pass, *La-Khur*, 18,170 feet, at a little before eleven o'clock, thermometer 27°·3, having been not quite four hours in accomplishing the ascent of 2410 feet. The sky at this time was quite cloudless, and though we were somewhat shut in by higher ridges close to us, we still had a wonderful view of the world of mountains by which we were surrounded. There was little that resembled the grand prospects of the outer Himalaya, where the eye may sweep at a glance over nearly 200 miles of the chain, and trace from their great snowy axis mountain after mountain and range after range gradually unfolding themselves, till the entire circuit of the horizon is filled with the outlines of their countless ramifications, dark purples of the distance imperceptibly melting into the liveliest tints the foreground, the ridges clothed with forest, and the valleys enlivened by ds and villages. Unlike this, we here stood in regions where the lichens on rocks were the last refuge of vegetation. Shattered cliffs and impassable cipices, capped with eternal snow, frowned upon us from every side. Yawning asms, long barren slopes of loose stones, and the desolation of glaciers lay at our t. The mountains that bounded our view stood out hard and cold against the ar blue sky, piled one behind the other in a chaos of confusion, neither softened outline or colour by atmospheric influences, nor relieved by any trace of life or dure. Among the peaks that I recognized was *Nanda Devi*, distant about 20 les, which rises to 25,400 feet; but our map, when we passed, was not nearly so fect as it now is, and in such a scene it is extremely difficult to distinguish the ges and peaks without a good map to assist the eye.

On this ascent the vegetation was most scanty, the last plant seen being the tle *Urtica hyperborea*, before noticed, which came up probably above 17,500 t. From the pass we looked down over two glaciers. That to the east along side of which we had come gives rise to the principal feeder of the *Chirchun* er, and communicates by a great *névé*, over the pass called *La-sar*, with other glacier, over which, as I before mentioned, ineffectual attempts had been de to establish a direct communication from *Dung* to *Chirchun*. The glacier to west of the pass supplies the chief feeder of the stream that flows under *Topinga* and *Girthi*, and our road lay down it. The descent was fearfully steep, er a cliff of limestone interspersed with the great slopes of loose sharp fragments rock that are so characteristic of these mountains above the limit of vegetan. For the first time since quite the beginning of our journey, I thought the cent so bad that I would not ride my jhobu down it, though, in fact, it would, believe, have been safe enough to do so. The slopes of loose sharp angular ces of limestone lying at their natural angle of repose, between thirty and forty grees from the horizontal, varied here and there by a step of solid rock polished the feet of men and cattle, down which, slippery as they were, the jhobus d half to jump, half to slide, did not afford an inviting prospect for such a ride; alse step must have shot the rider over the animal's head, and he would then, thout fail, and in an incredibly short time, have been added to other rubbish on moraine of the glacier below.

We managed, however, to reach these moraines in a more convenient manner. e found them and the lower part of the glacier generally very black from the k shales and limestones which are here the prevailing rocks. Crossing the cier, we went up the opposite moraine, and a steep pull brought us to summit of *Jainti dhura*, the second high ridge we had to go over, at about lf-past one o'clock. This point was about 18,390 feet above the sea, and is one the highest passes that I have crossed. The thermometer in the air stood at $^{\circ}\!\cdot2$, the soil one foot below the surface being $31^{\circ}\!\cdot5$.

Jainti is merely a short projecting spur from the *Unta-dhura* watershed ridge, er which the route from *La-khur* to *Unta-dhura* crosses. From it rises a peak at reaches an elevation of perhaps 19,000 feet, a little to the north of the point ere we crossed it, and beyond this it ends abruptly in a precipice over *Topiunga*. Being thus thrust out, as it were, from among the surrounding great ges, though it is probably as high as most of them, the view from *Jainti-dhura* grand in the extreme.

In passing through the highest portions of these mountains, the traveller, who turally expects to find scenes of surpassing grandeur in the midst of their gantic snow-clad pinnacles, is too often doomed to disappointment, and in his painful progress along the narrow gorges he seldom sees anything beyond the rocks that frown immediately over his head. Exceptions there are, however, and the scene that we here had presented to us was among these so often hoped for, but so seldom found; nor do I ever remember to have beheld, either before or afterwards, such a stupendous chaos of mountains, of the effect of which on the mind no description could convey an adequate conception. It was a brilliant day; the wind not too strong, and the intense power of the sun was agreeably subdued by the fleecy white clouds which hung about the higher peaks, or floated off from them in the fresh breeze until they disappeared in the blue sky of Tibet. High health, the feeling of exhilaration felt in sharp and dry air, and the satisfaction which we experienced at the successful termination of our journey, prepared us to enjoy whatever we saw. Nor are the silent and almost unperceived suggestions of scientific culture among the least important agents in producing the emotions of wonder that fill the mind in gazing on such scenes, where the relics of the ocean-beds of an almost measureless past, piled one on another at these stupendous elevations, display the vastness of the powers of nature, into the operations of which we strive not too successfully to inquire. The glacier along which we had just come descended thousands of feet below us, and gave birth to the *Girthi* river, a torrent the course of which was marked by a streak of foam along the great gulf into which we looked. A huge rock rose from the middle of this glacier, throwing off the frozen stream on either side in great wave-like cliffs of ice. *Unta-dhura*, the first pass we had crossed on our way into Tibet, we now saw, not a little to our surprise, almost at our feet, 800 feet below us. Yet no snow lay on the ridge on which we stood, neither had we hitherto crossed any snow in our ascent either on the *La-khur* pass or to the still higher spot where we then were. Of vegetation there was no vestige, excepting far down in the gorge of *Topi-dunga*, beyond which towered *Kamet*, the great peak of the *Garhwal* watershed, 25,502 feet in altitude.

The cliffs that flank *Topi-dunga* on the south are of Upper Silurian age, and are violently shattered and most precipitous. The order of succession of the beds, which extend from Silurian to Carboniferous, is strongly marked by their vividly contrasted colouring. Grey, black, and dark red, having a pale band of quartzite on the top of all, which looked almost ghastly among the snow that lay thick upon it. The escarpment of Kyungar facing the south-west is as abrupt as is well possible, but is topped with a less rugged and more swelling outline. It is composed of Triassic and Rhœtic capped with Cretaceous beds, and a continuation of it, no less precipitous, extends beyond *Girthi* along the north bank of the *Hoti* river. Beyond *Hoti* the continuity of the ridge is broken, but as a geological feature the escarpment can again be recognized at the *Niti* pass.

An easy descent brought us to the north foot of *Unta-dhura*, where we found that fresh snow had fallen since we had crossed. The old snow, which must have been the accumulation of former years, was distinguished by an appearance of stratification caused by the edges of a succession of icy bands projecting obliquely from the general snow surface, with as many intermediate layers of softer snow between them. The lamination may be readily understood as the effect of the freezing of the surface of successive falls of snow, and is commonly to be seen in similar circumstances. It was in the hollow between *Jainti* and *Unta-dhura* that I noticed the remains of the old glacier which I mentioned when describing the old moraines on the *Darma Yaukti*. On the summit of *Unta-dhura*, which we reached at a quarter to three, there was no vegetation whatever, excepting a few lichens on the shattered rocks that crown the ridge. The thermometer was now at 31°·2.

I have already described the route from *Unta-dhura* to *Milam*, which we now ain joined, and I need only add that our descent was undertaken under very fferent auspices from our ascent. Our return journey over these passes had, in ct, been anything but painful, and there was, I think, no day which we had spent agreeably since we left *Milam*. We were, however, late in reaching *Shelong*, iefly from the cattle being generally knocked up by want of food, and from many them having sore feet. This indeed had got to such a pitch that their track was arked over the glaciers in blood, but it was impossible to loiter; nor could we lt at *Dung*, for there was not a scrap of wood nor a blade of grass to be got there.

We ourselves arrived at *Shelong* shortly after seven o'clock in the evening, ving been nearly twelve hours on the road; but the tents did not come up for long time, and we had an opportunity, as we sat in the open air by a fine blazing e of juniper, such as had not rejoiced us for weeks, of admiring the genial armth of the climate of a spot only 12,500 feet above the sea-level. The following orning, September 26, we returned to *Milam*.

The day after our arrival at Milam, a Huniya arrived from Dungpu, a village ar the Satlaj, sent by the Zungpun of Daba, who had by this time become vare of our having gone into Tibet, to inquire where we had been, and to see hether we had come back. The zungpun had sent his emissary from Dungpu, he passed that place on his return home from Darchin, where he had been to eet some Lhasan officers, probably those we had heard of at Chujia-tol. He d no definite knowledge of our movements, but had heard that we had crossed e frontier. I desired a message to be sent in return to tell him exactly where e had been, and I added, that if it suited me to go into Hundes again next year should certainly do it. I had no idea at the time of doing anything of the sort, ut I did actually carry my threat into execution. At the same time it must be id that it is very doubtful whether my message was ever delivered to him.

Note on Himalayan Glaciers.

The largest Himalayan glacier with which I am personally acquainted is that ear Milam, at the head of the Gori river; but those of the Vishnuganga, near adarinath, and of the Bhagirathi, near Gangotri, are also extremely large.

The annexed woodcut (p. 412) will convey an idea of the size of the Gori and ishnuganga glaciers, of which we have rough plans, as compared to some of the est-known glaciers of the Alps.

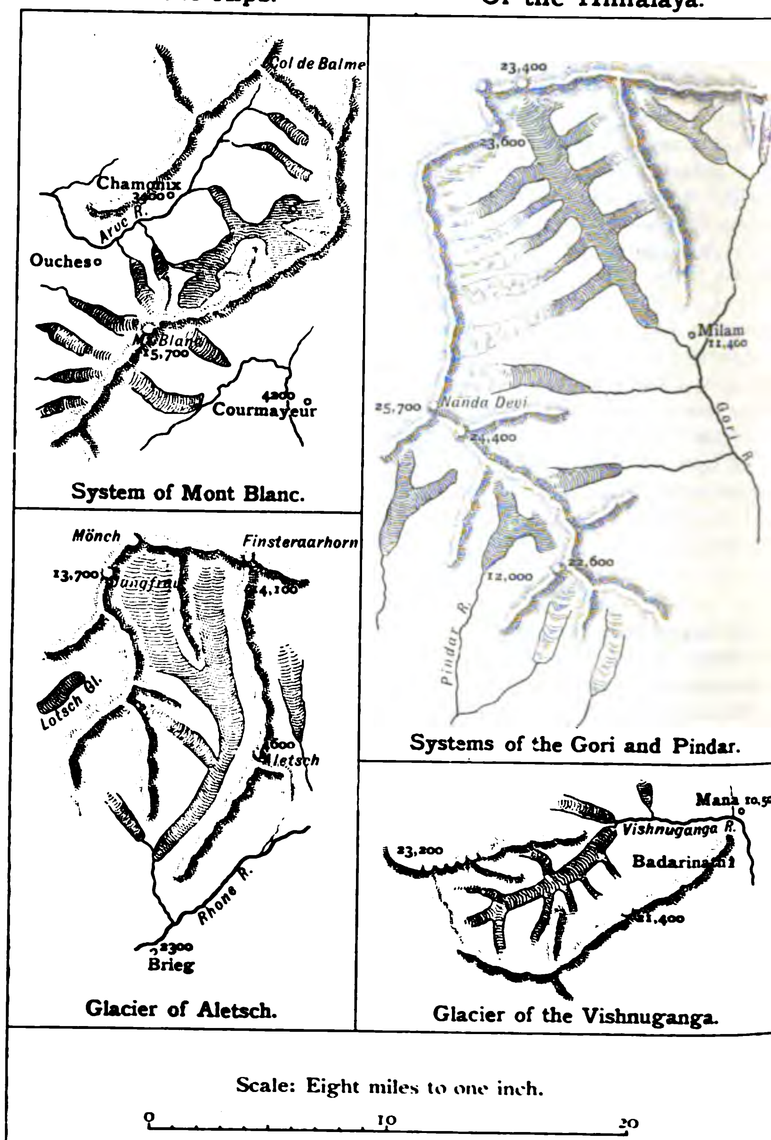
It will here be seen that the Gori glacier alone, the surface of which is about 1 miles long, is so large that it would about fill the whole valley of Chamonix, om the Col de Balme to Ouches; at the same time, while the summit of Mont lanc rises about 12,300 feet above Chamonix in a distance of 6 miles, the peaks t the head of the Gori glacier rise above Milam, at a distance of 12 miles, nly 12,200 feet. The glaciers of the valley of Chamonix are not by any means he largest in Switzerland, and the glacier of Aletsch, in the Vallais, must, dging from the map, be nearly as long as that of the Gori, or even longer, but he valley of Chamonix is so well known, that the comparison with its glaciers ill probably be more generally appreciated.

On the southern slope of the tableland, the glaciers appear to descend somewhat ower in the north-western regions than in the eastern; Dr. Hooker informing us hat they seldom, if ever, descend so far as 14,000 feet in Sikim,* while they fre- uently reach below 12,000 feet in Kumaon. Immediately north of the Indian atershed, the glaciers are smaller than to the south of it, and terminate at much igher levels, varying from 15,000 to 17,000 feet; in the central parts of Western

* 'Himalayan Journals,' vol. ii. p. 57.

GLACIERS

Of the Alps. Of the Himalaya.



System of Mont Blanc.

Glacier of Aletsch.

Systems of the Gori and Pindar.

Glacier of the Vishnuganga.

Scale: Eight miles to one inch.

Walker & Boutall

Tibet they appear to be comparatively rare and of small dimensions; but on the Turkish watershed they again become much larger, and some of them come down even a little below 12,000 feet, though others on the same range terminate as high as 15,000 feet.* In the countries north-west of the Indus, near Gilgit, Mr. Winterbottom found one of the glaciers to descend as low as 8600 feet.

The variations in the levels to which these glaciers descend must, in a great degree, depend on the peculiar circumstances of each individual locality, though the mean temperature of the place will of course, to some extent, regulate their general elevation, and the summer temperature will give a negative limit, beyond which they can never pass. The two chief factors of these variations will be, first, the extent and elevation of the snow-basin that feeds the glacier; and, second, the slope of the surface along which the glacier travels. It will be seen, on a moment's consideration, that if two glaciers are formed on opposite faces of a ridge like the Indian watershed, which descends on the south side from 18,000 to 11,500 feet in a direct distance of 10 miles, while on the north the descent is only from 18,000 to 16,000 feet in the same distance, a south glacier of 10 miles long will arrive at a level of 11,500 feet, and a north glacier of the same length only 16,000 feet. If the feeding snow-basin is larger on the south face, the additional waste from the glacier descending into warmer regions may be easily countervailed, but no imaginable increase in the supply of snow would be likely to carry the north glacier to such a level as 11,500 feet, which it might not be able to attain without an extension of its length of 100 miles or more. These considerations, combined with the known diminution in the fall of snow in the interior of the chain, appear to be sufficient to account for the higher level at which the glaciers terminate to the north of the Indian watershed, without supposing any special action of climate as has been suggested.

No really satisfactory conclusion can be come to regarding the cause of the lower level to which the glaciers of the Himalayan slope descend in Kumaon, as compared to Sikim. Judging from the somewhat greater elevation to which forest extends in Sikim, we may, perhaps, have some reason to infer a rather higher mean temperature at like elevations in Sikim than in Kumaon, which, indeed, might be considered a natural result of the lower latitude of the former; but our thermometric data are not sufficient to settle the point directly, and the climate of Sikim being so much more wet than that of Kumaon, it would be unsafe to make use of mere *à priori* arguments.

For similar reasons, it is hardly possible to institute any proper comparison between the glacial phenomena of Europe and the Himalaya, but the following points may be noticed:—

HEIGHTS ABOVE SEA-LEVEL.

	Europe.		Tibeto-Himalayan System.		
	Norway.	Alps.	South of Indian watershed.	North of Indian watershed.	Turkish watershed.
	Ft.	Ft.	Ft.	Ft.	Ft.
Snow-line	3000-5500	8500	16,000	18,000	20,000
Glaciers end ...	0-1500	3500-6000	11,600-13,000	15,000-16,000	11,800-15,000
Glaciers descend below snow-line ...	3000-4000	5000-2500	4400-3000	3500-2500	8200-5000

* *R.G.S.J.*, vol. xxiii. p. 52; Thomson's 'Travels in Tibet.'

From these figures it will be seen that the range of glaciers compared to the snow-line, is very similar in Europe and on the Himalaya, though in Northern Tibet, in one well-ascertained instance, in Yarma-Nubra, a glacier is known to descend more than 8000 feet below the limit of perpetual snow. The glacier seen by Mr. Winterbottom, north of Gilgit, coming down to 8600 feet, that is, perhaps to more than 10,000 feet below the snow-line, is yet more extraordinary; but the elevation is not so well determined in this case; nor have we any direct evidence as to the height of the snow-line on the mountains in this quarter, though from the general arid character of the country, we have no reason to suppose the climate to be more wet than Northern Tibet generally, or that the snow would lie lower there than on the Karakorum pass, where it has been estimated by Dr. Thomson not to come below 20,000 feet. This point is worthy of the attention of travellers in these countries.

In the absence of satisfactory records of the thermometer at places on the Alps, near the termination of a glacier, I have calculated the mean temperature of three of the hottest months for Chamonix, by interpolation, in proportion to its elevation, between Geneva and the Convent of St. Bernard, and I find them to be—July, 61°; August, 61°; September, 55°. Taking Vevay as the lower station, instead of Geneva, which appears abnormally hot, the temperatures would be—July, 59°; August, 57°; September, 52°. For three years the mean temperature of Zermatt was, for July, 56°; August, 51°; and September, 49°. At Grindelwald for two years: July, 60°; August, 57°; and for one year: September, 50°. These figures may be compared with the mean observed by myself at Niti, at 11,600 feet, the extreme limit of glaciers in Kumaon, which will be seen to be nearly the same, namely, July, 58°; August, 58°; September, 55°. So, too, in Norway, the approximate summer temperatures at the termination of the southern groups of glaciers, which descend to about 1200 or 1300 feet above the sea, may be taken at 4° less than the mean of Bergen and Drontheim, that is, July, 59°; August, 55°; and September, 50°. And for the more northern regions, where the glaciers reach to the sea-level, we might have temperatures intermediate between Drontheim and Alten, or July, 60°; August, 57°; and September, 49°. From this, it would appear probable that the extreme limit to which glaciers can reach will not have a mean temperature of the hottest month exceeding 59° or 60°.

All the phenomena of glaciers seen elsewhere are to be observed on those of the Himalaya and Tibet, and, with two exceptions, they will require no special comment.

The first of these is the velocity of the motion of the ice, which must, of course, greatly depend on the circumstances of each particular case; but an analogy with the motion of the glaciers of the Alps is sufficiently shown by the few observations I have made in Kumaon. The mean of four days' motion in May, on the glacier at the source of the Pindar, gave a velocity of about 9½ inches for the twenty-four hours, for the central parts of the ice, about 1¾ mile above the terminal cave. The same glacier, from May 21 to October 15, moved over 98½ feet, being at the rate of just 8 inches in the twenty-four hours.* The motion of the centre of the great glacier of the Gori, 7 or 8 miles from its lower extremity, was 38 feet, between August 29 and September 30, being at the rate of about 14¼ inches in the twenty-four hours. In juxtaposition with the above, I may add, that the motion of the Mer de Glace, as measured by Prof. J. Forbes, varied from 27 to 9 inches in twenty-four hours in different parts of the glacier and at

* For details of the first measurements made by myself of the motion of the Pindari glacier, see *J.A.B.S.*, vol. xvii. p. 203.

different times between the months of June and September; the mean at a central point (L'Angle) being about 13½ inches in twenty-four hours for the three months of July, August, and September.* The motion of the middle part of the glacier of the Aar is also stated by M. Martins to be 71 mètres per annum, which amounts to 7½ inches in twenty-four hours.†

THE DATE LINE IN THE PACIFIC.‡

Dr. A. M. W. Downing, F.R.S., has kindly supplied us with the following. He has also obtained permission for the reproduction of the interesting map which accompanied his paper.

The point to which attention is drawn in this paper is this: Where does the day change for the portion of continents and islands which are contiguous to the 180th degree of longitude? or, in other words, what is the course of the date line (as it is called) from the arctic to the antarctic regions?

It is obviously most convenient that the date line should approximate, as closely as political and geographical circumstances will admit, to the 180th degree of longitude. Prior to about the middle of the present century this was far from being the case. Up to that time the Philippines kept the American date, owing to the fact that the Spaniards originally approached those islands from the Pacific coast of America. Thus Luzon and Celebes, though on the same meridian, kept different dates, the former the American, the latter the Asiatic. To remedy this inconvenience, the Manila authorities arranged that December 30, 1844, should be immediately followed by January 1, 1845, thus adopting the American date for the archipelago.

The purchase of Alaska by the United States had also its effect in straightening the date line, as this territory, which had formerly kept the Asiatic date, from henceforth, of course, adopted that of America. Further progress in the direction of the assimilation of the date line to the 180th meridian must necessarily be slow, as the course of the line is mainly determined by the grouping of the islands, and by the particular circumstances in each group upon which depends the direction in which it has intercourse with the outer world.

A glance at the map which accompanies the paper will show the discrepancies that, at the present time, exist in the position of the date line as laid down by different authorities. The most remarkable divergence is in the case of the line given in Stieler's Hand Atlas. But as the Atlas is dated 1892, this position of the date line may, perhaps, be considered as not being quite up-to-date. The line marked "Wharton" is that of the Hydrographic Office, and was kindly communicated to the author by Admiral Sir W. Wharton; that marked "Smith" is taken from an interesting article in the *Century Magazine* for September of last year, by Mr. Benjamin E. Smith, who, however, does not give his authority for the position of the line; that marked "Davidson" is due to Prof. Davidson of the University of California, and was kindly communicated by Prof. Harkness of Washington.

* 'Travels through the Alps,' chap. vii.

† 'Revue des Deux Mondes,' vol. xvii. p. 924.

‡ Abstract of a paper entitled "Where the Day Changes," recently read to the British Astronomical Association, and which is printed in the *Journal* of that Association, vol. x. No. 4.

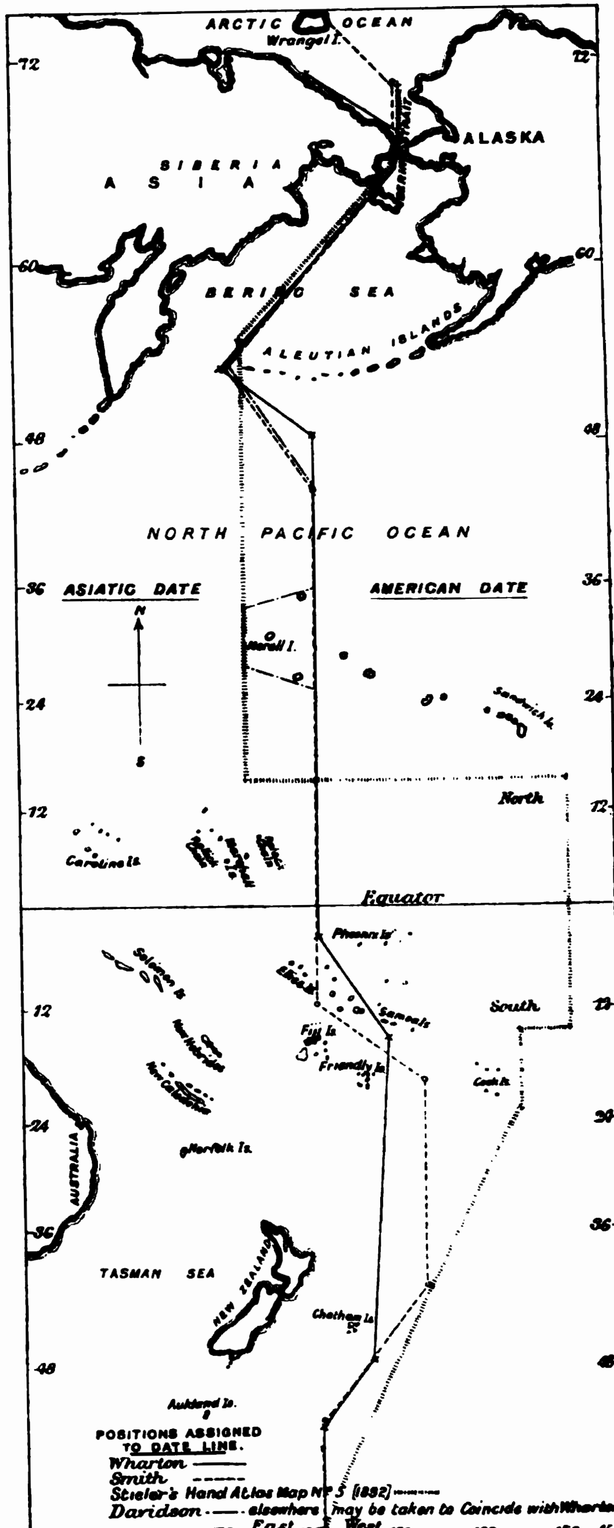


CHART SHOWING DATE LINE IN THE PACIFIC.

It will be noticed that Wharton and Davidson only differ in unessential particulars, affecting one small group of islands. It may, therefore, be concluded with some confidence that we have in these two lines an almost certainly accurate delineation (with the exceptions referred to) of where, at the present time, the day changes.

THE MONTHLY RECORD.

EUROPE.

Dr. Cvijić's Researches in Macedonia.—Prof. Jovan Cvijić continued his researches in Macedonia during the summer months of 1899, and is now engaged in the preparation of a geological map and geomorphological description of the country. He has also paid special attention to an examination of the lakes of Macedonia, the results of which are of much interest. The soundings, over two hundred of which were taken in the larger lakes, show that Lake Ochrida is one of the deepest in Europe, coming tenth in order with a maximum of 286 metres (938 feet). It is thus 34 metres (111 feet) deeper than the Lake of Constance, which has more than double its area, and apart from Loch Morar in Scotland (329 metres, or 1079 feet), a Norwegian lake, and the wide basin of Lake Onega in Russia, is surpassed in depth only by some lakes in the Southern Alps. Lake Prespa, or Presba, is, on the contrary, only 54 metres (177 feet) * deep, and Lake Ostrovo, situated further east on the Monastir-Saloniki railway, 61 metres (200 feet). The smaller lakes are, comparatively, very shallow. Lake Ochrida is fed by a large number of strong springs—in fact, it may be said that its deep basin is entirely filled by spring-water. Its colour is accordingly an extremely pure blue, and the white sounding-lead can be distinguished at a depth of 40 feet. The maximum temperature gradient (*i.e.* the most rapid diminution of temperature in a downward direction) occurs at a surprisingly great depth in all the Macedonian lakes, being found in some almost as much as 25 metres (82 feet) below the surface. Prof. Cvijić proposes to publish bathymetrical maps and profiles of the lakes (the former on the scale of 1 : 100,000) on the model of those in Penck's works on the lakes of Austria, and Dr. Mill's maps of the English lakes.

ASIA.

M. Bonin in North-Western China.—The first number of *La Géographie* (p. 57) contains news of the progress of M. Bonin (*Journal*, vol. xiv. p. 206) down to August, 1899. From Ning-Hsien-fu (Ning-hia ?) he had crossed the Alashan desert by a new route, differing from those of Prjevalsky and Potanin, to Liang-chau in Kansu. The passage of the desert occupied fifteen days, water being met with almost daily, except in the region of dunes known to the Mongols as Tingri ivissu (celestial dunes), which are formed of sand so fine that the least breeze is sufficient to obliterate the tracks. It is therefore necessary to depend solely on the instinct of the camels for the maintenance of the proper direction.

AFRICA.

Moore's Tanganyika Exploration.—Apropos of the communication by Mr. Fergusson on Lake Tanganyika in the present number, a telegram from Sir

* Dr. Oestreich (*ante*, p. 174) was told by the fishermen that the greatest depth was forty times the span of the outstretched arms, the difference being easily accounted for by the probable deviation of their lines from the perpendicular.

Harry Johnston to the Foreign Office has been communicated to the Society stating that Mr. Moore's expedition has safely reached Uganda.

African Trade.—The various consular and colonial reports issued during the past year enable us to obtain a general view of African trade during 1898, the last year for which full returns are available. The great bulk of the trade of the continent belongs still, of course, to the older extra-tropical European possessions, fully 70 per cent. of the total being divided between Cape Colony (with total trade of 42 millions), Natal (6·6 millions), Algeria (22·9 millions), and Egypt (22·8 millions). Next to these come Mauritius (5·8 millions), Portuguese East Africa (4·4 millions, including goods in transit), and Tunis (3·9 millions). Other countries, however, show a steady increase within recent years, though much of this is due to a greatly increased export of rubber, obtained too often by wasteful methods which must lead before long to a reduction in the supply. In certain cases the increase is due to imports for railway construction, etc., and not to normal commerce. Of the tropical dependencies of European countries, Zanzibar comes first with a total of just over three millions; but this is, of course, made up mainly by transit trade to the adjacent coast territories. Senegal, Portuguese East Africa (special trade), and the Congo State all showed totals of over two millions, Angola and the Gold Coast falling very slightly behind; while Lagos, the Niger Coast Protectorate, Réunion, and German East Africa all passed the total of one million. The British colonies continue to do a preponderating proportion of their trade with the mother country, but a falling off of British trade is recorded in several of the foreign possessions, *e.g.* Madagascar (owing to the new tariff), Angola, and the Congo State. With many of the French West African colonies, however, it has shown a marked increase during the past few years, the total volume of British trade with these having more than doubled since 1894, while the import of British cottons has risen since that year from £114,000 to £391,000. Much of the trade of French Guinea and Dahome passed respectively through Sierra Leone and Lagos, but efforts have lately been made to divert the trade from the former to Konakri. In Senegal France maintains a decided ascendency. The trade of the German possessions, as recorded in a recently issued *Weissbuch* (No. 20), shows a general increase, the most promising colony being, perhaps, the Cameroons, where the plantations of cacao supply £15,000 worth of that article for export. The natives are said to show some willingness to work. In the Congo State and Angola, where rubber forms by far the largest article of export, the trade is chiefly in the hands of the Belgians and Portuguese respectively, though the Germans are now obtaining some footing in Angola, and threaten the position of the British. On the East Coast trade is not generally so active, and in Portuguese East Africa especially the exports are small, while the imports are largely swelled by goods in transit to the Transvaal and Mashonaland, and by materials for the Beira railway. The last returns for British East Africa show a slight falling off of trade, while in German East Africa the exports form little more than a quarter of the total.

Proposed new French Expedition across the Sahara.—The impetus lately given to French operations in the Northern Sahara has led to the organization of an expedition, supported by the Paris *Matin*, for the study of a route for the proposed Trans-Sahara railway to Lake Chad. Its leader is to be M. Blanchet, who will be accompanied by a geologist and several engineers. According to *Petermanns Mitteilungen*, in which this announcement is made, the whole of the Sahara between Insalah and Timbuktu—also, according to present plans, to be eventually traversed by a railway—is to be formed into a separate government under the name Mauritania.

Telegraphic System in French West Africa.—In the first number of *La Géographie*, M. Binger gives a useful historical sketch of the development of telegraphic lines in French West Africa, with a sketch-map showing the lines open, constructing, and projected. The writer points out the valuable results towards the establishment of French influence in West Africa which have followed from the methodical extension of the telegraphic system, commenced in 1862 by the first step towards a line from Dakar to St. Louis. The first direct communication between France and Senegal was effected in 1884 by the line connecting the colony with the Canaries. Since that date the lines have been pushed constantly forward towards the interior, which is now better provided in this respect than any other part of tropical Africa. From four starting-points on the coasts of Senegal and French Guinea lines have been carried towards the upper Niger, with various connecting lines between them. All unite before reaching Bamako and Segu, from the latter of which a northern line continues to Timbuktu, while a more southerly one traverses the countries within the bend of the Niger, and ultimately reaches the coast of Dahome. A branch line will soon reach Kong from the north, and may ultimately be continued to join the system of the Ivory Coast, which at present consists of a line parallel with the coast through the whole length of the colony and a short branch towards the interior. Other projected lines are: (1) a connecting line from French Guinea to the western extremity of the Ivory Coast; (2) a line from Bandiagara (to which a branch already runs from the Senegal-Dahome trunk line) to Say on the Niger, with a connecting link thence to the Dahome line.

The Iron Industry in Togoland.—In the fourth number of the *Mitteilungen aus den Deutschen Schutzgebieten* for 1899, F. Hupfeld gives a sketch of the iron-workings at present carried on by the natives in Togoland. Iron ore is everywhere found in the crystalline schists, of which the mountain zone running through the country in a north-easterly and northerly direction is composed. But though traces of former workings are seen in many parts of this zone, the industry is practised at the present day in two districts only—that of Basari and Banyeri in the north, and that of Boem in the centre. The production is greatest in the former, which is a country of isolated hills rather than mountain ranges. The inhabitants speak a language different from that of their neighbours, though said to present analogies with that of the Gurmas further north. They have a hatred of strangers, and are little touched by Mohammedan or European influence, so that the iron industry is with them in its primitive condition. In the Boem district the production is already diminishing owing to the importation of European (principally English) iron. The craft of the blacksmith will, however, continue to be practised, though perhaps subject to modifications. The writer gives full details as to the methods of smelting, etc., employed, with illustrations of the furnaces used in the different districts.

Brazzaville.—A large-scale plan of the French station of Brazzaville is given in the *Dépêche Coloniale* for February 18–19, accompanied by a sketch of the development and prospects of the place by Emile Lenoir. The plan shows the quarters reserved for the present and future Government buildings, and the concessions hitherto secured by various commercial companies, the whole extending, with some intervals, for a distance of 2½ miles along the shores of Stanley pool. M. Lenoir lays stress on the exceptional advantages presented by the site, which will make it, he thinks, one of the most important African centres in the future, possibly receiving the commerce even of Adamaua and the region of Lake Chad. Its great need is that of a railway to the coast, though a great development is already noticeable since the opening of the Belgian railway. It is already provided with telegraphic communication with the coast.

Region of Maximum Rainfall in West Africa.—A record of the rainfall at Debunja, a plantation on the western flanks of the Cameroons, which has been kept regularly since 1895, shows that that locality is not only the rainiest in all Africa (so far as can be affirmed in the present state of our knowledge), but the second rainiest district on the globe. The excessive rain of 1895 was thought to possibly indicate that the year was an abnormal one, but subsequent observations prove that this was not the case, the rainfall of each of the succeeding years having slightly exceeded the total for 1895. The results of the observations for 1898, with a comparison with the total of the three preceding years, are given in the *Mitteilungen aus den Deutschen Schutzgebieten* for 1899, the mean for the four years being 9462 mm. or 372·5 inches, as compared with a fall of 475 inches at Cherrapunji. Records from a second station on the west of the mountain, extending with some breaks from the end of 1895 to September, 1899, are published in the first number of *Petermanns Mitteilungen* for the present year. They show that the rainfall here agrees closely with that at Debunja, the annual mean being 9344 mm. or 367·9 inches. The months from June to October show the largest totals, and December and January the least. An amount of 12 inches has more than once been recorded in a single night. Such excessive rainfall seems to be limited to a small area, records from other stations in the territory showing a much smaller amount. At the government station on the Cameroons river the mean of the five years 1894–98 shows an annual fall of 158 inches only.

Disaster to Dr. Pleyn's Expedition in the Cameroons.—We have already referred (*Journal*, vol. xiv. p. 444) to Dr. Pleyn's exploration in the south-west corner of the Cameroons territory, to which he went, by way of the Congo, for the purpose of furthering its economic development. It is now announced (*Pet. Mitt.*, 1900, p. 48) that while attempting to open direct communication with the Yaunde station in the centre of the territory, Dr. Pleyn lost his life from a poisoned arrow on November 24 last, during an attack by the Busa tribe. The deceased traveller was apparently Dr. F. Pleyn, who in 1898 published a work on the climatology and hygiene of the Cameroons, as he is spoken of as a forest officer, while Dr. A. Pleyn, who has also done scientific work in the territory, belongs to the medical service.

Meteorology of Tropical Africa.—The eighth report of the British Association Committee on the climatology of Africa, drawn up by Mr. Ravenstein, is published in the recently issued general report of the association for 1899. The number of stations from which returns have been received reaches the high total of forty as compared with twenty-six during the previous year. The most valuable work has perhaps been done in Nyasaland, where the meteorological service has been organized by Mr. J. McClounie, head of the scientific department. We are glad to see that the very complete series of observations inaugurated by Mr. John Moir at Lauderdale in 1894, of which only two years' results had been previously published, has been continued without a break, being now brought down to 1898 by the publication of three additional years' records. During Mr. Moir's absence in 1896 the observations were made by Mr. Thomson. The series now bears comparison with those obtained by the Germans at the Cameroons and elsewhere, and the hours of observation (6 a.m., 2 p.m., and 9 p.m.) agree with those adopted by the latter, except the first, which is an hour earlier at Lauderdale. At the new stations at Zomba and Fort Johnston the first observation is made, as by the Germans, at 7 a.m. At Mombasa a continuous record (though not so detailed) has been kept by Messrs. Pigott and Craufurd since 1894, but the full observations begun in 1896 by the Scotch missionaries at Kibwesi, have been interrupted by the removal of the mission from that station. They are being continued, however, at the new station in Kikuyu. A record has been kept by Mr. Ormerod of the level of the Tana river at Golbanti, which shows that the floods reflect two rainy seasons, which are not those of the lower river, but of the country at its source near Mount Kenya. The Tana is therefore a miniature Nile, and offers great potentialities for irrigation.

Geological Features of German Nyasaland.—At a meeting of the Berlin Geographical Society in December last, Herr W. Bornhardt gave an instructive paper on the "Geography and Geology of German Nyasaland," a report of which appears in the last number of the *Verhandlungen* for 1899. Herr Bornhardt has been principally known for his discovery of workable deposits of coal in the basins of the Songwe and Kivira rivers (*Journal*, vol. xiii. p. 73), but his extensive journeys in the country north and east of Nyasa have given him good opportunities of becoming acquainted with the general structure of the land. Regarding the lake itself, he has no hesitation in ascribing its formation to the subsidence of a segment of the Earth's crust, though it will be remembered that Mr. J. E. Moore throws doubt upon this explanation of the origin of the lake as a whole. Herr Bornhardt—who, among other evidences of subsidence, points to the great depth of the lake—considers that the line of depression is prolonged north of Nyasa, in which direction it forks into two branches, the one passing north-west to Lake Rukwa, the other, due to diagonal faulting, embracing the wide Ruaha valley, bounded on the west and south by well-marked fault-scarps. The falling in of the floor of the trough is intimately connected with a welling up of volcanic material, which, just at the diverging point of the two northern branches, in some measure break their continuity with the main trough. The highlands around the north end of the lake are divided into three sections by the rift-valleys. The northern mass, which in Mount Beya reaches a height of 9700 feet, seems to be composed entirely of gneiss. The western highlands occasionally present, in their northern parts, the character of a tableland, due apparently to deposits of sandstone of "Karroo" age. Sandstones occur also at a lower level on the border of the highlands, and in these the coal deposits are found. Further south gneiss again appears. The eastern highlands are divided into two sections by the deep valley of the Ruhuhu, the largest feeder of the lake, the only gap through which it might be possible to bring a railway from the coast to Nyasa. Sandstone again occurs here, and with it coal, but not of any value. North of the gap runs a zone of gneiss, forming the longitudinal ridges and valleys of the Livingstone or Kinga range; the ridge nearest to the lake falling abruptly to the water from a height of 6000 feet above it. The writer contends that these highlands well merit the name of a range, as they fall considerably to the east as well as to the west. Further north they widen out, but maintain their mountainous character. They are broken towards the east by the wide hollow of Buanyi, bordered by table-like masses composed in their upper parts of horizontal quartzites, sandstones, and conglomerates, which are probably of older date than the sandstones of the Songwe and Ruhuhu. They rest on tilted beds of ancient crystalline schists, which characterize the eastern parts of the highlands, though narrowing down towards the south. On the eastern margin the surface consists chiefly of a thick deposit of sandy loam, which seems to have been derived from denudation of the Kinga range when at a greater elevation than at present. The uplands are for the most part covered with rich grasses, and parts of the region might be suitable for plantations under European supervision, but there is little prospect of success for small farmers. South of the Ruhuhu the highlands consist of two *massifs*, gneiss in the north and granite in the south, separated from the lake by a strip of lower but much broken country. Herr Bornhardt concludes by describing the rich alluvial plain of Konde with the volcanic masses to the north, culminating in Mount Rungwe (10,400 feet), the highest point of the whole country. This district is the most promising of all Nyasaland.

AMERICA.

Alaskan Surveys during 1899.—A short *résumé* of the survey work accomplished last year in Alaska by parties from the U.S. Geological and Coast and Geodetic Surveys, is given in the fifth number for that year of the *Bulletin of the American Geographical Society* (p. 503). One expedition of the Geological Survey, under Messrs. W. J. Peters and Alfred Brooks, was successful in fixing the position of the headwaters of the Copper, Tanana, and Nebesna rivers, a reconnaissance map of most of the route being constructed. The proposed additional work in the direction of Birch creek and the Mynook district was of necessity abandoned. A second party, consisting of Messrs. F. C. Schrader and T. G. Gerdine, made its way by rail and steamer *viâ* the White pass and the Yukon river to Fort Yukon, thence ascending the tortuous Gens de Large river in canoes. A new part of its course was mapped, and the Kuyukuk having been reached by a portage, that river was descended to the Yukon, topographical and geological reconnaissances of the whole route being made. Subsequently, having reached the coast by steamer, Mr. Schrader, joining Mr. Brooks, mapped a strip of the coast near Cape Nome. The beach diggings were found to extend for 16 to 18 miles between high water and the tundra, the gold occurring in streaks of very fine grains. During the summer the examination of the Yukon delta was completed by Messrs. Pratt, Putnam, and Faris of the Coast and Geodetic Survey. It had been hoped that a deeper entrance to the Yukon than that generally used might be found, but in this the party was unsuccessful. The coast-line was found to extend from 10 to 15 miles further out than had been supposed. The water is exceedingly shallow, miles of mud-flat being exposed by certain combinations of wind and tide. While canoeing round the whole delta, Dr. Edmunds had to go out of sight of land or to drag his canoe through miles of mud. Scammon bay, south of the Yukon, was found to be useless as a port in lieu of St. Michael's, but a good harbour for light-draught vessels was found between Cape Nome and Golofnin bay. Finally, an excellent collection of small mammals and birds was made during a boat voyage down the Yukon by a party sent out by the Biological Survey, consisting of Messrs. Osgood, Maddren, and Bishop. The work of the party supplements that of the Harriman expedition (*ante*, p. 66).

The Idaho and Montana Boundary-line.—The United States Geological Survey has completed the survey and marking of that portion of the boundary-line between Idaho and Montana running north from the Bitter Root mountains to the international boundary, corresponding to the 39th meridian west from Washington, or 116° 3′ 2·30″ west from Greenwich. The remaining portion of the line follows the crest of the Bitter Root and Rocky mountains. An article giving particulars of the work, by Mr. R. U. Goode, appears in the January number of the *National Geographic Magazine*. The line going northward starts at an elevation of about 4850 feet, and, descending from the summit of the Bitter Root mountains, crosses the Clark fork of the Columbia at an altitude of about 2220 feet, and reaches the summit of the Cabinet mountains at an elevation of 6670 feet. It next intersects many canyons tributary to the Kootenai river, and crosses the latter, touching the platform of the station-house at Leonia on the Great Northern Railroad, at an elevation of 1824 feet; thence it ascends the Yak mountain, reaching an altitude of 6585 feet, whence there is a gradual descent to the international boundary, at which point the elevation is about 4500 feet. The length of the line surveyed passes through a latitudinal interval of 1° 1′ 24·65″, or about 70½ miles.

New Matter bearing on Humboldt's Travels.—A series of papers and letters by Alexander von Humboldt, published for the first time in the *Zeitschrift* of the Berlin Geographical Society (1899, pt. 4), throws new light on the events connected with the traveller's preparations for his great journey to South America. It has been generally believed that the merit of opening the way for that undertaking belonged exclusively to Baron von Forell, ambassador at the court of Madrid from the King of Saxony; but materials have hitherto been too scanty to admit of a full knowledge of the course of events which preceded the departure on the voyage. The want has now been supplied by the discovery of the papers above referred to, most of which consist of letters addressed by Humboldt to Baron von Forell in 1799 and 1800. Having come into the hands of Karl von Forell, the last representative of the family, they were bequeathed by him to the Swiss historian Alexander Daguet, among whose papers they were found by his grandson Pierre Favarger. They have lately been secured by the Berlin Geographical Society, and placed for publication in the hands of Herr E. Lentz, who in an introductory notice explains fully their bearing on the history of the voyage. It appears from the letters that in the negotiations respecting permission to travel in the Spanish colonies, three men bore a principal part—Von Forell, the Spanish minister Urquijo, and the Prussian secretary of legation Von Tribolet. It has been stated by Humboldt's biographer, Bruhns, that no interest in Humboldt's plan was evinced by the Prussian envoy, Count von Rohde. This is easily accounted for by the fact that the count was not at Madrid during 1799, while the now-published material shows that the secretary, Von Trilobet, who managed the business of the embassy in his absence, was on most intimate terms with Humboldt. The Spanish minister was also personally well disposed to the traveller. The documents, which include a statement by Humboldt of his previous scientific labours and a memorandum on the points which he wished touched upon in his passport, show how much of the initiative was due to the traveller himself, and also set forth clearly the relative positions of the two members of the expedition. The memorandum just alluded to is interesting as indicating the ideas which Humboldt entertained as to the route to be followed and other details of his plans. The letters to Von Forell both give an additional insight into the character of the traveller, and also supply details as to his scientific labours during the early part of the journey.

Dr. Hermann Meyer's Second Expedition to the Xingu.—A note in the *Geographische Zeitschrift* (1900, p. 117) gives a short account of Dr. Hermann Meyer's second expedition to the headstreams of the Xingu (*Journal*, vol. xiv. p. 324), from which the traveller has lately returned to Leipzig. The expedition—which included, in addition to Dr. Meyer, Drs. Koch (Giessen), Mannsfeldt (Dresden), and Pilger (Berlin), as well as seven German colonists from Rio Grande do Sul, and a number of Brazilians, negroes, and Indians—assembled early in 1899 at Cuyaba, whence a start was made across the plateau to the north towards the Rio Formoso, apparently a main branch of the Ronuro. The descent of this river, which commenced in eleven canoes in May, 1899, involved serious difficulties, owing to the rapids in its course and the uninhabited character of its banks. Many canoes and effects were lost, while sickness broke out among the members of the party. One of the many falls of the Ronuro, "Bastian fall," has a drop of over 60 feet. In this part of the river absolutely no fish were found, so that the food-supply presented great difficulties. Finally the mouth of the Kuluene was reached, whereupon the expedition entered that stream and visited the various Indian tribes encountered by Dr. Meyer on his first journey. Extensive ethnographical collections having been made, Cuyaba was again reached early in October. Dr. Pilger, who had separated from the rest of the party on arrival at the Ronuro, obtained a large number of botanical specimens, forming the largest collection yet made in the interior of South America.

Geographical Features of Southern Patagonia.—Prof. J. B. Hatcher, whose recent return from lengthened explorations in Patagonia was referred to in our last number, contributes to the February number of the *National Geographical Magazine* a concise description of the main features of the country visited by him, with a discussion of their mode of origin. Beginning from the line of sea-cliffs, consisting of alternate layers of sandstones and clays, which form the eastern limit of Patagonia, he describes in turn the elevated barren plains rising from the coast in a succession of steps, furrowed by deep transverse valleys, and covered in the central parts by rugged lava-fields; the more fertile zone, covered in great part by glacial deposits, which skirts the Andes on the east; and the three parallel chains of the Andes themselves, separated by two deep longitudinal valleys. The most striking phenomenon is the anomalous position of the continent water-parting to which the principal difficulties in the settlement of the Chilean-Argentine boundary question is due. Prof. Hatcher, who goes somewhat fully into the question, differs from Dr. Moreno in his explanation of the unusual drainage conditions. An examination of the low continental divides, to the east of the line of lakes which Dr. Moreno considers to have been formerly drained to the Atlantic, showed that the original rocks are not covered to any considerable depth by glacial detritus, such as might have dammed back the outlets of the lakes. Prof. Hatcher attributes the present conditions entirely to the movements of elevation and subsidence which have prevailed in recent geologic epochs, and points to the state of things in the extreme south, where the movement of elevation has been less marked than in the north, as representing a former stage in the geographical evolution of other parts of Patagonia. In his opinion, the longitudinal valleys of the Andes and the transverse valleys which cross the whole country, had their origin previous to the last submergence, which occurred during a relatively short period in late Pliocene times. This submergence was greater over the western than over the Eastern Andes, thus rendering the western channels deeper than the eastern. During the first stage of subsequent elevation, the valleys would remain submerged, the transverse ones forming straits connecting the two oceans. In the second stage they would appear as land valleys, while the western longitudinal valley would form a continuous channel sending a series of fiords into the eastern one. In the third, the connection between the two longitudinal valleys would be broken, the eastern one being occupied, as at the present day north of Lake Argentina, by a series of lakes discharging westwards. A fourth stage, in which the bottom of the western valley is brought above water-level, is observable in the extreme north.

AUSTRALASIA AND OCEANIC ISLANDS.

A Newly-Discovered Cave in New South Wales.—In his reports on the limestone caves of New South Wales for 1898, embodied in the Annual Report of the Department of Mines and Agriculture of the Colony for the same year, Mr. O. Trickett describes a newly-discovered cave at Wombeyan, celebrated for its extensive decorations. The "Junction Cave," as this new cave is called, is situated near the junction of the Wombeyan and Mares Forest creeks. Its length between the extreme points is about 10 chains in a direct line, while its explored passages are said to total about three times that length. There are two entrances. The lower one is about 60 feet from the Wombeyan creek, and about 20 feet above the level of the creek. From this entrance a narrow and tortuous passage, with many ripple-marked terraces, leads to the centre of the cave. The upper entrance is about 130 feet above the creek, from which it is distant about 170 feet. The cave is traversed by a number of passages, notably by two running north and south. The northern one of these is of particular interest, being embellished with many beautiful pillar and "shawl" formations and cream-coloured crystalline deposits. At a certain point the present underground waterway is visible. Southward the passage is notable for its draped and terraced crystalline "cascades," ornamented grottos and stalactites. It opens out into a large dry cavern, 116 feet long, and appears to be 70 feet high in one place. The report is illustrated with a plan and sections.

Points of Nomenclature in the Western Pacific.—In the first number of the *Verhandlungen* of the Berlin Geographical Society for 1900, Herr F. Strauch calls attention to one or two points respecting the nomenclature of places in the German sphere in the Western Pacific. The first refers to the Admiralty group, to the largest island of which no individual name is generally applied, the term great Admiralty island being used in our maps for want of a better. No native name seems to be in use, inquiries during a recent visit by the commander of the *Möwe* having been unsuccessful in eliciting any. Herr Strauch, however, points out that a name exists which meets the requirements laid down at the Seventh International Geographical Congress for cases where native names are wanting. The island, to which Schouten's map merely applies the general description "hoch landt," was sighted on January 10, 1781, by Maurelle, commander of the Spanish frigate *Princesa*, who gave it the name "Don José Basco," in honour of the then governor of the Philippines, and the name seems to have the right of priority, as neither Schouten nor Carteret bestowed any. It is wrongly written "Bosco," both by Meinicke and in the *Challenger* Report ('Narrative,' vol. i. part ii. p. 697). Referring to an allusion by Count Pfeil in his recent work to the first settlement of Port Hunter, on Duke of York island, Herr Strauch points out that the name is derived from Captain John Hunter, who accompanied Governor Philipp to Botany bay in 1788, and visited the island in 1791, and not from the captain of the Wesleyan Missionary Society's ship, which first visited the port in 1875. The name Port Hunter was used by D'Urville in 1833. Among the many instances of confusion arising from ill-judged changes of names, Herr Strauch mentions that Blanche bay, named after the British corvette of that name, has been by some altered to "Weisse Bai," though the proper name is retained in the best German maps.

The "Albatross" Expedition to the Pacific.—A third letter from Dr. Agassiz regarding the work of the *Albatross* expedition, dated Suva harbour, Fiji islands, December 11, 1899, is published in *Science* of February 23, as also in the *American Journal of Science* for March. On the way to Suva a few soundings were made between Tahiti and Tonga, the depths ranged from 2472 to 2882 fathoms, the bottom being red clay. A trawl haul was made about 75 miles to the eastward of Tonga-Tabu, in a depth of 4173 fathoms. In the proximity of the 4762-fathom sounding marked on the chart, a depth of 4540 fathoms was obtained. The soundings taken in the vicinity of the Fiji islands seem to indicate a continuous plateau of moderate depths from Wailangolala south, upon which the islands of the Lau group rise. An account of the structure of the Leeward Society islands is given. Aitutaki, in the Cook group, was found to be volcanic. Niue is described as composed of elevated coralliferous limestone showing three well-marked terraces, which in many cases are disappearing completely. The main portion of the letter deals with the Tonga group, and details of their topography and structure are given. In conclusion, the writer states "that in the Tonga group, which is a very extensive area of elevation, the recent corals have played no part in the formation of the masses of land and of the plateaus of the Tonga ridge, and that here again, as in the Society islands and Cook islands, both also in areas of elevation, they are a mere thin living shell or crust growing at their characteristic depths upon platforms which in the one case are volcanic, in the other calcareous, the formation of which has been independent of their growth." The Ellice, Gilbert, and Marshall islands will probably be visited next.

Depths in the North Pacific.—The Washington correspondent of the *New York Sun* of February 25, states that Lieut.-Commander H. M. Hodges, of the U.S. surveying ship *Nero*, has discovered a submarine depression of great depth in trying to find a southern route to connect Guam with the proposed cable from Honolulu to the Midway islands. In this depression, which has been named Nero Deep, two remarkable soundings were obtained, one of 5160 fathoms, and the other of 5269 fathoms. This is about 100 fathoms deeper than the soundings made by H.M.S. *Penguin* in the South Pacific, and appears to be the deepest sounding ever made in any ocean. The deepest temperature-readings obtained were 35°·9 at 5070, and 36° at 5101 fathoms. A line drawn from Guam to Midway island on the bathymetrical map published in the *Challenger* Narrative crosses the southern extremity of the Tuscarora Deep; but as bottom temperatures of 35° or 34°·9 were obtained in that depression, it would appear that the new soundings do not form part of it, but indicate a separate hollow, the walls of which rise nearer to the surface than do those of the Tuscarora Deep. Pending the publication of the official report, however, nothing definite can be said except that in this as in other cases of recent deep-sea soundings the depth of the ocean is shown to be greater than was formerly supposed.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Climate and Industry.—A paper on the climatic distribution of industry, read by Dr. Ernst von Halle at the Berlin meeting of the International Geographical Congress, is printed in the first number of the *Geographische Zeitschrift* for 1900. The writer begins by referring to the economic laws which have been laid down in the past as determining the action of climate on industry, and which have been appealed to by the champions both of slavery as a necessary institution, and of free trade; afterwards pointing out the tendency of modern scientific progress to disturb formerly accepted conclusions. The conditions of production, as well as of transport, have been so changed, above all by the use of steam, that new solutions of the problem as regards both its geographical and economic aspects must be sought. In adopting the theory that the raw products of the whole world must be brought for manufacture to certain centralized points, former speculators attributed too much weight to climatic factors, and the effect of these both on the possibilities of production and on the conditions of human life are now seen to have undergone a change. The effects of both heat and moisture can now be combated by artificial means, while the present facilities for rapid transport, and improved sanitary and other conditions of life, make it possible for the northern races to carry on industrial undertakings in hot regions where such were formerly considered impossible, as, *e.g.*, in the Southern United States, South America, Mexico, and the West Indies, as well as India and China. The comparative independence of climatic conditions is seen, too, in the far north, in the goldfields of Alaska, and in Russian industrial undertakings on the borders of the polar regions. The extensive employment of Italians and others in America, and of Chinese and Indian coolies in various parts of the world, is pointed to as favouring the industrial development of the tropics, which in many ways are held to possess advantages over the temperate zone. The mental capacity necessary for the initiation of such progress seems, however, to be found only in the latter. The writer concludes by pointing out that the successful states of the future will be those which have secured a supply, from their own territory, of the products of all climatic zones.

An Equal-area Projection for Equatorial Maps.—Ten years ago an article appeared in *Petermanns Mitteilungen* by Herr Nell, on an improved form of conical projection, which, while retaining the advantage of equality of areas, avoided to some extent the distortion arising from the oblique angle at which the meridians cut the parallels at a distance from the centre of the map. The subject is again taken up in the same periodical (1900, pt. 2) by Dr. E. Hammer, who discusses fully the formulæ to be used for such a projection, with special reference to the limiting case when the equator is the central parallel of the map. The writer points out the disadvantage of the modified cylindrical projection, usually known as that of Sanson, or Flamsteed, which is so persistently retained for maps of the equatorial regions, such as Africa or the Pacific islands, and considers that, as it seems impossible to banish this altogether, an improvement in its form would be of some importance. To this end the ordinates are so chosen as to lie midway between those of Lambert's and Sanson's projections, thus avoiding, as far as possible, the disadvantages of both. Dr. Hammer first finds the expressions for the co-ordinates in the case of a cone, and then applies the corrections necessary to suit them to that of an ellipsoid, obtaining by this means a table of co-ordinates, at intervals of 5°, for a map extending 40° from the equator. The values for the 5° intervals of latitude, given in kilometres, vary from 552 (between 0° and 5°) to 490 (between 35° and 40°), while the same interval of longitude is represented at the equator by 556·5, and at 40° by 491·2. Beyond 20° the intervals between the parallels are somewhat less curtailed than was the case by Herr Nell's method, so that the meridians are very slightly more in agreement with those of Sanson's projection. As regards the obliquity of the angles at which the parallels and meridians intersect, Dr. Hammer gives a table showing the values according to the three systems under discussion. At 40° from the equator and 40° from the central meridian the deviation from a right angle amounts, according to the new method, to 20° 34′, as compared with 25° 18′ and 30° 11′ by Sanson's and Lambert's methods respectively.* Dr. Hammer considers this not a very decided improvement in itself, but thinks that the adoption of the new method might lead the way to better methods of delineation for the equatorial regions generally. He concludes his article by pointing out a simple method of avoiding the inaccuracy resulting from the common practice of disregarding the difference between the length of chords and arcs in setting off the intervals of longitude.

Subterranean Explorations by M. Martel in 1899.—An interesting *résumé* of the work accomplished during 1899 by the indefatigable speleologist M. Martel appears in the first number of *La Géographie*. M. Martel began the campaign in May, in the Jura, which has been examined since 1896 by MM. Fournier and Magnin, and which, he says, promises to rival the regions of the Karst and of the Causses as a field for underground exploration. Unexpected results as regards the mutual relations of sources and abysses were yielded by the barometric and thermometric observations, while on sounding for the first time the famous rock-pool of Creux Billard, near Salins, a depth of almost 70 feet was revealed, the bottom of the channel by which it is drained being below the level of the neighbouring valley. In the *massif* of the Vercors, M. Martel visited, among others, the grottos of Bournillon and of the Brudoux, both excellent examples of subterranean hydrology. The latter was explored for 380 yards beyond the

* For a limited zone in the vicinity of the equator, Lambert's projection gives the smallest divergence.

furthest point previously reached. Thermometric observations proved that the stream issuing from the Goulenoire is not, as had been supposed, derived from the Bourne, but must have an elevated origin. In the *massif* of the Dévoluy (Hautes Alpes) the most important work was the exploration of a pot-hole named by M. Martel, after his conductor, the Chourun Martin. It revealed the fact that the abyss reaches the total depth of at least 310 metres (1020 feet), composed of four separate shafts, while the explorers imagined they heard the fall of rocks down a fifth. The depth just mentioned makes the abyss the deepest natural one known, that of Trebitsch, in Istria (321 metres), being in part artificial. At the lowest point reached it was about 400 metres (1300 feet) above the Source des Gillardes, the general outlet for the subterranean waters of the district. In the Chourun de la Parza, M. Martel found *névé*, crevassed like a glacier, at the depth of 30 metres (98½ feet), the deepest crevasse giving an additional depth of 44 metres (144 feet). M. Martel subsequently examined several of the subterranean passages of Vaucluse and the Causses. In the latter he found the tunnel of Bramabiau completely dry, a very rare occurrence. He was able to verify the fact that considerable modifications, due to erosion, have taken place since his former visits. The depth of the Armand pot-hole was remeasured by the aid of two barometers, and the original determination (207 metres, or 679 feet) proved correct, owing to the mutual compensation of two opposite errors. The bottom of the Gouffre de Padirac was found filled with snow, by which the temperature of the underground stream is lowered 14°–15° Fahr. below the normal. Some new exploration was accomplished, but the complete examination of the cavern will require a dry season, many appliances, and much endurance on the part of its explorers. M. Martel insists on the necessity of preventing the pollution of the underground waters by the common practice of throwing the carcases of animals down the pot-holes.

Hydrographic Surveys in Iceland and the Færoes.—M. Rabot communicates to *La Géographie* (No. 1) some details of recent marine surveys on the coasts of Iceland, etc., taken from the *Geografisk Tidskrift*. The surveys were made by MM. Holm and Hammer in the Danish guard-ship *Diana*, and in spite of the constant fogs, which last summer allowed work during nine days only, all the fjords of Eastern Iceland, from Langanæs to Berufjord, were examined, while the configuration of the sea-bottom was also determined by soundings. The east coast is skirted for a breadth of 50 to 60 miles by banks, giving the sea a depth of under 100 Danish fathoms (620 feet), except where they are traversed by submarine ravines. The results of the surveys ought, it is said, to be of practical service to the fisheries, the banks alluded to being much frequented by cod. Those in the neighbourhood of the Færoes were also examined, and this work will be continued during the present year.

GENERAL.

Geographical Association.—The annual meeting was held at the Imperial Institute in connection with the English Education Exhibition on January 8, and, in the absence of the President, the chair was taken by Dr. H. R. Mill. The Annual Report shows that the Association is growing, slowly and steadily, both in numbers and in influence. It was announced that Mr. B. Bentham Dickinson (Rugby) had signified his intention of retiring from the office of hon. secretary, which he had held since the foundation of the Association in 1893, and a cordial vote of thanks to him for his services was carried unanimously. Mr. Dickinson was not only the founder of the Association, but for the last seven years he has ungrudgingly devoted time and labour to its development. The Association's collection of lantern-slides (maps, diagrams, and views), which now numbers more than 1500, is entirely his work. By his personal influence and enthusiastic belief in the educational value of geography as a school subject, he succeeded in inducing members of the staff in nearly all the great schools in the country to join the Association, and the committee are glad to know that they can still count on his assistance and advice as one of their body, and that in Dr. A. J. Herbertson (assistant to the Reader in Geography at Oxford) he will have a worthy successor. The President, Mr. Douglas W. Freshfield, treasurer, and other members of the committee were re-elected, with the exception of the Rev. Dr. Gibbins (Kidderminster), who had tendered his resignation. Dr. R. D. Roberts (Cambridge) was elected in his place; and with the addition of Mr. T. G. Rooper (Southampton), already nominated in November, the committee was brought to its full number of twelve, exclusive of the officers. On the motion of Dr. Herbertson, it was decided "That the Geographical Association shall be open to *all* teachers of the geography and other persons interested in the teaching of geography." The effect of this will be to enable teachers in *Primary* schools to become members of the Association, which has hitherto been confined to teachers in secondary and higher schools and colleges. At a meeting of the committee held in February, a comprehensive programme of work for the current year was drawn up. This is now in print, and the hon. secretary or treasurer will be happy to send a copy to any one who wishes for further information regarding the aims and methods of the Association.

Geography at the Australian Association for the Advancement of Science.—The reports of the recent meeting of the Australian Association for the Advancement of Science, published in the *Melbourne Age* and *Herald* (January 10–16), include abstracts of two or three papers of geographical interest. In one of these Mr. J. A. Panton summed up the various indications which have accumulated in the course of time as to the fate of Leichardt's lost expedition, and sketched the probable course of events connected with its last stages. Mr. Panton considered it proved that the whole party had passed the point in the Macdonald range where the tree was eventually found marked with the letter L. Thence, after unsuccessful attempts to advance westward, the survivors probably went north, some of them, but not the leader, reaching Elsey creek by way of Emily spring and Sturt creek. Afterwards going east in the endeavour to reach Queensland, they were captured and detained by natives of the Simmen river. The question of an artificially watered stock route through Central Australia was discussed by Mr. W. H. Tietkens, who pointed out the various advantages which would result from the establishment of such a route. The line suggested would lead from east to west in about 25° 40′ S., taking advantage of the favourable conditions offered by the Mann, Tomkinson, and Cavenagh ranges, which extend for 400 miles. Among the points at which a large extension of the present water-supply would be required, none would be of more importance than Alexander springs, 100 miles west of Warburton ranges, lying as it does on the threshold of a waterless tract of perhaps 200 miles. The results of a number of temperature and density observations in the seas round Australia were communicated by Mr. T. W. Fowler, who stated that during the past two years there has been a considerable decrease in the density of the waters about the Australian coasts, coupled with a lower summer temperature of the sea-water in Bass strait, which pointed to an increased drift of antarctic water northwards.

OBITUARY.

Admiral Somerset.

Leveson E. H. Somerset was the second son of Lord Granville Somerset. He was born in 1829, and was educated at Cheam and at Westminster School, where he showed remarkable proficiency. He was in the sixth form before he entered the navy. Leveson Somerset became a gunnery lieutenant, and served in both Baltic campaigns. He landed with the naval brigade at the capture of Bomarsund in 1854. He also commanded a rocket boat during the night attack on Sveaborg in 1855. He was superintendent of Bermuda Dockyard 1875–78, aide-de-camp to the Queen, and, as Rear Admiral, was second in command of the Channel Fleet 1880–81. Admiral Somerset joined the Society in 1862. He took great interest in geographical work, and when he first became a Fellow, he was a frequent attendant at our meetings. Since his retirement he has led a most useful life, and his loss will be much felt.

Dr. Friedrich Jagor.

The death occurred in February of the well-known scientist Dr. F. Jagor, whose works on the Philippines and other parts of the Malay region attracted considerable notice a quarter of a century ago. A short account of the traveller given in *Globus* (vol. 77, p. 152) states that he was the son of an hotel proprietor in Berlin, who came from Russia at the beginning of the nineteenth century. During a visit to Paris he acquired such a taste for ethnology, that, instead of following in his father's steps, he devoted himself to travel, the extensive ethnological collections which he made being for the most part deposited in the Berlin Ethnological Museum, with which he was officially connected of late years. His best-known work—that on the Philippines—was translated both into English and Spanish. Jagor was never married, but lived the quiet life of a savant. At the time of his death, which resulted from an attack of influenza, he had reached the advanced age of eighty-three years.

CORRESPONDENCE.

Fish in Frozen Rivers and Lakes.

In the *Geographical Journal* for March, p. 256, General Strachey discusses the question as to what becomes of the fish in the streams running into the Mansarowar lake in Tibet. He seems inclined to think that they go down to the lake and thus escape being frozen, or that the supply is received from the lake every summer, these small streams being towards autumn merely a series of detached pools from which the fish could not escape.

The same question occurred to me with regard to the streams running into the Pangong lake at its western end about 15,000 feet above the sea-level; but in that case the fish must, I think, be frozen up and survive the process. The lake is, I believe, too salt (1300 parts of salt in 100,000 of water, 600 parts being sulphate of soda) for fish to live in it; in fact, I could find no animal life except a small crustacean (probably a Gammarus). The stream entering the lake from the north was only about a foot or two deep and a few feet wide. In July 1870, it was swarming with three or four species of fish, to such an extent that in an hour or two I caught nearly a hundredweight of them, varying from 3 to 8 inches in length. In October this stream was entirely frozen, and would remain so for many months; the temperature of the air on October 8 at sunrise was 15° Fahr., and next day 13° Fahr. It would be interesting to know if any and what fish can be frozen with impunity. I have only been able to hear of one case. Mr. Kappel, librarian of the Linnæan Society, tells me that the late Dr. Day brought to the Society's room a large trout frozen up in ice. It was thawed out, and at first appeared to be dead, but after a few minutes it jumped about the table and seemed to be as lively as if fresh from the river. Only Mr. Kappel and Dr. Murie were present with Dr. Day.

GEO. HENDERSON.
Surgeon-Major.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1899–1900.

Sixth Ordinary Meeting, February 19, 1900.—Admiral Sir W. J. L. WHARTON, K.C.B., F.R.S., Vice-President, in the Chair.

ELECTIONS.—*Percy Edward Amy; Captain Frederick John Choles; Rev. John George Gibson; George Grey; J. Williamson Johnston; Thomas Cardwin Lamb; Frederick Clare Lees, B.A.; Rev. William Martin-Ellis, M.A.; Julian M. Vernon Money-Kent (A.M. Inst. C.E.); Martin Hubert Foquet Sutton; Reuben Henry Williams; William Hunter Workman, M.A. (Yale), M.D. (Harvard).*

The Paper read was:—

"Journeys in the Chinese Shan States." By F. W. Carey.

Seventh Ordinary Meeting, March 5, 1900.—Sir CLEMENTS MARKHAM, K.C.B., President, in the Chair.

ELECTIONS.—*A. J. Drexel Biddle; William Louis Bunting; John Richard Higson, B.A.; Alan Bourchier Lethbridge; Christopher Mudd; Edward Penton, B.A.; Captain Ernest Rose, R.H.G.; William Stansfield Torbitt, B.A.*

The Paper read was:—

"In the Heart of Borneo." By Charles Hose.

Eighth Ordinary Meeting, March 19, 1900.—Sir CLEMENTS MARKHAM, K.C.B., President, in the Chair.

ELECTIONS.—*William Baird; Rowland Lloyd Drury; Captain Arthur Trevelyan Moore, R.E.; Baron Nettelbladt.*

The Paper read was:—

"Explorations in the Patagonian Cordilleras." By Dr. Hans Steffen.

Afternoon Technical Meeting, Tuesday, March 20, 1900.—Sir CLEMENTS MARKHAM, K.C.B., President, in the Chair.

The Paper read was:—

"Twelve Years' Work of the Ordnance Survey." By Colonel Sir John Farquharson, K.C.B., R.E.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By HUGH ROBERT MILL, D.Sc., LL.D., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.	Mag. = Magazine.
Abh. = Abhandlungen.	Mem. = Memoirs, Mémoires.
Ann. = Annals, Annales, Annalen.	Met. = Meteorological.
B. = Bulletin, Bollettino, Boletim.	P. = Proceedings.
Com. = Commerce.	R. = Royal.
C. Rd. = Comptes Rendus.	Rev. = Review, Revue.
Erdk. = Erdkunde.	S. = Society, Société, Selskab.
G. = Geography, Geographie, Geografia.	Sitzb. = Sitzungsbericht.
Ges. = Gesellschaft.	T. = Transactions.
I. = Institute, Institution.	V. = Verein.
Iz. = Izvestiya.	Verh. = Verhandlungen.
J. = Journal.	W. = Wissenschaft, and compounds.
k. u. k. = kaiserlich und königlich.	Z. = Zeitschrift.
M. = Mitteilungen.	Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Alpine Lakes. *Spelunca* 4 (1898): 168–170. **Viglino.**
Sur l'Excavation des Lacs alpins par les Glaciers. Par M. F. Viglino. *With Illustrations.*

Austria—Bohemia. *Globus* 77 (1900): 8–13. **Zemmrich.**
Die Zustände an der Sprachgrenze in Westböhmen. Von Dr. J. Zemmrich. *With Map.*

Austria—Geodesy. ——
Publicationen für die Internationale Erdmessung. Die Astronomisch-Geodätischen Arbeiten des K. und K. Militär-Geographischen Institutes in Wien. XIII. Band. Trigonometrische Arbeiten. 6. Die Netz-Ausgleichungen im westlichen Theile der Monarchie. Herausgegeben vom K. und K. Militär-Geographischen Institute (pp. viii. and 218); XIV. Band. Das Präcisions-Nivellement in der Oesterreichisch-Ungarischen Monarchie. IV. Süd-östlicher Theil (pp. viii. and 226); XV. Band. Trigonometrische Arbeiten. 7. Die Netz-Ausgleichungen im mittleren Theile der Monarchie (pp. x. and 210). XVI. Band. Astronomische Arbeiten. 5. Längenunterschied-Messungen Budapest-Wien, Krakau-Budapest und Budapest-Pola. Ausgleichung des Längennetzes. Anhang über Stromzeiten. Herausgegeben vom K. und K. Militär-Geographischen Institute. Wien, 1899. Size 12 × 9½, pp. vi. and 228. *Presented by the Institute.*

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Considérations sur l'évolution de la Sambre et de la Meuse (*Communication préliminaire*). Par J. Cornet. (Extrait des Annales de la Société géologique de Belgique, t. xxvii.) Liège, 1899–1900. Size 9½ × 6½, pp. [8]. *Presented by the Author.*

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Les Commentaires de Jules César interprétés au point de vue de la Belgique. Par Ch. Piot.

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The Races of Europe, a Sociological Study (Lowell Institute Lectures). By William Z. Ripley, PH.D. Accompanied by a Supplementary Bibliography of the Anthropology and Ethnology of Europe, published by the Public Library of the City of Boston. London: Kegan Paul & Co., 1900. Size 9½ × 6½, pp. xxxii., 624, x., and 160. *Maps and Illustrations. Price 18s. net. Presented by the Publishers.*

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Die Einfluss der Wärmeschwankungen des Norwegischen Meeres auf die Luftcirkulation in Europa. Von Dr. Emil Lesshaft.

On the influence exercised by the temperature of the water in the Norwegian sea on the direction of the cyclone tracks across Europe, and thus upon the weather.

Europe—Food Supply. *J.R. Statistical S.* 62 (1899): 597–638. **Crawford.**
Notes on the Food Supply of the United Kingdom, Belgium, France, and Germany. By R. F. Crawford.

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Les Ecossais, dits Scoten ou Schotte, en Flandre. Par Ch. Piot.

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Sur la dénudation du plateau central de Haye ou Forêt de Haye (Meurthe-et-Moselle). Note de M. Bleicher.

The *Pays de Hayes* is a portion of the forest-covered belt of oolitic rocks which borders the Paris basin in the east. The land is very broken and cut into deep ravines, some of the characteristics of which form the subject of this paper.

France. *Mém. S. Spéléologie,* No. 22 (1899): 1–52. **Décombaz.**
Explorations souterraines dans le Royans et le Vercors (2ᵉ Campagne). Par M. O. Décombaz. *With Plans and Illustrations.*

France. *Ann. G.* 9 (1900): 17–31. **Cora.**
Observations sur la route de Chamonix au Mont-Blanc. Par M. Guido Cora.

France—Caylar. *B.S. Languedoc. G.* 22 (1899): 1–8. **Rouville.**
Une application de géographie rationnelle: Le canton du Caylar (Hérault). Par P. G. de Rouville.

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Contribution à une faune historique du Bas Languedoc. Par Cazalis de Fondouce.

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La Géographie Militaire et les nouvelles méthodes géographiques. La France du Nord-Est. Par O. Barré. Paris: Berger-Levrault & Cie., 1899. Size 10 × 6½, pp. 124. *Maps and Illustrations.*

France—Roujan. *B.S. Languedoc. G.* 22 (1899): 30–35. **Rouville.**
Un résumé de l'histoire du globe: Le canton de Roujan (Hérault). Par P. G. de Rouville.

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Erläuterungen zur Geologischen Spezialkarte von Preussen und den Thüringischen Staaten. Blatt Rüdersdorf, im Massstab 1 : 25,000. Berlin, 1899. Size 10½ × 7½, pp. 76. *Map and Illustrations.*

Germany—Berlin. **Baschin.**
Die geographische Lage von Berlin. Die erdmagnetischen Elemente. Das Klima von Berlin. Von O. Baschin. (Sonderabdruck aus der Festgabe der Stadt Berlin für die Teilnehmer an dem VII. Internationaler Geographen-Kongress 1899.) Size 6½ × 4½, pp. 16. *Presented by the Author.*

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Geognostische Beschreibung der Umgegend von Berlin. Von G. Berendt. Zur Erläuterung einer zweiten Auflage der geologischen Uebersichtskarte der Umgegend von Berlin im Massstabe 1 : 100,000 in 2 Blättern. Herausgegeben von der Königlich Preussischen geologischen Landesanstalt. Berlin, 1899. Size 10½ × 7, pp. 60. *Presented by Dr. J. Scott Keltie.*

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Thal- und Seebildung im Gebiet des Baltischen Höhenrückens. Von Dr. Keilhack. (VII. Internationaler Geographen-Kongress, Berlin, 1899.) Size 10 × 7, pp. 14. *Map. Presented by Dr. J. Scott Keltie.*

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Greece—Corfu. *Oester. Monats. Orient* **25** (1899): 124–126. ——

Die Wirthschaftsverhältnisse von Corfu.

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Beschrijving van eenige nieuwe grondboringen. Door Dr. J. Lorié. *With Plate.*

Hungary—Transylvania. *B.S.G. Română* **20** (1899): 75–118. **Moldovan.**

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Italy. Handbook for Travellers. By Karl Baedeker. Third Part: Southern Italy and Sicily, with Excursions to the Lipari Islands, Malta, Sardinia, Tunis, and Corfu. Thirteenth Revised Edition. Leipsic: Karl Baedeker; London: Dulau & Co., 1900. Size 6½ × 4½, pp. lxviii. and 432. *Maps and Plans. Price* 6 *m. Presented by Messrs. Dulau & Co.*

Italy—Naples. **Neville-Rolfe.**

Trade of Naples and District for the year 1898 (Supplementary). Foreign Office, Annual No. 2330, 1899. Size 10 × 6, pp. 34. *Price* 2½*d.*

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In Search of Brigands and Nuraghi. By Samuel Wells. *With Illustrations.*

Italy—Sicily. **Churchill.**

Trade of Sicily for the year 1898. Foreign Office, Annual No. 2331, 1899. Size 9½ × 6, pp. 42. *Price* 2½*d.*

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Termini geografici dialettali raccolti in Sicilia. Per Olinto Marinelli.

Mediterranean. **Helmolt.**

Weltgeschichte. Herausgegeben von Hans F. Helmolt. Vierter Band. Die Randländer des Mittelmeers. Von Eduard Graf Wilczek, Dr. Hans F. Helmolt, Dr. Karl Georg Brandis, Prof. D. Wilhelm Walther, Dr. Heinrich Schurtz, Prof. Dr. Rudolf von Scala, Prof. Dr. Karl Pauli und Prof. Dr. Julius Jung. Leipzig und Wien: Bibliographisches Institut, 1900. Size 10½ × 7, pp. x. and 574. *Maps and Illustrations.*

The historical descriptions are based on geographical conditions, and there are many maps showing the division of countries at different periods.

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An Anthropogeographical Study of Corsica.

A summary of Prof. Ratzel's work.

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The Mediæval Architecture of Cyprus. Review of M. Enlart's *L'Art gothique et la Renaissance en Chypre.* By John Bilson. *With Illustrations.*

Mediterranean—Malta. **Strickland.**

Malta. Report for 1898. Colonial Reports, Annual No. 270, 1899. Size 9½ × 6, pp. 50. *Price* 3*d.*

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Les Populations Danubiennes, Roumains et Bulgares. Par le R. P. van den Gheyn.

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Russia—Odessa. **Mackie.**
Agriculture and Trade (Supplementary) of Odessa and District for the Year 1898. Foreign Office, Annual No. 2366, 1899. Size 10 × 6, pp. 42. *Price* 2½*d.*

Spain—Gibraltar. **Jackson.**
Gibraltar. Report for 1898. Colonial Reports, Annual No. 276, 1899. Size 10 × 6, pp. 28. *Price* 2*d.*

Sweden—Gothenburg. **Duff.**
Trade of Gothenburg and District for the year 1898. Foreign Office, Annual No. 2337, 1899. Size 10 × 6½, pp. 36. *Price* 2½*d.*

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Die Mauern von Konstantinopel. *With Illustrations.*

United Kingdom—Manchester Ship Canal. **Fletcher.**
Manchester Ship Canal. The Economic Results of the Ship Canal on Manchester and the surrounding district. By A. Woodroofe Fletcher, LL.B. Manchester: Chas. Sever, 1899. Size 8½ × 5½, pp. 44. *Presented by the Manchester Ship Canal Company.*

A statement of the progress of the Manchester ship canal in developing the district through which it passes.

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Cabul and Herat. By Demetrius C. Boulger.

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Innermost Asia, Travel and Sport in the Pamirs. By Ralph P. Cobbold. London: W. Heinemann, 1900. Size 9 × 6, pp. xviii. and 354. *Maps, Portrait, and Illustrations. Price* 21*s. Presented by the Publisher.*

This volume contains the record of a journey through Kashmir to the Pamirs, Kashgar, South-Western Siberia, and back to India over the Pamirs again. There are also chapters on the political questions concerning the regions which were travelled through, and appendices dealing with the history, commerce, and mineral wealth of the regions, as well as the treaties regarding the "Anglo-Russian frontier" and a short bibliography of works in languages other than Russian.

China. *B.S.G. Paris* 20 (1899): 433–449. **François**
De Canton à Long-Tchéou. Par M. François. *With Maps.*

China. **Glass.**
Report by Mr. J. G. H. Glass on the Concessions of the Pekin Syndicate, Limited, in the Provinces of Shansi and Honan, China, with Estimates of Cost of Railways and other Works necessary for their development. 1899. Size 12½ × 8, pp. 174. *Map. Presented by the Pekin Syndicate, Limited.*

A comprehensive report on the resources of the territories for the commercial exploitation of which the Pekin Syndicate has obtained a concession from the Chinese Government.

China. **Kotvich and Borodovski.**
Liao-tung and its ports: Port Arthur and Ta-lien-wan. Historico-geographical description. By V. Kotvich and L. Borodovski. [In Russian.] St. Petersburg: A. Ilina, 1898. Size 9½ × 6½, pp. 48. *Map and Plans. Presented by M. L. Borodovski.*

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Sur la Géologie de la Chine méridionale. Note de M. Leclère.

M. Leclère's geological surveys were made from Tongking in 1897–99, and effected a junction between the surveys in French Cochin-China and those of Richthofen and Loczy in Northern China. They include Yunnan, the southern edge of Sechuan, and finally the provinces of Kweicheou and Kwangsi.

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La Chine d'aujourd'hui et la Chine de demain. Par M. Marcel Monnier.

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Contains a map of the projected railway system in China, indicating the share in the enterprise claimed by each of the foreign powers.

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Supplement 1898 relating to China Sea Directory, vol. iii. Third Edition, 1894. Corrected to July 13, 1898. London: J. D. Potter, 1898. Size 10 × 6½, pp. 32. *Price 4d. Presented by the Hydrographer, Admiralty.*

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American Trade with India. A Report by the Philadelphia Commercial Museum. Philadelphia, 1898. Size 9½ × 6, pp. 44.

India—Andaman and Nicobar Islands. *J.S. Arts* **48** (1899): 105–125. **Temple.**

Round about the Andamans and Nicobars. By Colonel R. C. Temple. *With Map.*

India—Bengal. ——

List of Consultations, Proceedings, etc.: Bengal, 1704–1858. Preserved in the Record Department of the India Office, London. London: Eyre & Spottiswoode, 1899. Size 13½ × 8½, pp. iv. and 516. *Presented by the India Office.*

An index of official documents in the Bengal archives.

India—Ceylon. **Leclercq.**

Une ville morte à Ceylan. Par Jules Leclercq. (Extrait des *Bulletins de l'Académie royale de Belgique* (Classe des lettres, etc.), No. 6 (juin), 1899.) Bruxelles, 1899. Size 9 × 6, pp. 485–524. *Presented by the Author.*

India—Ceylon. **Thorburn.**

Ceylon. Annual Report for 1898. Colonial Reports, Annual No. 274, 1899. Size 9½ × 6, pp. 32. *Price 2d.*

India—Lepcha Dictionary. **Mainwaring and Grünwedel.**

Dictionary of the Lepcha Language. Compiled by the late General G. B. Mainwaring, revised and completed by Albert Grünwedel. Berlin: printed by Unger Brothers, 1898. Size 10½ × 7½, pp. xvi. and 552. *Presented by the Bengal Government.*

India—Vizagapatam. **Bion.**

Notes on the Meteorology of Vizagapatam, part ii. By. W. A. Bion. Calcutta, 1899. Size 9 × 6½, pp. 41–152. *Diagrams. Presented by the Meteorological Office, Government of India.*

Japan—Formosa. **Griffiths.**

Trade of Tainan for the year 1898. Foreign Office, Annual No. 2341, 1899. Size 10 × 61, pp. 16. *Price 1d.*

Japan—Formosa. **Layard.**

Trade of North Formosa for the year 1898. Foreign Office, Annual No. 2339. 1899. Size 9½ × 6, pp. 18. *Price 1½d.*

Malay Archipelago—Sumatra. **Parker.**

Imp. and Asiatic Quarterly Rev. **9** (1900): 127–144.

The Island of Sumatra. By E. H. Parker.

On the history of Sumatra and the identification of old place-names.

Malay Peninsula. **Swettenham.**

The Real Malay, Pen Pictures. By Sir Frank Athelstane Swettenham, K.C.M.G. London and New York: John Lane, 1900. Size 8 × 5½, pp. x. and 296. *Price 6s.*

Malay Peninsula—Folklore. **Skeat.**

Malay Magic, being an Introduction to the Folklore and Popular Religion of the Malay Peninsula. By Walter William Skeat. With a Preface by Charles Otto

Blagden. London: Macmillan & Co., 1900. Size 9½ × 6, pp. xiv. and 686. *Illustrations. Price 21s. net. Presented by the Publishers.*

A comprehensive study of the folklore of the Malays, founded upon the personal observations of the author mainly in the state of Selangor, and extended by citations from the works of other writers. The preface points out the practical importance of the psychology of subject-races, and shows that political errors might be avoided if the motives swaying the native mind were understood. The book is illustrated by pictures of some of the magical "properties" in use by the Malays.

Persia—Khorassan. **Whyte.**
Trade of Khorassan for the year 1898–99. Foreign Office, Annual No. 2368, 1899. Size 9½ × 6, pp. 16. *Price* 1d.

Russia—Caucasus. *Ann. G.* 9 (1900): 32–42. **Flahault.**
La végétation du Caucase, d'après M. Gustav Radde. Par M. Ch. Flahault. *With Map.*

Russia—Siberia. *Petermanns M.* 45 (1899): 29–37, 228–235, 261–267. **Krahmer.**
Der Anadyr-Bezirk nach A. W. Olssufjew. Von Generalmajor z. D. Krahmer.

Russia—Siberia. *Scottish G. Mag.* 16 (1900): 17–29. **Simpson.**
The New Siberia. By J. Y. Simpson, M.A.

Russia—Transcaucasia. **Stevens.**
Agriculture in Transcaucasia for the year 1899. Foreign Office, Annual No. 2365, 1899. Size 9½ × 6, pp. 10. *Price* 1d.

Russian Empire. **Bookwalter.**
Siberia and Central Asia. By John W. Bookwalter. Illustrated from photographs taken by the author. Second Edition, with a Map. London: C. A. Pearson, Ltd., 1900. Size 9½ × 6½, pp. xxxii. and 548. *Price 21s. Presented by the Publishers.*

The author, an American business man, describes in a simple, straightforward way his observations on a journey along the Siberian railway, and a subsequent visit to Central Asia. The descriptions are rendered effective by a large number of snap-shot photographs, which give an excellent idea of the nature of the country.

Siam. ———
American Trade with Siam. A Report by the Philadelphia Commercial Museum. Philadelphia, 1898. Size 9 × 6, pp. 32.

Siam—Chiengmai. **Black.**
Trade of Chiengmai and District for the year 1898. Foreign Office, Annual No. 2362, 1899. Size 9½ × 6, pp. 16. *Price* 1d.

Turkey—Asia Minor. *Atti R.A. Lincei, Rendiconti* 8 (1899): 365–368. **Agamennone.**
Il terremoto di Balikesri (Asia M.) del 14 settembre 1896. Nota di G. Agamennone.

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Ricerche e studi sull' Etiopia. Relazione del socio C. Conti Rossini. *With Maps.*

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Bougie, die Perle Nord-Afrikas. Prag: H. Mercy Sohn, 1899. Size 18 × 13½, pp. viii. and 122. *Plan and Illustrations. Presented by H. I. and R. H. the Archduke Ludwig Salvator.*

This is a description with handsome illustrations of a small island, which has been treated to a more superb volume than even the Archduke himself has hitherto produced in his artistic treatises on the islands of the Mediterranean.

Azores. *Ann Hydrographie* 28 (1900): 1–2. **Schröder.**
Azoren. Aus dem Reisebericht S.M.S. *Moltke*, Kommandant Kapt. z. S. Schröder. August 1899. *With Plan and View.*

Cape Colony—East London. **Israel and Reinicke.**
Ann Hydrographie 27 (1899): 592–599.
East London. Nach Berichten vom Kaiserlichen Konsulat daselbst und von den Kapt. F. H. Israel und G. Reinicke. *With Plan.*

Congo State. *B.S.G. Com. Paris* 21 (1899): 305–314. **Dyé.**
Les voies de transport dans le Haut Oubangui. Par M. A. H. Dyé. *With Map.*

Congo State. **Lycops.**

Codes Congolais et lois usuelles en vigueur au Congo, collationnés d'après les textes officiels et annotés par Alphonse Lycops. Bruxelles: V. F. Larcier, 1900. Size 7 × 4½, pp. 604. *Presented by the Author.*

An epitome of the very numerous laws, regulations, and disabilities which have effect in the Congo State, prefaced by a political history of the state.

East Africa—Historical. **Strandes.**

Die Portugiesenzeit von Deutsch- und Englisch-Ostafrika. Von Justus Strandes. Berlin: Dietrich Reimer (Ernst Vohsen), 1899. Size 10 × 7, pp. xii. and 348. *Maps and Illustrations. Presented by the Publisher.*

On the period of Portuguese predominance in East Africa, with special reference to Kilwa and Mombasa.

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Dall' Abissinia al lago Rodolfo per il Caffa. Conferenza del capitano A. K. Bulatovich. Con note di G. Roncagli. *With Maps.*

Egypt. ——

Dictionnaire géographique de l'Égypte. Le Caire, 1899. Size 11 × 7½, pp. xxii. and 650.

This dictionary contains the name of every inhabited place in Egypt, arranged alphabetically according to the transliteration of the name in the Roman alphabet, but accompanied in each case by the name in the original Arabic character. Brief particulars of position, population, etc., are also supplied.

Egypt. *B.S. Khédiv. G.* 5 (1899): 189–202. **Fourtau.**

Les environs des Pyramides de Ghizeh. Par M. R. Fourtau.

Egypt. **Cameron.**

Trade of Port Said and Suez for the year 1898. Foreign Office, Annual No. 2338, 1899. Size 10 × 6, pp. 12. *Price* 1*d.*

Egypt—Folk-lore. *Abh. Deutsch. Morgenländ. Ges.* 11 (1899): 1–243. **Hartmann.**

Lieder der Libyschen Wüste. Die Quellen und die Texte nebst einem Exkurse über die bedeutenderen Beduinenstämme des westlichen Unterägypten. Von Martin Hartmann.

Egypt—People. *B.S. Khédiv. G.* 5 (1899): 203–248. **Piot.**

Causerie ethnographique sur le Fellah. Par Piot Bey.

Egypt—Sand-Dunes. **Cornish.**

On Desert Sand-Dunes bordering the Nile Delta. By Vaughan Cornish. (From the *Geographical Journal* for January, 1900.) Size 10 × 6½, pp. 32. *Maps and Illustrations.*

Egypt—Upper Nile. *B.S.G. Marseille* 22 (1898): 401–410. **Teisseire.**

La question du Haut-Nil au point de vue juridique, communication de M. Raymond Teisseire.

French Congo. *B.S.G. Paris* 20 (1899): 412–413. **Guy.**

Note sur les explorations de M. Perdrizet. Par Camille Guy. *With Map.*

French Guinea. *B.S.G. Paris* 20 (1899): 365–411. **Salesses.**

De Conakry au Niger. Par le Capitaine E. Salesses. *With Map.*

French Guinea. **Arthur.**

Trade of French Guinea for the year 1898. Foreign Office, Annual No. 2364. 1899. Size 10 × 6, pp. 20. *Price* 1½*d.*

German East Africa. *M. Deutsch. Schutzgeb.* 12 (1899): 228–235. **Glauning.**

Bericht des oberleutnants Glauning über die Fortschritte der Pendelexpedition.

German East Africa—Lake Kivu. *M. Deutsch. Schutzgeb.* 12 (1899): 235–237. **Kandt.**

Bericht von Dr. R. Kandt über seine Reisen am Kivusee. *With Map.*

German South-West Africa. *M. Deutsch. Schutzgeb.* 12 (1899): 225–227. ——

Regenmessungen in Deutsch-Südwestafrika.

German West Africa—Kamerun. *M. Deutsch. Schutzgeb.* 12 (1899): 222–224. ——

Begleitworte zur Karte der Pflanzungsgebiete am Kamerungebirge. *With Map*

German West Africa—Kamerun. *M. Deutsch. Schutzgeb.* **12** (1899): 201–218. **Conrau.**
Im Lande der Bangwa. Von G. Conrau.
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German West Africa—Kamerun. *M. Deutsch. Schutzgeb.* **12** (1899): 221–222. **Moisel.**
Begleitworte zu der Karte der Wegeaufnahmen G. Conraus im Lande der Banyang, Bangwa, Kabo, Basosi und Bafo. Von Max Moisel.

German West Africa—Kamerun. *M. Deutsch. Schutzgeb.* **12** (1899): 218–219. **Plehn.**
Meteorologische Beobachtungen am Gouvernementsgebäude in Kamerun. Von Dr. A. Plehn.

German West Africa—Togo. *M. Deutsch. Schutzgeb.* **12** (1899): 194–195. **Diehl.**
Meteorologische Beobachtungen an der Missionsstation Ho. Von Missionar H. Diehl.

German West Africa—Togo. *M. Deutsch. Schutzgeb.* **12** (1899): 175–194. **Hupfeld.**
Die Eisenindustrie in Togo. Von Fr. Hupfeld. *With Illustrations.*

Lake Chad. *Mouvement G.* **16** (1899): 541–545. ——
Autour du Tchad.

Madagascar. **Granddidier.**
Sur l'origine des Malgaches. Par Alfred Grandidier. (Extrait de la 'Revue de Madagascar.') Paris: P. Dupont, 1899. Size 9½ × 6, pp. 12. *Illustrations.*

Madagascar. **Turner.**
Trade of Madagascar for the year 1898. Foreign Office, Annual No. 2334, 1899. Size 10 × 6, pp. 12. *Price* 1*d.*

Madeira. **Spence.**
Trade of Madeira for the year 1898. Foreign Office, Annual No. 2333, 1899. Size 10 × 6, pp. 10. *Price* 1*d.*

Marocco. *Questions Dipl. et Colon.* **8** (1899): 321–331. **Kryszanowski.**
Le Maroc français. Par L. Kryszanowski.

Nigeria. **Goldie.**
Report by Sir George Goldie on the Niger Sudan Campaign (1897), with Miscellaneous Documents, including the Military Report by Major Arnold, Commandant of Royal Niger Constabulary. London: Witherby & Co. Size 13 × 8½, pp. 24. *Maps.*

Portuguese East Africa. **Costa.**
Cap. Gomes da Costa. Gaza, 1897–98. Lisboa, M. Gomes [1899]. Size 10 × 6½, pp. 176. *Maps and Illustrations. Presented by the Author.*

Portuguese East Africa. **Worsfold.**
Portuguese Nyassaland. An account of the Discovery, Native Population, Agricultural and Mineral resources, and Present Administration of the territory of the Nyassa Company, with a Review of the Portuguese Rule on the East Coast of Africa. By W. Basil Worsfold. London: Low & Co., 1899. Size 9 × 5½, pp. vi. and 296. *Maps (in cover) and Illustrations. Price* 7*s.* 6*d. net.*

A collection of facts derived from official and other sources bearing on the character and resources of a comparatively little known region of Portuguese East Africa.

Portuguese West Africa. **Casement.**
Trade of Angola for the years 1897 and 1898. Foreign Office, Annual No. 2363, 1899. Size 9½ × 6, pp. 38. *Price* 2½*d.*

Réunion. **Bennett.**
Trade of Réunion for the year 1898. Foreign Office, Annual No. 2350, 1899. Size 10 × 6, pp. 10. *Price* 1*d.*

Somaliland—Bottegò's Second Expedition. *Science* **10** (1899): 951–955. **Sclater.**
Results of the Second Bottegò Expedition into Eastern Africa. By Dr. P. L. Sclater.

St. Helena. *Imp. and Asiatic Quarterly Rev.* **9** (1900): 98–107. **Sterndale.**
St. Helena in the Present Time. By His Excellency R. A. Sterndale, Governor of St. Helena.

Sierra Leone. **Nathan.**
Sierra Leone. Report for 1898. Colonial Reports, Annual No. 273, 1899. Size 9½ × 6, pp. 38. *Price* 2*d.*

South Africa. **Brown.**

The Guide to South Africa for the use of Tourists, Sportsmen, Invalids, and Settlers. With coloured maps, plans, and diagrams. Edited annually by A. Samler Brown and G. Gordon Brown, for the Castle Mail Packets Company, Limited. 1899–1900 Edition. Seventh Edition. London: Low & Co., 1899. Size $7\frac{1}{2} \times 5$, pp. xlviii. and 420. *Price* 2*s*. 6*d*.

The present edition of this concise and handy Guide has been revised up to July of last year. In addition to the usual Guide-book information, it contains a great deal of condensed and statistical matter bearing on South Africa generally, and is well supplied with maps.

South Africa. **Theal.**

South Africa (the Cape Colony, Natal, Orange Free State, South African Republic, Rhodesia, and all other territories south of the Zambesi.). By George M'Call Theal, LL.D. Seventh Impression. (Fifth Edition.) (The Story of the Nations.) London: T. Fisher Unwin, 1900. Size $8 \times 5\frac{1}{2}$, pp. xxviii. and 452. *Maps and Illustrations. Price* 5*s*.

A summary of events in South African history from the discovery of the Cape by the Portuguese in 1486 onwards. The supplementary chapter deals with the latest phase of South African history—the outbreak of the present war.

South Africa—Bibliography. *B. New York Public Library* **3** (1899): 429–461. ——

Works relating to South Africa.

South Africa—Climate. **Scholtz.**

The South African Climate, including Climatology and Balneology, and discussing the advantages, peculiarities, and capabilities of the country as a health resort—more particularly with reference to affections of the chest. By William C. Scholtz, M.D. London: Cassell & Co., 1897. Size 9×6, pp. 200. *Illustrations.*

Zanzibar. **Cave.**

Trade of Zanzibar for the year 1898. Foreign Office, Annual No. 2351, 1899. Size $9\frac{1}{2} \times 6$, pp. 20. *Price* $1\frac{1}{2}$*d*.

NORTH AMERICA.

Alaska. **Moser, etc.**

Treasury Department, United States Coast and Geodetic Survey. Bulletins, Nos. 37–40. Alaska: Washington, 1899. Size $12 \times 9\frac{1}{2}$, pp. 113–204. *Charts. Presented by the U.S. Treasury Department.*

Alaska. *National G. Mag.* **11** (1900): 29–31. **Preston.**

The Copper River Delta. By E. D. Preston.

Alaska—Cape Nome District. *National G. Mag.* **11** (1900): 15–23. **Schrader.**

The Cape Nome Gold District. By F. C. Schrader. *With Map and Illustrations.*

On the remarkable gold-diggings on the extreme west of Alaska discovered in 1899 between tide-marks on the seashore.

America—Name. *Naturw. Wochenschrift* **14** (1899): 592–594. ——

Woher hat "Amerika" seinen Namen?

Brazil—Coffee. ——

Coffee Production in Brazil and Consumption in the United States. Foreign Office, Miscellaneous, No. 512, 1899. Size $10 \times 6\frac{1}{2}$, pp. 8. *Price* $\frac{1}{2}$*d*.

Brazil—Rio Grande do Sul. **Staniforth.**

Trade of Rio Grande do Sul and District for the year 1898. Foreign Office, Annual No. 2332, 1899. Size $9\frac{1}{2} \times 6$, pp. 26. *Chart. Price* 4*d*.

Chile—Atacama Desert. *Z. Ges. Erdk. Berlin* **34** (1899): 281–311. **Darapsky.**

Zur Geographie der Puna de Atacama. Von L. Darapsky. *With Maps.*

Canada. **Barlow.**

Report on the Geology and Natural Resources of the area included by the Nipissing and Temiscaming Map-Sheets, comprising portions of the District of Nipissing, Ontario, and of the County of Pontiac, Quebec. By Alfred Ernest Barlow, M.A.—Geological Survey of Canada, part i., Annual Report, vol. x. Ottawa, 1899. Size $10 \times 6\frac{1}{2}$, pp. 302. *Maps (separate) and Illustrations. Presented by the Geological Survey of Canada.*

Canada. *B.S.G. Paris* **20** (1899): 450–461. **Legal.**

Au Nord-ouest canadien. Les Pieds-Noirs. Par Mgr. Legal.

Canada—British Columbia. *Nautical Mag.* 69 (1900): 16–19. **Small.**
Inland Waterways of British Columbia. By H. B. Small.

Canada—Hudson's Bay Company. **Willson.**
The Great Company (1667-1871), being a History of the Honourable Company of Merchants-Adventurers trading into Hudson's Bay. Compiled from the Company's Archives, from Diplomatic Documents and State Papers of France and England, from the Narratives of Factors and Traders, and from many Accounts and Memoirs, by Beckles Willson. With an Introduction by Lord Strathcona and Mount Royal, Governor of the Hudson's Bay Company. 2 vols. London: Smith, Elder & Co., 1900. Size 8½ × 5½, pp. (vol. i.) xxx. and 340; (vol. ii.) x. and 370. *Maps and Portraits. Price* 18*s. Presented by the Publishers.*

A fascinating narrative of the career of the Hudson Bay Company in the north-west of Canada from the time of its foundation by Prince Rupert in 1670 to the relinquishment of territorial rights in 1870. A map is given, showing the posts of the Company at the period of its greatest extension before the settlement of the Oregon dispute, and the history is rendered interesting throughout by biographical notices and anecdotes of the leading organizers and pioneers.

Canada—Ontario. **McInnes.**
Report on the Geology of the Area covered by the Seine River and Lake Shebandowan Map-Sheets, comprising Portions of Rainy River and Thunder Bay Districts, Ontario. By William McInnes, B.A. (Geological Survey of Canada. Part H, Annual Report, vol. x.) Ottawa, 1899. Size 10 × 6½, pp. 66. *Maps (separate). Presented by the Geological Survey of Canada.*

Chile—Copper. *An S. Ci. Argentina* 48 (1899): 209–238. **Jiménez.**
La industria del cobre en Chile de Juan Velásquez Jiménez.

Costa Rica. *Globus* 76 (1899): 348–353. **Sapper.**
Ein Besuch bei den Guatusos in Costarica. Von Dr. Carl Sapper. *With Illustrations.*

French Guiana. *Tour du Monde* 5 (1899): 589–600. **Brousseau.**
La territoire contesté Franco-Brésilien. Par M. Georges Brousseau. *With Map and Illustrations.*

French and Dutch Guiana. **Pigott and Wacongne.**
Trade of French and Dutch Guiana for the year 1898. Foreign Office, Annual No. 2360, 1899. Size 9½ × 6, pp. 14. *Price* 1*d.*

Jamaica. *Scottish G. Mag.* 15 (1899): 628–639. **Hill.**
A Sketch of the Geology of Jamaica. After R. T. Hill of the U.S. Geological Survey.

Jamaica. *Scottish G. Mag.* 15 (1899): 617–627. **Nash.**
Jamaica, with remarks on some of the other West Indian Islands. By Alfred G. Nash. *With Map and Illustrations.*

Mexico. *B.S.G. de l'Est* (1899): 98-110. **Diguet.**
Relation sommaire d'un voyage au versant occidental du Mexique. Par M. Léon Diguet.

An extract from the *Bulletin du Muséum d'histoire naturelle*, 1898, No. 8, p. 345.

Mexico. **Lemcke.**
Mexico, das Land und seine Leute. Ein Führer und geographisches Handbuch unter besonderer Berücksichtigung der gegenwärtigen wirtschaftlichen Verhältnisse des Landes. Von Heinrich Lemcke. Berlin: A. Schall, 1900. Size 12½ × 10, pp. viii. and 290. *Map and Illustrations. Price* 10*s.*

A geographical description of Mexico, with special reference to the economic conditions of the country and the prospects of future development.

Nicaragua. **Chambers.**
Trade of Nicaragua for the year 1898. Foreign Office, Annual No. 2329, 1899. Size 9½ × 6, pp. 16. *Price* 1*d.*

St. Vincent. **Thompson.**
St. Vincent. Report for 1898. Colonial Reports, Annual No. 281, 1899. Size 9½ × 6, pp. 20. *Price* 1½*d.*

Trinidad. **Knollys.**
Trinidad. Report for 1898. Colonial Reports, Annual No. 272, 1899. Size 9½ × 6, pp. 52. *Price* 3*d.*

West Indies. **Jay.**

A Glimpse of the Tropics; or, Four Months Cruising in the West Indies. By E. A. Hastings Jay, LL.B. London: Low & Co., 1900. Size 8 × 5½, pp. 284. *Map and Illustrations. Price 6s. Presented by the Author.*

A diary of a trip in a Royal Mail steamer, with some historical notes as to the islands visited. The term "roaring forties" applied to north latitudes appears to be new.

West Indies—Jamaica. **Hill.**

The Geology and Physical Geography of Jamaica: Study of a type of Antillean Development. Based upon Surveys made for Alexander Agassiz. By Robert T. Hill. With an Appendix on some Cretaceous and Eocene Corals from Jamaica. By T. Wayland Vaughan. (Bulletin of the Museum of Comparative Zoology at Harvard College, vol. xxxiv.) Cambridge, Mass., 1899. Size 9½ × 6, pp. 256. *Maps and Plates. Presented by the Author.*

CENTRAL AND SOUTH AMERICA.

Argentina—Patagonia. *B.S.R. Belge G.* 23 (1899): 366–374. **Lecointe.**

Voyage d'hiver en Patagonie. Par M. G. Lecointe. *With Map.*

A journey up the valley of the Rio Santa Cruz to Lake Viedma and back to the mouth of the river, carried out during the detention of the *Belgica* in the Strait of Magellan from June to August.

Argentine Republic. ——

Anuario de la Dirección General de Estadística correspondiente al Año 1898. Tomo ii. Buenos Aires, 1899. Size 11 × 7½, pp. 428.

Argentine Republic. *Ann. Hydrographie* 28 (1900): 11–14. **Danielssen and Hansen.**

Zur Küstenkunde von Argentinien. Nach Berichten des Kapt. B. H. Danielssen und des Kapt. H. Hansen.

Argentine Republic. *B.S.G. Com. Paris* 21 (1899): 364–393. **Machon.**

Voyage dans l'Argentine Sud. Par M. le Dr. Machon.

Argentine Republic—Buenos Aires. *P.I. Civil Engineers* 138 (1899): 170–248. **Dobson.**

Buenos Ayres Harbour Works. By J. M. Dobson. *With Plans and Sections.*

Argentine Republic—Ports. **Figueroa.**

Estudios sobre puertos en la Provincia de Buenos Aires. Segunda Parte. Costa marítima fluvial del Rio de La Plata. Por el Ing. Julio B. Figueroa. Text and Atlas. La Plata, 1898. Size (Text) 11 × 7½, (Atlas) 14½ × 11, pp. 308. *Presented by the Argentine Government.*

On the ports of the Argentine Republic, with a discussion of the tides, depths, and trade.

Bolivia. *J.S. Arts* 48 (1900): 234–243. **Conway.**

Some of the Undeveloped Resources of Bolivia. By Sir Martin Conway. *With Map.*

An account of the mineral wealth and the vegetable products of Bolivia, with special reference to the Indiarubber forests. Particulars are given as to the supply of labour and the means of communication.

Central America. *Verh. Ges. Erdk. Berlin* 26 (1899): 464–466. **Sapper.**

Herr Dr. Carl Sapper. Ueber seine Reisen in Central-Amerika.

A note on this paper appears in the *Journal* for March.

Costa Rica. *Globus* 77 (1800): 1–8. **Sapper.**

Ein Besuch bei den Chirripó- und Talamanca- Indianern von Costarica. Von K. Sapper. *With Illustrations.*

Nicaragua. *B.S.R.G. d'Anvers* 23 (1899): 309–366. **Jalhay.**

La République de Nicaragua, Notice historique, géographique et statistique. Par M. Henry Jalhay.

Porto Rico. **Hill.**

Notes on the Forest Conditions of Porto Rico. By Robert T. Hill. (U.S. Department of Agriculture, Division of Forestry. Bulletin No. 25.) Washington, 1899. Size 9½ × 6, pp. 48. *Map and Plates.*

A note on this paper appears in the *Journal* for March.

AUSTRALASIA AND PACIFIC ISLANDS.

Australia—River Murray. **Murray.**

Twelve Hundred Miles on the River Murray. By A. S. Murray. With Facsimile Illustrations in Colours by the Author. Australia: G. Robertson & Co.; London, J. S. Virtue & Co. 1898. Size 13 × 18, pp. 36. *Presented by the Publishers.*

Illustrated by facsimiles of the author's remarkably effective water-colours, representing the typical scenery of this most typical Australian river.

British New Guinea. **Le Hunte.**

Despatch from His Excellency the Lieutenant-Governor of British New Guinea reporting Visit of Inspection to certain places on the North-east Coast of the Possession. [No. 31] (pp. 10). Despatch reporting visit to head of Milne Bay to arrest certain Natives who had been guilty of an attack on Europeans. [No. 32] (pp. 4). Despatch reporting conclusion of Visit of Inspection round the Coast and islands of the Possession. [No. 34] (pp. 4). Despatch reporting proceedings from 14th June to date of arrival in Brisbane. [No. 56] (pp. 4). Brisbane, 1899. Size $13\frac{1}{2} \times 8\frac{1}{2}$. *Presented by the Colonial Office.*

Easter Island. **Barclay, Powell, Clark.**

P.R.G.S. Australasia: S. Australian Br. 3 (1899): 127–146.

Easter Island and its Colossal Statues, by Captain H. V. Barclay, R.N., including Detailed Report upon Easter Island, or Rapa-nui, by Commodore W. Ashmore Powell, R.N., and calling at Sala-y-Gomez and Easter Islands, by Commander Bouverie F. Clark, R.N. *With Map and Illustrations.*

New South Wales. **Coghlan.**

The Wealth and Progress of New South Wales, 1897–8. By T. A. Coghlan. Eleventh Issue. Sydney, 1899. Size 9 × 6, pp. 1084. *Diagram Map. Presented by the Agent-General for New South Wales.*

New South Wales. *J.R. Colonial I.* 31 (1900): 93–120. **Stephen.**

Reminiscences of New South Wales. By the Hon. Septimus A. Stephen.

Pacific Islands. *Naturw. Wochenschrift* 15 (1900): 49–55, 61–67. **Frobenius.**

Die Schilder der Oceanier. Von L. Frobenius. *With Illustrations.*

On the varieties of shields in use amongst the tribes inhabiting the Pacific islands.

Pacific Islands. *Verh. Ges. Erdk. Berlin* 27 (1900): 74–78. **Strauch.**

Zur Nomenklatur der Südsee-Inseln. Von F. Strauch.

Pacific Ocean. *American J. Sci.* 9 (1900): 33–43. **Agassiz.**

Explorations of the "Albatross" in the Pacific Ocean. By Alexander Agassiz.

Pacific Ocean. *Science* 11 (1900): 92–98. **Agassiz.**

Cruise of the *Albatross.* II. By Dr. A. Agassiz.

POLAR REGIONS.

Antarctic—Belgian Expedition. *La G., B.S.G. Paris* (1900): 81–92. **Racovitza.**

Résultats généraux de l'expédition antarctique belge. Par M. E. Racovitza. *With Map.*

Antarctic—German Expedition. **Drygalski.**

Verh. Ges. Erdk. Berlin 26 (1899): 452–463.

Plan und Aufgaben der Deutschen Südpolar-Expedition. Von Prof. Dr. Erich von Drygalski.

Arctic—Bering Sea. *Tour du Monde* 5 (1899): 601–612. **Zenzinoff.**

La Chasse aux ours marins de la Mer de Béring. Résumé du rapport inédit d'une mission officielle russe. Par B. de Zenzinoff. *With Map and Illustrations.*

Arctic Currents. *B.G.S. Philadelphia* 2 (1899): 71–75. **Bryant.**

Drift Casks to determine Arctic Currents. By Henry G. Bryant.

A number of small casks, built of great strength and provided with a written request to the finder to communicate with the Philadelphia Geographical Society, were sent out last summer to be placed by whalers on the solid floe ice in the arctic sea reached through Bering strait, in the hope that they would eventually drift out and be recovered on the Atlantic side.

German Antarctic Expedition. *Nature* 61 (1900): 318-321. **Drygalski.**
The German Antarctic Expedition. By Prof. Erich von Drygalski.

Spitsbergen. **Garwood.**
Additional Notes on the Glacial Phenomena of Spitsbergen. By E. J. Garwood. [From the *Quarterly Journal of the Geological Society* for November, 1899, vol. lv.] Size 9 × 6, pp. [12]. *Map and Illustrations. Presented by the Author.*

MATHEMATICAL GEOGRAPHY.

Cartography. *Science* 11 (1900): 181-186. **Lindenkohl.**
Leitfaden der Kartenentwurfslehre für Studierende der Erdkunde und deren Lehrer, bearbeitet von Prof. Dr. Karl Zöppritz. Zweiter Auflage, herausgegeben von Dr. Alois Blundau. Erster Theil. [Review.] By Dr. A. Lindenkohl.

This is a more than usually thorough review, forming to some extent a brief English abstract of the work noticed.

Geodesy. ——
The Earth Measured. By a Member of the Chicago Astronomical Society. Second edition. Chicago, for private circulation, 1899. Size 9¼ × 6¼, pp. 40.

Geographical Instrument. *Vidensk. Skrifter* (1899) (No. 2): 1-70. **Mohn.**
Das Hypsometer als Luftdruckmesser und seine Anwendung zur Bestimmung der Schwerekorrektion. Von H. Mohn.

Geographical Tables. *Nautical Mag.* 69 (1900): 1-14. **Goodwin.**
Spherical Traverse Tables and their Uses. By H. B. Goodwin, M.A.

Geophysics. *B.A.R. Belgique* 34 (1897): 1013-1019. **Folie.**
Sur des termes de nutation insensibles pour la Terre entière, sensibles pour l'écorce terrestre. Par F. Folie.

Geophysics. *Mém. A.R. Belgique* 58, 6 (1898): 1-39. **Folie.**
Théorie du mouvement de rotation de l'écorce solide du globe. Fondements de l'astronomie sphérique du xx^e siècle. Par F. Folie.

On the mathematical theory of the movement of the crust of the Earth as a whole with respect to the fluid interior, as a basis of spherical astronomy.

Geophysics. *Sitzb. A.W. Wien* 107, Abth. II. a. (1898): 1059-1112. **Oekinghaus.**
Ueber die zunahme der Dichtigkeit, Abplattung und Schwere im Innern der Erde auf Grundlage einer neuen Hypothese. Von E. Oekinghaus.

On the increase in density, polar flattening, and force of gravity towards the centre of the Earth according to a new hypothesis.

Latitude Changes. *B.A.R. Belgique* 34 (1897): 238-247. **Folie.**
Note préliminaire sur les trois périodes de la variation des latitudes. Par F. Folie.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Limnology. *Science* 11 (1900): 253-255. **Birge.**
Some of the Problems of Limnology. By Prof. E. A. Birge.

Prof. Birge treats limnology as if the word meant the study of the living organisms of lakes. This meaning, we believe, was never contemplated by the originator of the term. Limnobiology is a term more descriptive of the paper before us.

Meteorology. *Nineteenth Century* 47 (1900): 94-102. **Bacon.**
Climate and the Atmosphere. By the Rev. John M. Bacon.

Meteorology—Evaporation. **Mazelle.**
Sitzb. A.W. Wien 107 Abth. II. a. (1898): 280-303.
Verdunstung des Meerwassers und des Süsswassers. Von Eduard Mazelle.
On the evaporation of sea-water and fresh water.

Meteorology—Rainfall. *G.Z.* 6 (1900): 89-96. **Brückner.**
Ueber die Herkunft des Regens. Von Eduard Brückner.

Meteorology—Temperature. *Meteorolog. Z.* 16 (1899): 529-539. **Trabert.**
Die Bekämpfung der Frostgefahr. Von Dr. Wilh. Trabert.

On the methods of avoiding the bad effects of frost on crops by making artificial clouds of smoke to check radiation, and by other expedients. Reference is made to

Mr. Hammon's work, 'Frost: when to expect it and how to lessen the injury therefrom,' published by the United States Weather Bureau.

Oceanography. ———
Die Deutsche Tiefsee-Expedition auf dem Schiff *Valdivia* 1898–1899. (VII. Internationaler Geographen-Kongress, Berlin, 1899.) Size 10 × 7, pp. 120. *Maps, Diagram, etc.*

Oceanography—Red Sea. *Sitzb. A.W. Wien* 107, Abth. 1 (1898): 609–637. **Luksch.**
Vorläufiger Bericht über die physikalisch-oceanographischen Untersuchungen im Rothen Meere, 6 September 1897 bis 24 März 1898. Von Josef Luksch. *With Map.*

Oceanography—Strait of Dover. **Moore.**
Report on Observations of the Tidal Currents and Undercurrents in the Strait of Dover made with a Deep-Sea Current Meter. By Captain W. Usborne Moore, R.N., H.M.S. *Research*, 1896. London: J. D. Potter, 1899. Size 13½ × 8½, pp. 18. *Chart. Price* 3s. *Presented by the Hydrographic Office, Admiralty.*

Zoogeography. *Sitzb. A.W. Wien* 107, Abth. 1 (1898): 1057–1170. **Vierhapper.**
Zur Systematik und geographischen Verbreitung einer alpinen *Dianthus*-Gruppe. Von F. Vierhapper, jun. *With Map and Plates.*

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Ancient Empires. **Maspero.**
G. Maspero. Histoire ancienne des Peuples de l'Orient Classique. I. Les origines, Egypte & Chaldée (1895); II. Les premières mêlées des Peuples (1897); III. Les Empires (1899); Paris, Hachette et Cie. Size 11½ × 8, pp. (I.) 804; (II.) 798; (III.) 826. *Maps and Illustrations.*

A massive contribution to our knowledge of the empires of the lands bordering on the Eastern Mediterranean and the Persian gulf in the earliest times.

Anthropogeography. **Körösy.**
Zur internationalen Nomenclatur der Todesursachen. Kritische Bemerkungen zu Dr. Bertillon's Vorschlägen. Von Dr. Josef von Körösy. Berlin: Puttkammer & Mühlbrecht, 1899. Size 10 × 7, pp. 42. *Presented by the Author.*

On an international classification of the causes of death for use in the compilation of vital statistics.

Anthropogeography. **Kiær.**
Projet d'explorations démographiques à exécuter dans des pays inconnus. Par M. A. N. Kiær. Kristiania, 1899. Size 10 × 6½, pp. 12. *For private circulation.*

Proposals for carrying out census enumerations in parts of the world not yet under the complete control of civilized governments. The proposal originated at the St. Petersburg Statistical Congress in 1898, and was supported at the Berlin Geographical Congress in 1899. It will, we believe, be further discussed at one of the Paris Congresses this year.

Commercial Geography. ———
The World's Commerce and the United States' share of it. Second Edition. Philadelphia: Commercial Museum, 1899. Size 8½ × 4, pp. 16.

Commercial Geography. *Contemporary Rev.* 76 (1899): 371–378. **Bowles.**
The Sea the Only Road for Trade. By T. G. Bowles, M.P.

Commercial Geography. *G.Z.* 6 (1900): 10–20. **Halle.**
Die klimatische Verteilung der Industrie. Von Prof. Dr. Ernst von Halle.

Commercial Geography—Tea. **McEwan.**
VII. Internationaler Geographen-Kongress, Berlin, 1899. The Geography of Tea. By John McEwan. Size 8½ × 4½, pp. 20. *Presented by the Author.*

Historical. **Gallois.**
Terzo Congresso Geografico Italiano. Améric Vespuce et les Géographes de Saint-Dié. Mémoire de M. L. Gallois. Firenze: M. Ricci, 1899. Size 9½ × 7, pp. 16. *Presented by the Author.*

Historical. **Partsch.**
Die geographische Arbeit des 19 Jahrhunderts. Rede gehalten beim Antritt des Rectorats der Universität Breslau am 15 October 1899. Von Professor Dr. Josef Partsch. Breslau: W. G. Korn, 1899. Size 9 × 6, pp. 18.

On the geographical work accomplished during the nineteenth century.

Historical Geography. *G.Z.* 5 (1899): 665–671. **Kretschmer.**

Die Beziehungen zwischen Geographie und Geschichte. Vortrag, gehalten auf dem VII. internationalen Geographen-Kongress zu Berlin. Von Konrad Kretschmer.

Historical—Kepler. **Pixis.**

Kepler als Geograph, eine historisch-geographische Abhandlung von Rudolf-Pixis. (Münchener Geographische Studien, herausgegeben von Siegmund Günther. Sechstes Stück.) München: T. Ackermann, 1899. Size 9½ × 6, pp. viii and 142. *Price* 2*s*. 6*d*.

A study of Kepler's views on physical geography based ultimately on the eight-volume edition of the collected works, and on subsequently published correspondence.

Migrations. *Globus* 76 (1899): 377–380. **Dix.**

Ein Jahrhundert der überseeischen Völkerwanderung. Von Arthur Dix.

The number of emigrants from Europe by sea during the nineteenth century is estimated in round numbers as 30,000,009.

Political Geography. **Léotard.**

Conférence de M. Jacques Léotard sur les Compétitions Européennes au Soudan et en Chine faite le 6 Avril 1899 à l'Association Amicale des Anciens Élèves de l'École Supérieure de Commerce. Marseilles. Size 10 × 6½, pp. 8. ***Presented by the Author.***

Universal History. **Helmolt and others.**

Weltgeschichte. Erster Band. Allgemeines—Die Vorgeschichte—Amerika—Der Stille Ozean. Von Dr. Hans F. Helmolt, Prof. Dr. Josef Kohler, Prof. Dr. Friedrich Ratzel, Prof. Dr. Johannes Ranke, Prof. Dr. Konrad Haebler, Eduard Graf Wilczek und Dr. Karl Weule. Leipzig und Wien: Bibliographisches Institut, 1899. Size 10½ × 7, pp. x. and 630. ***Maps and Illustrations.***

This is the first volume of a treatise on the history of the world from the standpoint of the development in culture of the human race. It contains a general account of the prehistoric period, and sketches in some detail the history of America and of the Pacific ocean from the earliest times to the present day.

BIOGRAPHY.

Bandelier. **Ballivián.**

Mr. Adolfo F. Bandelier y sus Investigaciones en el Continente Americano. Por Manuel Vicente Ballivián. La Paz, 1899. Size 9 × 6½, pp. 20. ***Presented by the Author.***

Barbier. **Pfister.**

Joseph-Victor Barbier. Notice sur sa vie et ses travaux. Par Ch. Pfister. Nancy [not dated]. Size 9 × 5½, pp. 38. ***Portrait.*** ***Presented by the Société de Géographie de l'Est, Nancy.***

Baumann. *Deutsche Rundschau G.* 22 (1900): 231–233. ——

Dr. Oskar Baumann. ***With Portrait.***

Dr. Baumann was born in Vienna in 1865, and, after having taken a great part in the exploration of East Africa, died last year.

Biographical Dictionary. ——

Who's who, 1900. An annual Biographical Dictionary. Fifty-second year of issue. London: A. & C. Black, 1900. Size 7½ × 5, pp. xviii. and 1092. ***Presented by the Publishers.***

This convenient handbook of brief biographies of living persons is fast becoming indispensable, although there is room for the inclusion of some additional geographers and travellers.

Camperio. *B.S.G. Italiana* 1 (1900): 142–154. **Blessich.**

Manfredo Camperio. Cenni necrologici del socio Aldo Blessich.

Fisher. *Geolog. Mag.* 7 (1900): 49–54. **Davison.**

Eminent Living Geologists: Rev. Osmond Fisher, M.A. By C. Davison. ***With Portrait.***

The author of 'Physics of the Earth's Crust.'

Hazen. *Science* 11 (1900): 222–223. ———
Professor Henry Allen Hazen.

This notice of Prof. Hazen, the American meteorologist, is printed from advance sheets of the *Monthly Weather Review*.

Humboldt. *Z. Ges. Erdk. Berlin* 34 (1899): 311–362. **Lentz.**
Alexander von Humboldt's Aufbruch zur Reise nach Süd-Amerika. Nach ungedruckten Briefen A. v. Humboldt's an Baron v. Forell dargestellt von Eduard Lentz.

Kropotkin. ———
Memoirs of a Revolutionist. By P. Kropotkin. With a Preface by George Brandes. 2 vols. London: Smith, Elder & Co., 1899. Size 8½ × 5½, pp. (vol. i.) xiv. and 258; (vol. ii.) 340. *Portraits. Price* 21*s.*

In these volumes Prince Kropotkin publishes for the first time in the English language a short but clear description of his travels in Siberia while an officer in the Russian army, and explains how he was led to form the theory of the mountain system of Asia which is now universally accepted. He also furnishes an account of his studies of the physical geography of Finland, and the first volume contains so much geography that 'Memoirs of a Geographer' would form an appropriate title.

Rawson. *J.R. Statistical S.* 62 (1899): 677–679. ———
Sir Rawson W. Rawson.

Schmitt. *Deutsche Rundschau G.* 22 (1899): 135–137. ———
Robert Hans Schmitt. *With Portrait.*

GENERAL.

Almanac. ———
Annuaire pour l'an 1900, publié par le Bureau des Longitudes. Avec des notices scientifiques. Paris: Gauthier-Villars. Size 6 × 4, pp. vi., 628, 90, 16, 8, 2, 20, and 38.

In this issue hours are given in the *Annuaire* for the first time in the notation of 0^h to 24^h, starting from midnight.

Anthropogeography—Towns. **Thomson.**
P. and T.R.G.S. Australasia, Queensland 14 (1899): 1–8.
The Geographical Conditions of City Life. By J. P. Thomson.

Astronomy. **Downing.**
Precession Tables adapted to Newcomb's value of the Precessional Constant and reduced to the epoch 1910·0. By A. M. W. Downing, D.SC., etc. Edinburgh, 1899. Size 12½ × 10, pp. 86. *Presented by the Author.*

Astronomy. **Rambaut.**
On the Orbit of the part of the Leonid Stream which the Earth encountered on the morning of 1898, November 15th. By Arthur A. Rambaut, D.SC. (From the *Proceedings of the Royal Society*, vol. 65.) Size 8½ × 5½, pp. 321–328. *Presented by the Author.*

Bibliography. *P. and T.R.G.S. Australasia, Queensland* 14 (1899): 12–25. ———
Some Critical Notes on the Queensland Volume of the International Catalogue of Scientific Literature.

This report by the Council of the Brisbane branch of the Royal Geographical Society of Australasia apparently led to a correspondence with those responsible for the catalogue which was criticized; but while the letters of the Council are printed in an appendix, the replies have not been published.

Bibliography. **Fanchiotti.**
G. Fanchiotti. I Mss. Italiani in Inghilterra. Serie I. Londra. Il Museo Britannico. Vol. i. La Collezione Sloane. London, 1899. Size 11 × 7½, pp. 164.

On the Italian manuscripts in the Sloane Collection in the Library of the British Museum.

Bibliography—Catalogue. ———
Verzeichnis der Bücher in der Bibliothek der K. K. Geographischen Gesellschaft in Wien. Nach dem Stande vom 15 December 1897. Mit Nachtragen bis 31 December 1898. Wien, 1899. Size 9 × 6, pp. 450. *Presented by the K. K. Geographischen Gesellschaft, Wien.*

This catalogue of the Vienna Geographical Society is arranged under a comparatively small number of subject-headings in a series of lists, each of which runs alphabetically, according to authors' names. The whole is brought together in a continuous authors' index.

Bibliography—English Catalogue. ——

The English Catalogue of Books for 1899. Giving Titles Classified under Author and Subject in one Strict Alphabet, with particulars of Size, Price, Month of Publication, and Name of Publisher of the Books issued in Great Britain and Ireland in 1899, and the principal books published in America. London: Low & Co., 1900. Size 10½ × 6½, pp. 248.

Book of Reference. **Janes.**

The Englishwoman's Year Book and Directory, 1900. Second Year of New Issue. Edited by Emily Janes. London: A. & C. Black, 1900. Size 7½ × 5, pp. xxii. and 340. *Presented by the Publishers.*

British Empire. *P. Lit. and Philosoph. S. Liverpool* **53** (1899): 153–169. **Philip.**

The Growth of Greater Britain. A Review and a Forecast. By George Philip, jun. *With Map.*

The map shows by appropriate colours the gradual growth of the British empire and its territorial extent at different periods.

Education. **Zubiaur and Spilsbury.**

La Educacion Industrial. Informes sobre la Educación Industrial en los Estados Unidos de Norte-América y paises Europeos, publicados en Inglés bajo la dirección del Sr. Carrol D. Wright. Traducidos al Castellano por el Dr. J. B. Zubiaur y el Rev. Dr. J. H. Gybbon Spilsbury. Buenos Aires, 1899. Size 9½ × 6½, pp. 450.

Educational. **Ebner.**

200 farbige Skizzen (meist Tafelzeichnungen) zur Einführung in den Geographie-Unterricht. Für Lehrer und Schüler an Bürger- und Mittelschulen. Von Prof. Dr. H. Ebner. Wien und Leipzig: G. Freytag & Berndt [*not dated*]. Size 8 × 5½, pp. 72. *Presented by the Publishers.*

A collection of coloured diagrams, partly concerned with map-drawing, but mainly with statistics of various kinds.

Educational—Methods. *G.Z.* **6** (1900): 20–27. **Ratzel.**

Die Lage im Mittelpunkt des geographischen Unterrichtes. Von Friedrich Ratzel.

Educational—Methods. *J. School G.* **3** (1899): 368–375. **Snyder.**

Geographical Laboratory Work in Worcester Academy, Worcester, Mass. By W. H. Snyder.

Describes the series of exercises in practical geography carried out in the Physical Geography Laboratory of Worcester Academy. The exercises deal chiefly with the use of contour maps, drawing sections from maps, simple determinations of latitude and projections. The meaning and use of meteorological maps is also taught.

English Dictionary. ——

A Standard Dictionary of the English Language upon Original Plans, designed to give, in complete and accurate statement, . . . the Orthography, Pronunciation, Meaning, and Etymology of all the words and the meaning of Idiomatic Phrases in the Speech and Literature of the English-speaking Peoples. Prepared by more than Two Hundred Specialists and other scholars, under the supervision of Isaac K. Funk, D.D., LL.D., Francis A. March, LL.D., Daniel S. Gregory, D.D., LL.D. 2 vols. Vol. i., A to L; vol. ii., M to Z. New York and London: Funk & Wagnall's Co., 1900. Size 13 × 9½, pp. xx. and 2318. *Maps, Illustrations, and Coloured Plates. Presented by Dr. I. K. Funk.*

This very profusely illustrated dictionary is accompanied by a short gazetteer, which has not been uniformly revised to date, and a number of maps coloured politically, and produced in the familiar style of American atlases.

Geographical Congress. *Naturw. Wochenschrift* **14** (1899): 501–508. ——

VII. Internationaler Geographen-Congress Berlin, 28 September bis 4 Oktober 1899.

German Colonies. ——

Jahresbericht über die Entwickelung der Deutschen Schutzgebiete im Jahre 1898–1899. (Beilage zum Deutschen Kolonialblatt 1900.) Berlin: E. S. Mittler und Sohn, 1900. Size 12 × 9, pp. 318.

Rumanian Geographical Society. ———

Notice sur la Société Roumaine de Géographie (1875–1900). Bucarest: J. V. Socecŭ, 1899. Size 9¼ × 6½, pp. 24.

Travel. **Jefferson.**

A New Ride to Khiva. By Robert L. Jefferson. London: Methuen & Co., 1899. Size 8 × 5½, pp. xii. and 312. *Illustrations. Price 6s. Presented by the Publishers.*

The narrative of a cycle ride across Germany, Austria, Hungary, South Russia, and the Kirghiz steppe to Khiva. The cyclist was obliged to make use of camels in crossing the desert. The whole journey was a remarkable feat of endurance, and contains more of geographical interest than is usual in such works.

NEW MAPS.

By J. COLES, *Map Curator*, R.G.S.

EUROPE.

England and Wales. **Ordnance Survey.**

Publications issued since February 8, 1900.

6-inch—County Maps:—

ENGLAND AND WALES (revision):—**Cheshire**, 7 S.E., 45 N.E., 59 N.E., 64A N.E., 64 N.W., 65 N.W., S.E. **Derbyshire**, 21 S.E. **Staffordshire**, 1 S.E. **Westmorland**, 24 S.W., 25 N.W. 1s. *each.*

25-inch—Parish Maps:—

ENGLAND AND WALES (revision):—**Berkshire**, XII. 3, 7, 12; XIV. 9, 13, 14; XV. 14; XVII. 7, 8; XVIII. 3, 4; XXXIII. 2, 7, 8, 10, 11, 12; XXXV. 13. **Bucks**, XIII. 12, 13, 16; XIV. 7, 10, 11; XV. 2, 9, 11, 12, 13, 15; XVII. 12, 16; XVIII. 2; XIX. 1; XX. 6, 16. **Cumberland**, XXXV. 8; XLVII. 13; LIV. 8, 12; LV. 4, 5; LVI. 1; LVIII. 5, 13, 14; LXI. 2, 3. **Derbyshire**, XXXIV. 14; XXXV. 13; XXXVII. 8, 12; XXXVIII. 6, 9; XLII. 12, 15, 16. **Denbighshire**, I. 14 and 15; III. 3, 7, 8, 11, 12, 15, 16; IV. 13; VI. 4, 7, 8; VII. 1, 2, 3, 5, 6, 7, 8, 9, 10, 12, 13, 14, 16; XI. 16; XII. 1, 2, 3, 6, 8, 9, 10, 11, 13, 14, 15, 16; XVI. 4; XVII. 1, 5, 11; XX. 6; XXIV. 1, 2, 3, 7, 8, 9, 10, 11, 13, 14, 16; XXV. 5, 9, 10, 11, 12, 14; XXVI. 5; XXXI. 1, 2, 4, 11; XXXII. 1, 2, 7; XXXIII. 2, 6; XXXV. 2; XXXIX. 10. **Glamorganshire**, XI. 6; XVIII. 5, 13; XXVII. 8; XXXVI. 2, 3, 4, 5, 6, 7, 15; XLII. 10, 14, 16; XLV. 1, 2, 3, 4, 7, 8, 9, 11, 12; XLVI. 1, 3, 5, 7. **Nottinghamshire**, IX. 11, 13, 16; XV. 2, 4, 6, 7, 14; XVI. 3, 4, 16; XX. 3, 5, 7, 8, 9, 11, 12, 13, 15; XXI. 2, 5, 6, 7, 9, 10; XXIV. 1, 2, 5, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16; XXV. 1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14; XXVI. 1, 5, 6, 9, 10, 14. **Northamptonshire**, LXVI. 13; LXVII. 1. **Oxfordshire**, IX. 16; XI. 12, 14, 15; XIII. 12; XIV. 4, 7, 9, 10, 11, 13, 14; XV. 1, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 15, 16; XVI. 1, 4, 5, 6, 7, 8, 9, 11, 12, 13, 15, 16; XVII. 1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16; XXI. 4; XXII. 2, 3, 4; XXIII. 10; XXXIII. 15; XXXIX. 8. **Staffordshire**, XIV. 12, 14; XV. 9; XVIII. 4, 12; XIX. 4, 8, 12; XX. 12, 15. **Wiltshire**, III. 7, 8, 10, 11, 12, 14, 15, 16; IV. 7, 8, 10, 12, 13, 14, 15; V. 9, 13, 16; VI. 6, 9, 11, 13, 15; VIII. 1, 2, 3, 4; IX. 8, 12, 14, 15; X. 1, 2, 3, 5, 9; XI. 1, 3, 5, 7; XVI. 2, 3, 4, 6, 7, 8, 10, 11, 12, 14, 15, 16; XXIII. 2, 3, 4, 7, 10, 11, 12; XXX. 2, 6, 7, 9, 10, 11. 3s. *each.*

Miscellaneous:—County Diagrams, scale 2 miles to 1 inch, printed in colours, showing unions, sanitary districts, boroughs, and civil parishes; also the $\frac{1}{2500}$ scale sheet lines, viz. Cambridgeshire, Cardiganshire, Montgomeryshire, and Oxfordshire. *Price* 3s. *each.*

(*E. Stanford, Agent.*)

Historical Atlas. **Poole.**

Historical Atlas of Modern Europe, from the Decline of the Roman Empire; comprising also parts of the New World connected with European History. Edited by Reginald Lane Poole, M.A., PH.D., Fellow of Magdalen College, and Lecturer in Diplomatic, in the University of Oxford. Part xxv. Oxford: the Clarendon Press; London, Edinburgh, Glasgow, and New York: Henry Frowde, M.A.; Edinburgh: W. & A. K. Johnston. 1900. *Price* 3s. 6d. *Presented by the Clarendon Press.*

The present issue of this Atlas, Part xxv., contains the following maps: No. 40, Germany at the Peace of Westphalia, 1648, by the Rev. J. P. Whitney, M.A.; No. 59. the French Empire in 1810, by H. A. L. Fisher, M.A.; and No. 88, The United States of America after the treaty of 1783, by Hugh E. Egerton, M.A. Each map is accompanied by explanatory letterpress.

Portugal. **Portuguese Government.**

Portugal. Scale 1: 100,000 or 1·6 stat. mile to an inch. Sheets: 2, Larouco; 5, Chaves; 36, Quinta. Levantada construida e gravada pela Direcção Geral dos trabalhös geodesicos e topographicos, Publicada em 1898, 1899.

ASIA.

Asia. **Service Géographique de l'Armée, Paris**

Asie. Scale 1: 1,000,000 or 15·8 stat. miles to an inch. Sheets: Kang Neung. Pékin, Moukden, Tcheng-Te-Fou, Vladivostok, Nankin, Quelpaërt, Séoul. Dessiné, heliogravé et publié par le Service Géographique de l'Armée, Paris. *Price* 1·25 *fr. each sheet.*

As will be seen by the title, these sheets include those parts of China, Russia, and Korea with regard to which a great deal of political interest is felt at the present time. The map is very nicely drawn, soundings are given along the coast, and all means of communication are shown.

China. **Riddel.**

Map of the Neighbourhood of Swatow, from Pheng-Hai in the south-west to Chau-An on the east, and Yung-Ting in the north, with the course of the North Han to Ting-Chow and West Han to Moi-lim. Scale 1: 63,360 or 1 mile to an inch. By Rev. W. Riddel, M.D. London: McCorquodale, 1899. 12 sheets.

In this map the coast-line is taken from the Admiralty charts, and the chief inland positions are fixed by plane-table or sextant, the details being filled in with prismatic compass. The names of district cities are given in Mandarin Chinese, with local name underneath. Where names would be crowded, numbers have been used, beginning and ending in each 5-mile square, the position of which in each degree is marked by numbers at sides of the sheets, in order to find names by an index. A full explanation is given of the symbols used in the map.

The map is a lithographic facsimile of the original drawing by Dr. Riddel.

AFRICA.

South Africa. **Johnston.**

Special Map to illustrate the Military Operations in South Africa, 1900. W. & A. K. Johnston, Edinburgh & London. *Price* 1*s., coloured.*

Tunis. **Service Géographique de l'Armée, Paris.**

Carte topographique de la Tunisie. Scale 1: 50,000 or 0·8 stat. mile to an inch. Sheet lxxiii., Kerker. Dressé, heliogravé et publié par le Service Geographique de l'Armée, Paris. *Price* 1.50 *fr.*

West Africa. **"La Dépêche Coloniale."**

Gouvernement Général de la Cote Occidentale d'Afrique. Scale 1: 4,000,000 or 63 stat. miles to an inch. "La Dépêche Coloniale," Lundi 12 Février 1900. Paris.

AMERICA.

North-West Canada. **Surveyor-General's Office.**

Map of Parts of the Yukon Territory and Mackenzie District. Scale 1: 1,267,200 or 20 stat. miles to an inch. Surveyor-General's Office, Ottawa, 1899. *Presented by the Surveyor-General of Canada.*

Mr. W. Thibaudeau has compiled this map, under Mr. Ogilvie's direction, from all the most recent sources of information, which are acknowledged in a note. The object of the map is to show the course of the Peel river and its tributaries. It has been printed for the use of the Survey Office only, and is not intended for public distribution. There is no hill shading, but the supposed line of watershed between the Yukon and Mackenzie basins is laid down.

AUSTRALIA.

Western Australia. **Campbell.**

Topographical Map of Menzies, North Coolgardie Gold Field. Scale 4 inches to a mile. By W. D. Campbell, Topographical Surveyor, 1899. Geological Survey

Office, Perth, Western Australia. *Presented by A. Gibb Maitland, Esq., Government Geologist.*

Western Australia. **Geological Survey Office, Perth.**

Geological Sketch-Map of the country between Cue, Peak Hill, and Menzies. Scale 1 : 1,500,000 or 23·6 stat. miles to an inch. Geological Survey Office, Perth. *Presented by A. Gibb Maitland, Esq., Government Geologist.*

GENERAL.

Exploration. **Schrader.**

L'Année Cartographique. Supplément Annuel à toutes les Publications de Géographie et de Cartographie. Dressé et rédigé sous la direction de F. Schrader. Neuviéme Supplément, contenant les Modifications Géographiques et Politiques de l'Année, 1898. Paris : Librairie Hachette et Cie., 1900. *Price* 3 *fr.*

The first sheet of this useful atlas contains maps showing the route followed by Captain Welby and Lieut. Malcolm across Northern Tibet in 1896; a map of Formosa based on the Japanese maps published by the Geographical Society of Tokio; maps showing the routes followed by Mr. Cl. Madrolle in Yunnan, Se-Chuan, Hai-nan, and the Lei-Chau peninsula. There is also a map on which Mr. A. H. Savage Landor's route to the sources of the Brahmaputra is laid down. The African sheet contains a map showing Mr. E. Gentil's explorations between the Ubangi and Lake Chad; the frontier region between Liberia and the French possessions on the Ivory Coast; the region of the Bhar-el-Ghazal, on which the routes followed by the Marchand expedition during the years 1897–98–99 are laid down; the journey of Mr. L. Derragon between Jibuti and Addis-Ababa; and a map of the north-western portion of Madagascar, showing the explorations of Lieut. Duruy. On the American sheet are the following maps: Part of Central America, from the map of Dr. C. Sapper; a railway map of Argentina and Uruguay; and a map of the Andine Region of Argentine Patagonia, from unpublished documents furnished by Dr. F. P. Moreno. Each sheet of this atlas is accompanied by explanatory letterpress.

World. **Langhans.**

Deutsche Flotten-Wandkarte zur Veranschaulichung deutscher See-Geltung und See-Geschichte. Bearbeitet von Paul Langhans. Gotha : Justus Perthes. 8 sheets. *Price, in sheets,* 16 *marks.*

This map is intended to illustrate German naval history. German possessions are coloured red, principal railways and steamship routes are shown, and German naval stations clearly indicated; in addition to this, a great deal of information is given in tabular form.

World. **Vivien de Saint-Martin and Schrader.**

Atlas Universel de Géographie. Ouvrage commencé par M. Vivien de Saint-Martin et continué par Fr. Schrader. Sheet 42, Asie Physique. Paris : Librairie Hachette et Cie. *Price* 2 *fr.*

This is the last-published sheet of the Atlas Universel. It is coloured in fifteen different shades to indicate the elevations of the land and the depths of the ocean, which are also given in figures. The relief is also shown by hill shading, and, considering the small scale of the map, a large amount of detail is given.

CHARTS.

Russian Charts. **Chief Hydrographic Department, Ministry of Marine, St. Petersburg.**

Charts and Plans published by the Chief Hydrographic Department, Ministry of Marine, St. Petersburg.

Black Sea.

No.
542. Plan of Varna. Scale 2240 feet to an inch. 1899.
533. Plan of Burghaz harbour. Scale 4550 feet to an inch. 1899.
530. Plan of the Kilia mouths of the Danube. Scale 5150 feet to an inch. 1899.
535. Eupatoria bay. Scale 700 feet to an inch. 1899.
544. Plan of Dniester bay. Scale 0·9 stat. mile to an inch. 1899.

North Pacific Ocean.

1812. Plan of Possiet bay. Scale 4550 feet to an inch. 1899.

United States Charts. **U.S. Hydrographic Office.**

Pilot Chart of the North Atlantic Ocean for February, 1900. Published at the Hydrographic Office, Washington, D.C. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Canadian Rocky Mountains. **Wilcox.**

Five Picturesque Landscapes in the Canadian Rocky Mountains. By Walter D. Wilcox, Esq., F.R.G.S. New York and London: G. B. Putnam's Sons, 1900. *Presented by W. D. Wilcox, Esq., F.R.G.S.*

These are a very beautiful set of photographs of some of the most picturesque scenery of the Canadian Rocky mountains. The following is the list of their titles:—

(1) At the foot of the Rockies; (2) Moraine lake; (3) Lake Aline; (4) Mount Assiniboine; (5) Evening.

New Guinea and Pacific Islands. **Brown.**

Fifty-two Photographs of British and German New Guinea, New Britain, and Solomon Islands. By Rev. G. Brown, D.D. *Presented by Rev. G. Brown, D.D.*

Although the circumstances under which these photographs were taken by Dr. George Brown must at times have made his task a difficult one, he has nevertheless succeeded in producing remarkably good specimens. The selection of subjects has been carefully made to illustrate the scenery and natives, together with their dwellings, implements, etc. The titles are as follows:—

British New Guinea.—(1) London Missionary Society station, Port Moresby; (2) View from mission house, Port Moresby; (3) Street in Port Moresby; (4) Street in Port Moresby; (5) Street, Elevara island, Port Moresby; (6) Elevara island, Port Moresby; (7) New Guinea stone clubs; (8) Women coming from work; (9) Schoolgirls at mission station, Dobu; (10) Three schoolboys, Dobu; (11) Native houses, Dobu; (12, 13) Part of circular village, Fergusson island; (14) Women and girls, Dobu; (15) Women, Normanby island; (16) Women cooking, Normanby island; (17) Group of natives, Normanby island; (18) Natives, Normanby island.

German New Guinea.—(19) Group of natives; (20) Women and children; (21, 22) Women; (23–26) Natives; (27) Man in the act of shooting.

New Britain.—(28) Native village; (29, 30) Native dances; (31) Fijian dance.

Solomon Islands.—(32) Natives, Shortland group; (33) Tambu house, Shortland group; (34) House and natives, Rubiana, New Georgia; (35) Canoe, Rubiana, New Georgia; (36) Canoe and wooden figure, Rubiana, New Georgia; (37) Sacred image in bush, Rubiana, New Georgia; (38, 39) Figure showing distension of lobe of the ear, Rubiana, New Georgia; (40) Gemu, chief of Rubiana, New Georgia; (41) Man and women, Rubiana, New Georgia; (42) Burial-place, Rubiana, showing miniature house in which the skull of dead relatives is placed; (43, 44) Natives of Shortlands group; (45) Village, Aola; (46, 47) Village scene, Marau, Guadalcanar; (48) Beach scene, Florida; (49) Two natives, Marau; (50) Three men and boy, Marau; (51) Women and children, Marau; (52) Head hunter's canoe, Marau.

Vancouver Island. **Victoria Book and Stationery Co.**

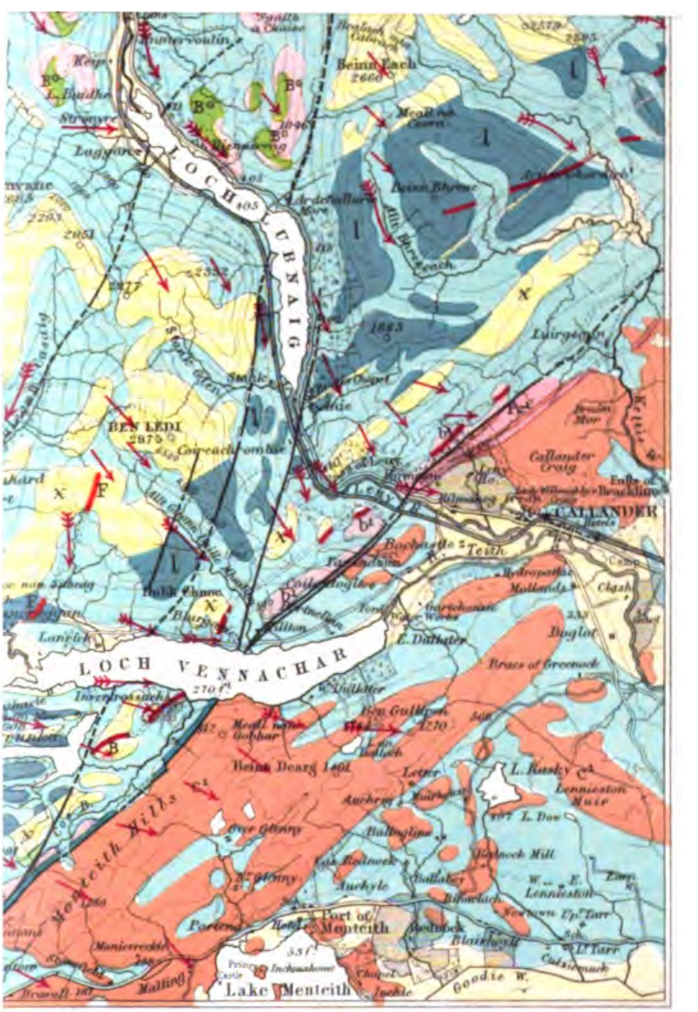
Photographic View Album of Picturesque Victoria, Vancouver Island. Published by Victoria Book & Stationery Co., Victoria, B.C. *Presented by Lieut. Tristan Dannreuther, R.N.*

The titles are given below:—

(1) Looking from the new Government buildings, James bay, Victoria; (2) James bay, from cathedral; (3) James bay, looking west from cathedral; (4, 5) Parliament buildings, Victoria; (6) East side, Parliament buildings; (7) Government street; (8) Post Office; (9) St. Anne's convent; (10, 11) Beacon hill park; (12) Mount Baker, from Victoria; (13) Esquimalt church and royal roads; (14) H.M. ships in Esquimalt harbour; (15) Outer harbour; (16) Olympic range, from Victoria; (17) The Gorge, Victoria Arm; (18) Naval canteen grounds, Esquimalt; (19) St. Andrew's Presbyterian church, Metropolitan Methodist church, Roman Catholic church; (20) Salmon run, near Yale; 30,000 Fraser river salmon; (21) A catch of trout before breakfast; Sproats falls, Alberni district, V.I.; (22) Sporting views in the neighbourhood of Victoria.

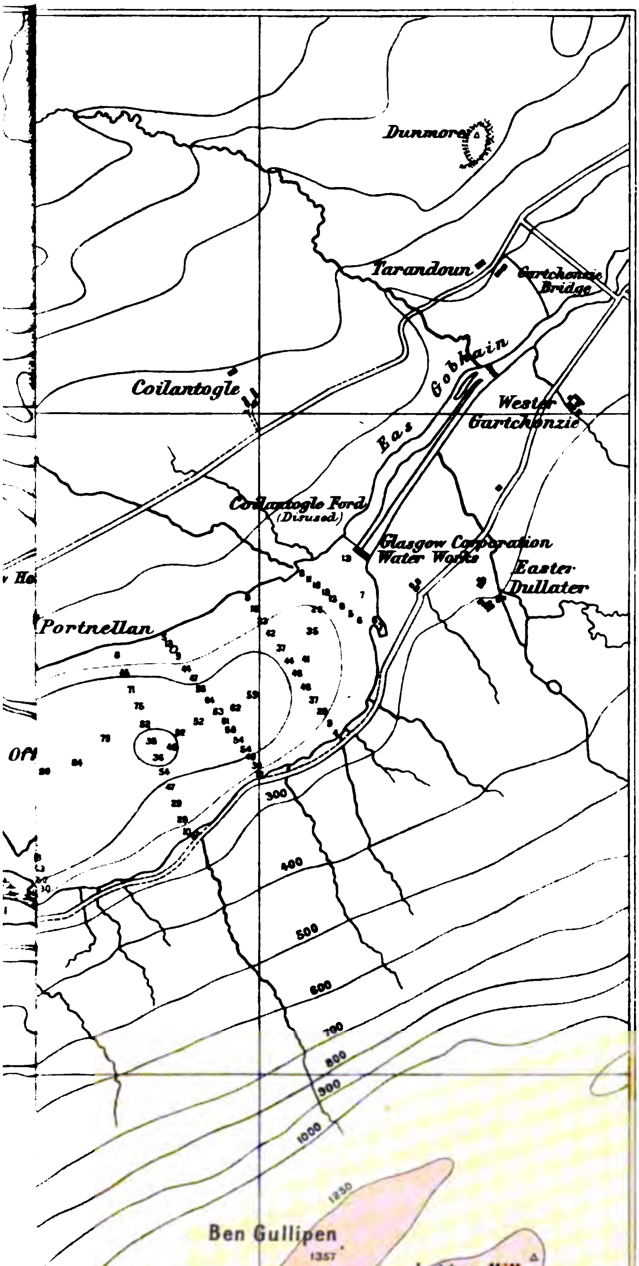
N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

J G Bartholomew.



J. G Bartholomew.

J. G. Bartholomew.



ACHRAY, VENNACHAR, AND DRUNKIE.

SURVEYED IN 1899

Scale 1 : 21,120 - 3 INCHES TO 1 MILE — 1 Mile — 1·61 Kilometres

0·31 KILOMETRE — 1 CENTIMETRE

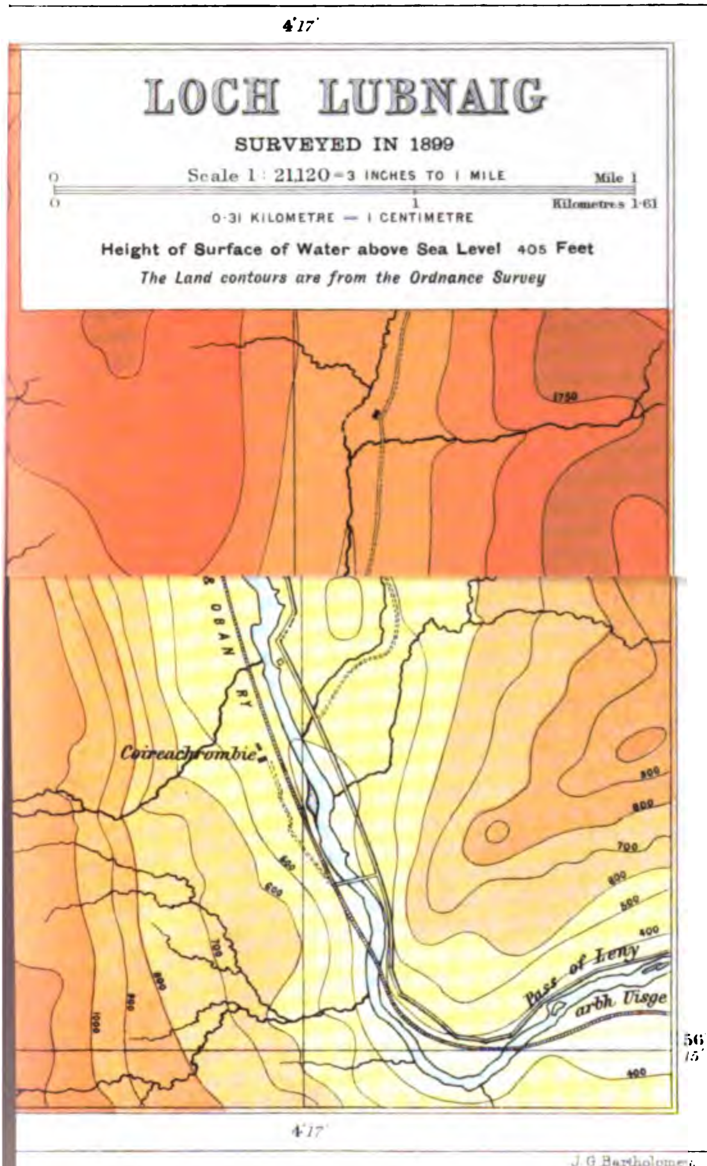
Surface of Water above Sea Level L. Achray 276, L. Vennachar 270, L. Drunkie 416 Feet

...and contours are from the Ordnance Survey

4°16'

Scottish Lochs.

. P. PULLAR, F.R.G.S. THE GEOGRAPHICAL JOURNAL



J. G. Bartholomew.

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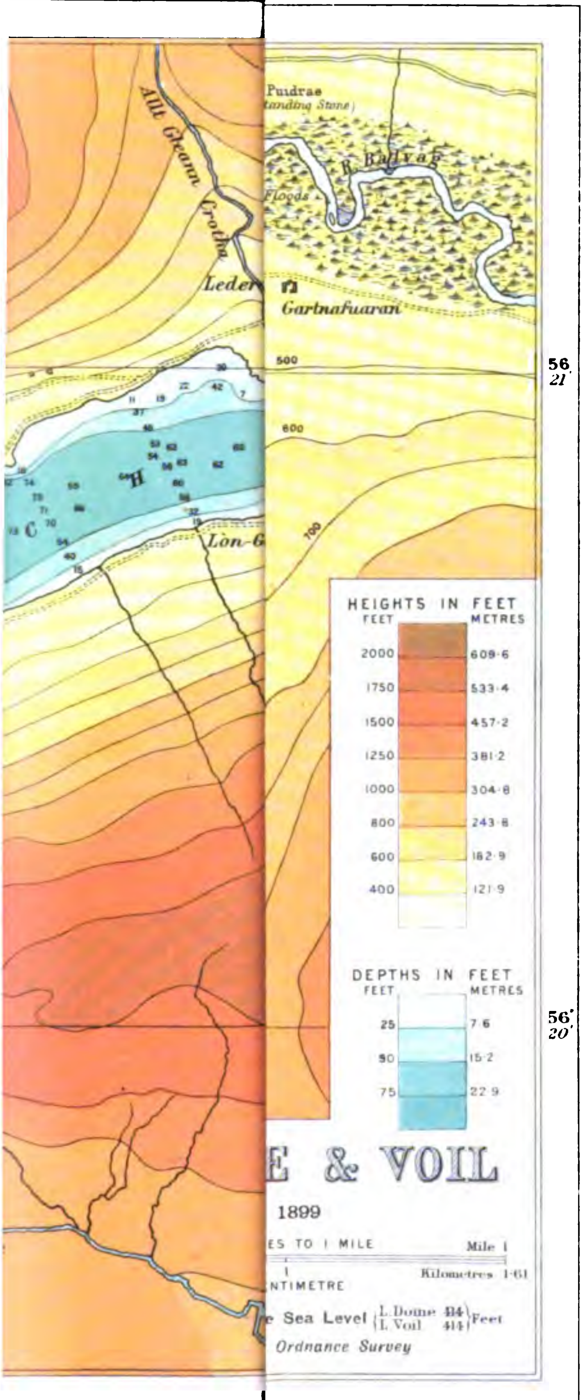

y the Royal Geographical

J G Bartholomew.

The

Geographical Journal.

No. 5. MAY, 1900. Vol. XV.

A JOURNEY TO THE SUMMIT OF MOUNT KENYA, BRITISH EAST AFRICA.*

By H. J. MACKINDER, M.A.

In East Africa stand two snow-capped mountains, extinct volcanic cones, whose names have been known for fifty years—Kilimanjaro and Kenya. They are about 200 miles apart, due north and south of one another, the equator crossing Kenya, the more northern of the two. It was the missionary Rebmann of Mombasa who, in 1848, first reported the existence of Kilimanjaro. In the following year his colleague, Krapf, saw Kenya from Kitui, a spot 90 miles south-east of the peak. Since that time Kilimanjaro is said to have been visited by more than a hundred Europeans, and both the British and the German Governments have now established stations in its immediate proximity. Its summit was conquered in 1889 by Dr. Hans Meyer. Kenya, on the other hand, being further inland, and for other reasons less accessible, has been more rarely visited. It was seen, for the second time only, in 1883 by Joseph Thomson, when he crossed the plateau of Laikipia, out of which rise the north-western slopes of the mountain. In 1887 Count Teleki penetrated the forest girdle of Kenya, and succeeded in reaching an elevation of nearly 14,000 feet. Six years later Dr. Gregory attained to a height probably about 2000 feet greater. Both of these attempts were on the south-western quadrant of the mountain. Captain Dundas had previously failed to emerge from the forests of the southern slope, but Dr. Kolb at a later time reached the open "alp" above the eastern forest. It appeared, therefore, that when the Uganda railway had reduced the distance from the coast to Kenya by two-thirds, it should be possible,

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with no great expenditure of time, to convey a well-equipped expedition in a state of European health to the foot of the mountain, and that such an expedition would have a reasonable chance of completing the revelation of its alpine secrets.

Rail-head having arrived at the requisite point in the summer of last year, our party, consisting of six Europeans, left Marseilles on June 10. My colleagues were Mr. C. B. Hausburg, who shared with me the expense of the expedition; Mr. E. H. Saunders, a collector; Mr. C. F. Camburn, a taxidermist; César Ollier, an Alpine guide from Courmayeur; and Joseph Brocherel, a porter from the same village. We were aided by a grant from this Society. Mr. Hausburg was good enough to act, not merely as photographer, but also as camp-master, thus leaving me free for observation and survey. The most important item in our equipment was a series of forty boxes, tin-lined, each weighing 25 lbs., and containing a day's complete rations for six white men. Two of these boxes were a man's load, and we carried them to the mountain, where food could not be obtained. They served our purpose admirably, and in a year of unusual drought were the basis of our success. By any other method of packing, theft and waste would have compelled retreat long before our work was accomplished.

We reached Zanzibar on June 28, and, warned by a telegram from Mombasa informing us that other caravans were about to set out for the interior, and that porters were in unusual demand, we asked for and obtained the kind permission of General Matthews, the Sultan's first minister, to recruit Swahilis in Zanzibar. On July 4 we landed at Mombasa, where famine-stricken Wanyika were engaged on relief works, and small-pox was prevalent. We therefore arranged with Major Souttar, to whom our thanks are due, that the fifty-nine Zanzibaris, who arrived on the 6th, should march to the fort and be isolated for the night. On the following morning they were placed in the train and sent to rail-head, then at Nairobi, a three days' journey from Mombasa. Mr. Hausburg took charge of them, and with him there went the other four Europeans, while I remained at Mombasa until the 12th, completing our arrangements. The advanced party were delayed by a railway accident, and Hausburg had to undertake the transhipment of all our goods at midnight. During my stay at Mombasa, I enjoyed the very kind hospitality of the chief engineer of the Uganda railway and Mrs. Whitehouse.

At Nairobi we camped alongside Mr. S. L. Hinde, the collector of Masailand. There we recruited local porters, with the invaluable help of Mr. F. G. Hall, the well-known district officer at Fort Smith. We also learned something of the ways of the country and of its game, and spent pleasant days in the company of the railway and Protectorate officials. With the aid of Captain Bearcroft of H.M.S. *Philomel*, of the Eastern Telegraph Company and Mr. Anderson, their manager at

Zanzibar, and of the Uganda railway and Mr. Stallibrass, the director of telegraphs, I endeavoured to fix telegraphically the longitude of Nairobi as a base for our work. Most unfortunately, the sky was overcast on two successive days selected for the operation; then the spread of small-pox compelled us to clear precipitately from Nairobi under threat of quarantine. On my return from Kenya, the *Philomel* had gone to Delagoa bay to take part in the Boer war.

We parted from Mr. and Mrs. Hinde at Nairobi, but we owe so much to their kind help, that they must be counted as members of the expedition in charge of the base.

The last detachment of the caravan left the railway on July 26, and

ON THE ATHI PLAINS.

marched to our first camp on the Nairobi river, 9 miles from the station. There we concentrated, and after a day's delay commenced our journey to Kenya in the morning mist of the 28th. All told we were 170 strong—six Europeans, sixty-six Swahilis, two tall Masai guides, and the remainder naked Wakikuyu. For four days we crossed the Kapoti plains, steering by Donyo Sabuk, the "great mountain" of the Masai. The plains are treeless and carpeted with sweet grass, which at this season was burned brown and crumbled under the foot. In addition to the Nairobi, we crossed three considerable streams—the Ruiru, the Daruku, and the Thika—whose waters, thigh-deep, are drawn from the slopes of Kikuyu away to the north-west. Their winding valleys are trenched into the plateau, and along the bottoms a continuous belt of tree and bush overarches the river-channel. There was evidence of lions at the river-banks, but game was not very abundant in this part of the plain, although we had seen herds of 1500 zebra, wildebeeste, and hartebeeste at a distance of 20 or 30 miles to southward beyond the Nairobi station. Rhinoceros were the most striking tenants of the waste. On two occasions, when we went more than usually near to them, they charged into the caravan, fortunately without serious effect.

At one point the Nairobi river, flowing flush with the plain and encumbered with tall mop-headed papyrus, suddenly plunges into a gorge with twin falls divided by an islet. The gorge head, moist with spray, is choked with tropical vegetation, including palms, which we had not seen since we left Voi, only 100 miles from the coast.

On the banks of the Athi, here called the Begazi, and at the foot of Donyo Sabuk, we fell in with Mbuthia, a wizened Kikuyu chief, with avarice and cunning written in every line of his face, who was returning to his village from a visit to Mr. Ainsworth at Machakos. He brought two cows, the one a gift to him from Mr. Ainsworth, the other for me to present on the Sub-Commissioner's behalf to the principal mzee or elder of Meranga. As long as he was with us it was Mbuthia's proud function, like a Hebrew king, to make pretence of driving these cows. If they strayed, his attendants turned them again to walk in front of him.

On July 31 we made a march of 15 miles from the Athi to Muluka, Mbuthia's village. Our way lay over the plain and across the Thika river into a country set thinly with scraggy trees, like a great apple orchard with drought-burned grass. This is the march-land between the grassy plain of the Masai and the cultivated hills and valleys of the Wakikuyu. Gradually the grass became longer and greener, until at last it was shoulder-high and seed-topped. Then we came suddenly to the brink of the deep valley of the Thuge brook, along which, in the bottom, wound a strip of irrigated cornland. On the opposite side, in a glade of the bush which ran up the slope, we pitched our camp in close neighbourhood to Muluka.

Here our troubles began, for our Kikuyu headmen came to us with strong expressions of distrust as to the intentions of their countryman, Mbuthia. It took some diplomacy to secure peace, and that evening we for the first time put a boma or fence round the camp, and the white men took turn in keeping guard. Next day we made a state entry into Muluka, photographed Mbuthia and his wives, and shifted camp across the ridge on which the village is placed, into the next valley—that of the Ilula brook. It was in this district that Mr. Haslam, one of the Protectorate officers, had been murdered a short time before, and here a neighbour of Mbuthia's, Mudiu of Katumba, a man of singularly deceitful and repellent countenance, intrigued with the Wakikuyu of our caravan, trying to make them desert us, in the hope, no doubt, of looting what we could not carry without their aid. In the evening, by firelight, our Kikuyu headmen endeavoured to counteract his and similar influences by orations, whose resounding periods and eloquent vowel sounds were seductive even to those of us who could not understand a word that was spoken. As the peroration was reached the orator put questions to the crowd, who replied unanimously, with an effect which resembled the rapid recital of the Church Litany, punctuated by the loud grunting

IN THE KENYA FOREST.

responses of the congregation. These Kikuyu headmen behaved well on the whole, and were loyal to us in spite of considerable temptations. Next morning, however, the whole body of Kikuyu porters attempted to desert, and were only checked by a display of firearms.

From this until August 6 we struck northward and eastward through a difficult country with successive ridges at right angles to our path, and deep-cut valleys between them. Rich banana shambas crowned the summits; irrigated strips of maize wound along the valleys. From a single prominent point in one of these valleys I counted fourteen separate villages. The soil was of a brilliant red; the grass was green, and the wild-flowers of an English aspect; the well-trodden paths were often sunk like Devonshire lanes, and when the morning dew was on the weeds, and the bananas for a moment out of sight, the whole scene appeared familiar and far from equatorial.

There seems to be no superior government among the Wakikuyu, and our fortunes varied with the character and temper of each local chief or elder. At one camp, on the Iseragua brook, the whole country-side was afraid of us, and through fear was hostile. At night large fires lit up the hilltops around us, the centres, no doubt, of shauri and medicine-making. A woman, probably a spy, tried to gain entry to the boma, and our old Masai, Ndani, got hold of her by the wrist across the fence and was about to run her through with his sword, but Hausburg saved her, and she got away. In the morning we found that the guides had deserted, and that no natives were visible except a group of spearmen high up on one of the remoter paths. We sent out an armed party with our Kikuyu headmen, who, after long parley at a distance gradually reduced, finally brought in two chiefs trembling like aspens. With these we set out, and by much shouting they induced others to join us. None the less, an arrow fell at my feet when we were traversing a thicket that day.

In sharp contrast to this was our treatment by Wanganga, an elder whose village was perched on the highest and steepest ridge which we had to traverse. After having rather nervously climbed some 500 feet under the eyes of spearmen perched on the rocks above us, we were surprised by a warm handshake from a tall dignified savage, supported by his son and by colleagues, and surrounded by the ladies of his harem, who presented to us a "chit," or letter, which he had obtained from Mr. Lane when on a visit to Kitui, and with it the finest sheep which we received as a present during the whole of our journey. We were still more surprised to find that some men, whom our Swahilis and Masai would have disarmed and plundered as suspects but for a fortunate interference on our part, had been guides sent out by Wanganga to bring us safely across his country. I was much impressed about this time by the significance of an inquiry from a chief as to whether I was a good or a bad white man.

On August 6 we marched out of the hill country of Kikuyu—which is a trenched and denuded lava plateau—over the brow of the gneissic hill Kandundu, with an extensive view upon plains to eastward, and then through the gap between the gneissic hills, Kamuti and Kambijo, across the Sagana, to the plain which is the beginning of Meranga. Here we pitched camp and stayed for three days. In the last two marches we had again had to deal with rivers rather than brooks, and of these the Maragua, the Kaiahue, and the Mathioya are worthy of mention.

Meranga is a country about 30 miles across, extending from the

Sagana northward to the edge of the Kenya forests. It has very definite limits. We entered it when we crossed the Sagana; we left it when we crossed the Ragati. It is part of Kikuyu, and yet very distinct from the remainder of that land. It appears to be ruled by a system of informal meetings, or shauris, of elders, who sit on little stools in a great ring. Such a shauri was held within sight of our camp on the day of our arrival, summoned, no doubt, by Magonie, the elder of the neighbouring village, with whom we had made friends. Through our glasses we watched one orator after another address the assembly, and daylight was failing before the interpreter came to announce that "the

THE CLOUDS ON LAIKIPIA PLATEAU, WITH NANDARUA AND SATTIMA ON THE WESTERN HORIZON, AS SEEN FROM THE UPPER LIMIT OF FOREST (ABOUT 10,800 FEET) ON THE SHOULDER OF MOUNT KENYA.

rich men of Meranga," as he put it, had come to visit us. The shauri had, in fact, adjourned to our camp, and when the ring had been re-established, and when Hausburg and I had joined it, and Magonie had made speeches, we were informed that the Wameranga were our friends, and would do all they could for us. Then the fifty Wazee rose, and, shaking hands with us, filed away each to his own village, or, in the case of the more remote, to stay the night with Magonie. Even at this first interview, however, we heard that the Wameranga were at enmity with the Kikuyu peoples, through whose territories, beyond Meranga, we should have to approach the western foot of Kenya, and that consequently there were limits to their power of helping us. Accidentally

I learned, what I afterwards abundantly verified, that Meranga has an alternative name, Ilyaini. There is some legend about a great chief, who was the father or founder of the country, and had two names, Meranga and Ilyaini.

Along the north bank of the Sagana is a most elaborate system of pits intended to trap hippopotamus, which are still plentiful in the river, and invade the native shambas by night, doing much damage. These pits are large and extend so far that together they constitute a considerable work of engineering. We found frequent hippopotamus skulls in their neighbourhood, each the record of a feast, for all the bones except the skull had been removed, and the teeth had gone from that. To supply our men with meat, Hausburg shot two hippopotamus in a pool 3 miles above our camp, into which the Sagana and Ragati rivers fall over edges of the lava sheets which here underlie the plain. But he won greatest renown by killing a hawk on the wing, a feat not usually attempted by the native bowmen. I tried in vain to obtain astronomical sights. For many days the weather here and at previous camps followed a constant *régime.* It did not rain, but the sky was always overcast, except for a gleam of sunshine shortly before evening. As might be expected under such conditions, the temperature was very equable.

We left Magonie's on August 10, our guides being three wazee—Kamanga, Kerrerri, and Magonie. Kamanga was an important elder verging on old age, a pleasant man, but of no strength of character. Magonie was a pushing, boisterous individual, friendly enough, but rather oppressive. We were told that he was a notorious drunkard. Kerrerri was a young man of somewhat Japanese countenance, very pleasant and intelligent, but of slippery character. I learned a great deal from him, but found it necessary to verify everything by the cross-examination of more stupid persons. A young friend of his who joined us later was the handsomest man I saw in Africa, and it struck me frequently that the better-bred Wakikuyu, with their comparatively thin lips, copper skin, well-bridged noses, and slightly oblique eyes, were a far more intelligent people than the average negro, more intelligent also than the negroid rank and file of their own people. In some respects resembling the Masai, they differ markedly from them in character, for the Wakikuyu are mercurial, and the Masai are reserved and silent. Yet the Wakikuyu have nothing of the childish and fatalistic temperament of the Swahili. They are responsible free men, not emancipated slaves.

For 7 miles from Magonie's our way was over the plain through fields of maize and maize stubble, and past banana groves. For the first time since we left the mango trees of the coast, we saw really fine spreading trees of the general appearance of walnut-trees, with large dark foliage—the remainder, no doubt, of the forest which seems to

ZANZIBAR.

"ALPINE VEGETATION ON MOUNT KENYA."

have clothed the greater part of the Kikuyu country at no distant date. The hedges between the fields were mostly of wild tomato, and bore both fruit and flowers. Beans, sweet potatoes, yams, and gourds were abundant. Narrow paths of greasy red soil traversed the country in all directions, crossing the streams by bridges formed of felled trees, the trunks of which are cleft down the centre, the flat surface being upturned. The paths were usually fenced in, and wild flowers grew along their edges. We saw evidence of the use of manure.

Towards the end of this march we entered a hill country, but the cultivation became if anything more extensive and more continuous, and

GIANT LOBELIAS.

the crops more luxuriant, for we had now come to that part of Kikuyu in which it appears to rain almost daily. From August 7 to the 15th, it rained every day from midnight, or earlier, until noon or later. We travelled under the most depressing conditions, drenched to the skin from the moment that we rose, making short marches over slippery paths, and pitching our camp on wet ground. Yet the aspect of the country was something never to be forgotten. Here, in the heart of Africa, in a region previously approached by half a dozen white men at most, we traversed square miles of standing maize, neatly divided by slight furrows into rectangular half-acre plots, each, we were told, valued for sale at the price of a goat, and we had to pitch camp in a market-place strewn with corn-cobs, or to march for several miles to the next vacant space. As we approached the end of Meranga, however, a singular change took place in the aspect of the people. At Magonie's, on the Sagana, they had worn cloth, and, friendship once established, had come freely into our camp, maintaining a day-long market outside it. Here, as we approached the borders of Wangombe and of the dreaded Watumutumu, even the chiefs wore skins, and for hours we marched over a land heavy with crops, and yet saw neither man nor woman. Again and again Kerrerri asked me to prevent our Swahilis from shouting and singing, in order that the inhabitants might not be frightened, and that he might have an opportunity of establishing relations with them.

Through Meranga we followed the valley of the Ragati, an important tributary of the Sagana not marked on the maps, which descends due southwards from Kenya. On August 12 and 13 we crossed its upper basin, where a number of streams from the Kenya forests converge to form the Ragati proper. Here the higher grounds rise above the cultivation and have the aspect of a rough English common, of the kind that would here be overgrown with gorse and bracken. Both the uplands and the stream-edges were brilliant with flowers; indeed, the whole of the upper part of Meranga is a paradise of wild-flowers.

On August 13 we crossed the Ragati and entered the little country of Kaleti, ruled by the chief Wangombe, a terror to the whole neighbourhood. We were told that at the time of our visit he held prisoner the son of our Masai, Ndani, and the brother of our Meranga, Kerrerri. In the early morning of the 14th, before we had as yet met the chief, Magonie and Kerrerri fled from us rather than encounter him. We had no alternative but to advance into his country without a guide. We made straight for his village, with the effect that he came out to meet us. After a long and irritating interview, he at last abandoned his effort to induce us to camp alongside of him, and undertook to guide us to the Sagana and to supply us with food, but he would have nothing to do with our friends the Wameranga.

We now marched for two days through a forest containing many elephants, whose paths we followed. The flowers were here rarer, but of the same species as in the cultivated country. The most singular point, however, was the almost complete absence of winged insects, at any rate in the day-time. Song birds, on the other hand, were abundant. The lofty trees were hung with beard-moss. Here and there we traversed green glades, from which conical hills, clothed with forest, could be seen to rise from among the trees in our neighbourhood. Niana and Kehari, the most prominent of these hills, became important landmarks at a later stage of our journey.

The rain now ceased, though it obviously persisted in the country that we had traversed. Ahead, to northward, was a great arch of blue sky, a clearing which had been seen at times, low on the horizon, from so distant a point as Magonie's. The relation of rain, wind, and land-relief was, in fact, strikingly illustrated by our experiences. The south-east monsoon was blowing strongly without depositing rain on the plains of the Athi and Sagana, whose elevation is about 5000 feet. When it struck the slope of Kikuyu, which rises gradually from 5000 feet to about 7000 feet, it drenched the whole country side. The high plains of Laikipia, which surmount the slope at an elevation of about 7000 feet, were dry. So sudden is the change from Kikuyu to Laikipia, that in the course of a single march of about 9 miles we left a

TREE GROUNDSEL.

dripping forest and came to a land which was the scene during the next few weeks, not merely of prairie fires, but also of forest fires. Yet in the presence of these fires we could see the heavy bank of clouds close at hand, driving up over the brink of the plateau and melting into thin air.

It was on the afternoon of August 15 that we emerged from the forest of Kikuyu, and crossing the Sagana again, here flowing to south-westward as a brawling mountain stream, we pitched the camp which was to be the base of our operations on Kenya. The site was a high one, and gave a wide view over the brown steppe of Laikipia to the distant curves of the Aberdare range. That evening the setting sun lit up the peak and snows of Kenya, which rose abruptly above the forest curtain of the mountain, at whose edge, splayed out for some distance on to the plain, we had now arrived.

Our first attention was to commissariat. Wangombe had promised us food for our porters, and he now refused to deliver it. We had no alternative but to detain him until he made his word good. We had a store of grain, accumulated during our passage through Meranga, but that was essential for the porters who were to be sent on to the mountain. In two days, as a consequence of our action, a caravan arrived, both of men and women, bringing a considerable supply, for which we paid liberally in cloth. We then paid off a portion of our Wakikuyu and sent them home. At the same time Wagombe left us, promising further supplies.

Next day, August 18, two parties left the camp—the one, under Sulimani, our Swahili headman, returned to Wangombe's to buy more food; the other was the mountain party in my own charge. Hausburg stayed in camp until the return of Sulimani, and was then to join me. Of the porters going to the mountain, twelve were equipped to remain there for some time, old Metropolitan police coats, boots, and extra blankets being served out to them.

On the evening of the 18th my party made a short march to a point at the forest edge, close to that by which Gregory entered it. Next day we commenced what we expected to be a tedious passage of perhaps three days. César and Joseph, woodmen as well as icemen, led the way with axes, and two askaris followed with machetes. Thus we cut what the guides christened "la grande route du Mont Kenya." Our work was eased by availing ourselves of elephant-paths and by keeping steadily to the ridge, thus avoiding the tangle by the streams. There was hoar-frost on the ground as we passed through the portal of the first trees in the early morning. Within, tall straight branchless conifers supported a dark roof of foliage with frequent gaps to the sky. The undergrowth was at first of laurel-like shrub and of tall stinging-nettles, and here green parrots flew screeching in flocks just above the treetops. Presently tufts of bamboo appeared, and then bamboo ousted all growth but the conifers, the ground-weeds, and the rope and string-like creepers. Hour after hour we forged onward, and after a time upward also, until with unexpected progress we grew ambitious of making the passage of the forest-zone in a single day. And this we accomplished, with one hour to spare before the inexorable tropical nightfall. We camped in a glade, part of the glade-maze which runs along the upper edge of the forest, and above us, comparatively close, was the green treeless shoulder of the mountain, hiding the central peak.

The next day we reconnoitred upward with a view to finding a site for the standing camp, which was to be the halfway shelter between the base of the mountain and the foot of the central peak, and in the afternoon we moved the tents to the spot selected. It was at an elevation of about 10,300 feet, and commanded a view over the forest slopes, across the Laikipian steppes, to Sattima and Nandarua, the twin heights of the Aberdare range. The phenomena of wind and cloud were of unceasing interest as watched from this position. At the camp itself even the lightest wind was rare, yet the drift of the smoke from the fires below showed the constant strength of the monsoon on the

KENYA PEAK AND THE TELEKI VALLEY, FROM THE SOUTH-WEST.

plain which we had left. A vast stratum of cloud hung day and night over the rainy slope by which we had ascended to the plain, and this we came to call the "cloud roof of Kikuyu." On one occasion I looked over its upper surface, across 80 miles of white woolly cloud, to the peaks of Donyo Lamuyu emerging like an island from a sea. Especially in the early morning, a tongue of cloud extended from the Kikuyu roof along the eastern foot of Sattima, thus masking from us the western half of Laikipia. At sunrise the summits of Nandarua and Sattima stood out cold and hard against the western sky, but as the morning advanced clouds capped the heights—clouds, however, of quite independent origin from the Kikuyu roof below, or its Laikipian tongue.

On August 21, César, Joseph, and I went up to what proved to be Gregory's Höhnel valley, and here for the first time we saw the extraordinary vegetation of the alpine zone of the mountain. The unbroken side of the valley, crowned with owl-haunted crags, has a moist peaty soil, in which are set yard-broad hemispherical tufts of wiry grass, each tuft having a moist rotten centre. Well beaten rat-paths ramify in all directions between the tufts, while every here and there are groups of cactus-like giant lobelia, of which some send up tall spikes bearing the flowers. In general appearance very like the lobelia, except as regards the flower, is a species of giant groundsel with silvery leaves; but the greatest curiosity of all is the tree groundsel, with a thick dark trunk 8 or 10 feet high, surmounted by a cactus-like head of green leaves, beneath which is pendant a mass of dead leaves, dry as tinder towards their tips, but moist and rotten near the trunk. Occasionally a tall spike, several feet in height, bearing yellow groundsel flowers and fluffy seeds, stands erect above the leaf-head, or broken and leaning gauntly to one side. In other spots are yellow composites, something like dandelions, but with blossoms sessile on the ground, and bushy everlasting flowers. Beautiful sunbirds with lark-like song fly from lobelia to lobelia.

That evening, as we were on the point of returning to the camp, a lighted match was dropped, for it never occurred to us that where the ground was boggy to the tread any special precaution was needful against fire. But the fire spread behind us with alarming rapidity, feeding on the surface of the grass tufts and the dry ends of the dead groundsel leaves. Next morning, when we set out with eight porters to carry stores up to form a depôt, a great column of smoke rose in front of us, and above it was white cloud drifting away to north-west, as though the volcano were once more in activity. Fortunately the men had boots with them, and, beating an entry through the hissing line of red flames, which broke into a roar as they grasped a tree groundsel or shrub heath, we raced for 50 yards through the acrid smoke. It was fully a quarter of a mile before we could see and breathe freely again, and then we were in a new land. The mountain-side was black, covered with velvety mounds which had once been grass tufts, but set with thousands of gleaming points—the silvery groundsels, which had been protected by the moisture cupped in their broad leaves. Presently we realized that we were within a vast circle of fire, and that the whole of the collecting-ground convenient to our middle camp was endangered. We determined to preserve the upper Höhnel valley, and fought the fire for two hours, at last with success, though a long watch was still necessary to check the flames which every now and again broke from the border of the smouldering area. The sun went down that evening amid smoke-banks of mauve and orange, the orb itself changing from blood-red to a glorious ruddy gold, while above were roseate and pale green clouds. The after-glow was of copper. As night settled down the ruddy glare rose high over the edges of the deep black valley, and the silver groundsels gleamed weirdly in the diffused light; but in rear—to eastward—was the cold dark valley head, the reward of our struggle in the afternoon.

The next morning we went up to the col above us and looked across the Teleki valley—in and from which Teleki and Gregory reached their highest points—on to the rocks and glaciers of the central peak. We chose, from a distance, the position of our topmost camp, a mile from the foot of the ice, and then returned to our tents by the rushing Höhnel stream, to receive a further relay of stores and to prepare for the final advance on the following day. But that afternoon a message came up from Hausburg, who had just arrived at the middle camp, to

KENYA PEAK AND THE TYNDALL GLACIER.

the effect that two of our Swahilis had been murdered, and that the base camp was nearly devoid of supplies. I immediately left the two guides where they were, and joined Hausburg at sunset.

It appeared that the food caravan sent out on the 18th, in charge of Sulimani, had duly arrived at Wangombe's, and that the porters had bought food for themselves, and also a small quantity to be added to our store. Wangombe then said that he could not get much more in his village, and asked that men should be sent with him to make purchases in another village. This Sulimani refused to arrange, but Sudullah, an energetic and favourite askari, insisted on going, and five others volunteered to go with him. Wangombe and many of his men accompanied them. While passing through a banana shamba, our party was attacked with arrows and spears by a force in ambush, led, apparently, by Wangombe's brother. A fight ensued, in which two men fell on our side, and, it was reported, five on that of the enemy. The remainder of our men got back to camp, bringing with them the weapons of their slain adversaries, but Sudullah was unfortunately one of the killed. Wangombe came to Sulimani that evening, asking him to stay where he was, as he wished for a shauri in the morning; but Sulimani struck camp at midnight, and returned to Hausburg on the morning of the 21st. On the 22nd Hausburg despatched Sulimani with thirty-five men, including the two Masai guides, to buy food at the Government station on Lake Naivasha, and leaving the base camp, now protected by a good boma, in charge of Ali, the interpreter, himself came up the mountain to consult with me.

On August 24 Hausburg and I went down again to the base, taking Saunders with us and all the food that could be spared. After going carefully through our stock, we determined to divide everything eatable between the men who still remained at the camp, and to despatch them in Sulimani's track towards Naivasha. They refused to stir without a white man to lead them, and we had reluctantly to give the charge to our collector, Mr. Saunders. The Masai guides had gone with the previous party, and Saunders had to undertake the crossing of an untraversed country with no better guide than a pocket-compass and an envelope bearing approximate directions. On the evening of the 25th, having accompanied the caravan a short distance on the way, Hausburg and I turned aside to shelter for the night under the lee of a valley brink, with feelings of no little anxiety for the fate both of Sulimani and Saunders. The garrison on the mountain had food for about three weeks.

The next day we returned through the forest to the middle camp, and, while Hausburg helped Camburn to collect there and in the Höhnel valley, I rejoined César and Joseph in the Teleki valley, where they had established our top camp and built a stone hut. Thence, in the early morning of the 30th, we set out on our first attempt to climb the peak.

The central peak of Kenya is a pyramid of highly crystalline rock, cleft at the summit into two points, standing north-west and south-east of one another, the north-western being some 30 or 40 feet higher than the other, and the two perhaps 1000 feet higher than any other point on the mountain. The Masai have a legend that they had their origin on Kenya, and I propose that the twin points should be named after the great Masai chief, Batian, and Nelion, his brother. I owe the suggestion to Mr. S. L. Hinde. Nearly three-quarters of a mile to south-eastward an ice-clad peak, visible from the plains of Laikipia, rises to about 16,300 feet, and for this I suggest the name of the living Masai chief, Lenana. Between Lenana and the central peak are glacier passes from which descend to northward and southward respectively, the two chief glaciers of Kenya, which have been named after Gregory and Lewis. As the word *Kenya* is probably a corruption of the Masai word signifying "mist," it seems appropriate, on that as well as physical grounds, to describe the notch in the summit between Batian and Nelion as the "Gate of the Mist."

Our way led up the left lateral moraine of the Lewis glacier, then

THE SUMMIT OF KENYA (POINT BATIAN).

diagonally across the glacier to a snow-filled couloir near its north-western corner. A short distance up the couloir we turned to the left and climbed the eastern face of the southern *arête* of the peak. We were here delayed by three *mauvais pas* and the treacherous nature of the fissured rock. On the ridge we were further delayed by the broken character of the edge, which compelled frequent traverses, so that night fell upon us at the foot of the point Nelion. We therefore sought a slab of rock just below the *arête* on its western side, and, after such food as could be afforded, tied ourselves to the rocks and prepared for the twelve hours of equatorial darkness. We were at an elevation of about 16,800 feet, but the cold was fortunately less than at the camp in the hollow of the head of the Teleki valley. It was not until 2 a.m. that the east wind, which had been moaning and screaming through the chinks of the rock-wall behind us, began to reach over and to stroke us with paws of cold air, making us draw close together and beat our knees. The sky was cloudless, and the stars, shining like lamps without twinkling, shed light enough to reveal the lakelets on the Two Tarn col to west of us. At 3 p.m. the moon rose, casting a cold light over the vast cloud roof of Kikuyu, and by diffused illumination making clear the surface of the Darwin glacier in the shadow of the precipice, 1500 feet beneath us. In the morning we climbed a little higher, aiming at the

AT AN ELEVATION OF 14,000 FEET, NEAR THE NORTHERN FOOT OF KENYA PEAK.

point Nelion, but were speedily brought up by a cleft cut completely through the peak, dividing the southern *arête* from Nelion. We had no alternative but to abandon the effort and return to our camp.

Hausburg and I now changed places, and while he and the two guides took the photographic camera, in one long day, completely round the foot of the peak, I went down on to the Laikipian plain to watch for the return of our caravans. I had to traverse the smouldering remains of a fire, which had seized the lower edge of the Kenya forest where it was crossed by our path.

As the days went by, spent chiefly in scanning the plain with a glass, and no one approached us, my wait became an anxious one; and on September 5, being the fifteenth day since the departure of Sulimani and the eleventh since that of Saunders, I had to send word for all to come down from the mountain in order to start for Naivasha on the 7th, lest starvation should overtake us. On the day arranged Hausburg duly conducted the retreat, to the bitter chagrin of César who had again been defeated by the peak. He and Joseph had laboriously cut their way up the Darwin glacier, and, bad weather intervening,

KENYA PEAK AND LENANA, FROM THE EAST. THE HALL TARN IN THE FOREGROUND.

could neither mount higher nor yet return by the dangerous way that they had come. They managed, however, to effect a traverse to the south *arête*, and returned by the route which we had followed in the first attempt.

Most fortunately, however, some two hours before Hausburg's arrival, Sulimani and Saunders marched in, and with them Captain Gorges, who commands at Naivasha. Sulimani had reached Naivasha, and after three days, consumed by an official correspondence, Captain Gorges had obtained leave to return with him to the foot of Kenya.

They took local Masai guides, and followed an important native track over the Aberdare range to the north of Sattima, a track apparently unrecorded except in the native itineraries collected at Mombasa and published by Wakefield in 1870. By an extraordinary chance, Saunders, who had made a difficult and toilsome journey over the shoulders of Sattima through trackless ravines choked with bush, struck the path which Gorges was following just half an hour before the caravan from Naivasha came up, two days out from the station. Thus it happened that our whole force was once more concentrated, and reinforced by the men belonging to Gorges. On the following day it was decided that Hausburg should lead the majority of our caravan back in company with Gorges, and that I should return to the mountain with four white and fifteen picked black men to make one more endeavour to solve its problems. Hausburg and Gorges left within six hours of our decision.

I now determined to move our base camp some 3 miles into the forest, and to leave Saunders and Camburn there, on a new collecting-ground. Our little force could not effect the removal of our stores at a single journey, and, following a practice which we had hitherto found successful, a portion of them was hidden in the bush. Unfortunately, we were watched on this occasion without our knowledge, and on the morrow, when Saunders returned to complete the removal, he surprised natives, apparently Wanderobo (elephant hunters of the forest), in the very act of looting. By the use of bird-calls as a warning, they managed to escape. They carried off much which was of little value to us; but the tin-lined food cases, whose loss would have compelled our immediate flight, had proved too difficult to be opened in a hurry by Wanderobo. This was not the only occasion on which we had evidence of the Wanderobo on Kenya, though they were so timid that we never succeeded in establishing relations with them. On one occasion, however, at an elevation of over 12,000 feet, when white men were absent, a party of eight of them came to three of our porters and inquired their business. They went away with the laconic remark that there was much shooting on the mountain.

At last, on September 12, César, Joseph, and I left our top camp at noon to make the final attempt to reach the summit. The journey round the peak, made by Hausburg, had clearly shown that no way was practicable up the northern precipice, and we had already failed twice on the southern side, once on rock and once on ice. We now planned a route partly over rock and partly over ice. We followed our first track up and across the Lewis glacier, and up the face of the southern *arête*, near the top of which we spent the night under a Mummery tent. We were up at earliest dawn, and away as soon as the sun rose out of the cloud roof to eastward, thawing our hands so that we could grasp the rocks. A traverse, with steps across the head of the Darwin glacier, brought us to a rocky rib descending from the western corner of Nelion, and up this we crept for a short way. We then decided to cross the glacier which hangs from the Gate of the Mist between the two points, and drains by a couloir into the Darwin glacier below. It proved very steep and intensely hard, so that three hours were consumed in cutting steps on a traverse which we had hoped to make in twenty minutes. A final rock scramble enabled us to set foot on the summit of

LAKE MICHAELSON. THE LAKE WAS ABOUT 1500 FEET BELOW THE POINT OF OBSERVATION.

Batian precisely at noon on September 13. The view from the Gate of the Mist had been magnificent. At the summit we were a few moments too late, for the mist, driving up, gave only momentary glimpses into the valleys beneath.

The mountain-top is like a stunted tower rising from among ruins and crowned by three or four low turrets, upon which we sat, feet inward. There was no snow there, and the thermometer slung in the air gave a temperature of 40° Fahr., while several kinds of lichen grew on the rocks. We dare, however, stay only forty minutes—time enough to make observations and to photograph—and then had to descend, not from any physical inconvenience due to the elevation, but for fear of the afternoon storm. We made our way downward from step to step cautiously in the mist, and reached our sleeping-place of the previous night at sunset; but we continued down the rocks by the moonlight, and arrived in camp after 10 p.m., exhausted, but victorious. We supped by the fire at midnight, with the sound of the Nairobi torrent ringing on the rocks and swelling and falling in the breeze, and from time to time with the hoot of an owl or bark of a leopard, yet none of them seeming to break the silence of the great peak which rose among the stars, sternly graceful, in the cold light of the sinking moon.

After a day's rest, we set out on a three days' journey round the mountain by a wider circuit than that followed by Hausburg. As no native could accompany us, and as we carried a plane-table in addition to food, we had to forego a tent, and to sleep in the open beside a fire of tree groundsel. We traversed the heads of six valleys, each with a character of its own. The Hobley valley has a great scree at its head of coarse blocks, for the most part brilliantly red, and it has a glaciated platform on its side bearing a tarn, with a second tarn in the bed of the valley. The Gorges valley has apparently been half filled with a subsequent flow of lava, so that it has a broad pavement, upon which are everywhere traces of extensive glaciation, and among them many tarns, mostly dry, and some containing pumice. A gorge, 1500 feet in depth, has at one place been worn into this platform, leading down to a black lake surrounded by cliffs. The Hinde valley is the widest and altogether the most spacious of the six, although it does not originate in the central peak. The Mackinder valley bears the drainage from the Gregory and minor northern glaciers, and is dominated on the north by two grand crags, which I have named, from Masai chiefs, Sendeyo and Tereri. The Hausburg valley is double-headed, being invaded by the glaciated end of the ridge which forms the central peak. It receives water from three glaciers. The Teleki valley has four distinct features at its head—two rocky corries or cirques, the Lewis glacier, and the central peak. To these six valleys should be added a seventh, the Höhnel, although we had no occasion to traverse it during this circuit. It has a considerable lake in its head, and, like the Hinde valley, does not derive immediately from the central peak. All these valleys are thrown eastward and westward from a lightly devious craggy ridge, lying nearly north and south, and bearing Lenana, but not the central peak. The axis of the central peak, on the other hand, lies at right angles to this, striking from Lenana to the head of the Hausburg valley, and throwing down the glaciers northward and southward.

From the end of the high ridge, between the Gorges and Hinde valleys, we looked on to what we called provisionally the East mountain—a broad green mound at a distance of about 10 miles, far larger and loftier than the numerous small cones which rise from the forest of the eastern and southern slopes. Between the East mountain and Kenya proper is green rolling country, scored by valleys, the whole of it above the level of trees.

We returned to the camp in the forest on September 20, where we rejoined Saunders and Camburn, and on the following day commenced our homeward journey. We crossed Laikipia north-westward, fording streams both of the Nairobi and Guaso Nyiro systems, but the most interesting features encountered were two parallel escarpments, striking with curious straightness north-north-west for many miles, and defining a strip of raised country some 8 or 9 miles across. The surface of the strip dipped gently northward, so that the escarpments were highest towards the south, that on the western side being seen to rise to quite 2000 feet above the plain. These are probably fault scarps, and lie nearly parallel to the scarps of the Great Rift valley. Together with Sattima and Nandarua they form Thomson's Aberdare range, and I would suggest that we should add to the presidential character of the range by speaking of the raised strip north of Sattima as the Markham Downs, for the landscape is markedly unlike that of Laikipia, and resembles that of the Sussex hills.

Beyond the second scarp we came down on to the Masai country of Ondagobbus, in which, towards the north, we saw the lake "El Bor Lossat," possibly identical with Thomson's Telphusa swamp. With the aid of the observations made by Saunders when crossing Sattima, I was able to lay out approximately the upper course of the river Morendat, and then, leaving the caravan to follow, I walked ahead to Naivasha, where I arrived on September 29. Thence, by the help of Captain Gorges and other friends, I was rapidly forwarded on my way to the coast, and, catching a steamer without delay, arrived in London on October 30. The remainder of the party, in the kind charge of Mr. Hausburg, came by the French mail, and reached Marseilles on November 13.

The results of our expedition are a plane-table sketch of the upper part of Kenya, together with rock specimens, two route surveys along lines not previously traversed, a series of meteorological and hypsometrical observations, photographs by the ordinary and by the Ives colour processes, collections of mammals, birds, and plants, and a small collection of insects. But we were unfortunate enough to lose a portion of our plants on the homeward journey.

Finally, I wish to express my sense of the indispensable services rendered to the expedition by my colleagues. César and Joseph had a passion for work which made itself especially evident upon the ice and in the forest. Our success upon the peak was in large measure due to

César's judgment. Of the plucky crossing of Sattima by Saunders I have already spoken. To him and to Camburn we owe the excellent condition of the collections brought home. Above all I owe thanks to my friend Mr. C. B. Hausburg, who not only shared the expense of the expedition, but took so large a part in the management of the caravan, and proved himself so invaluable a shot and so accomplished a photographer. And we all owe thanks to those in East Africa who helped and befriended us.

Before the reading of the paper, the Chairman, Sir THOMAS HOLDICH (Vice-President), said: Mr. Mackinder, who will read the paper to-night, is well known to all of us as a scientific geographer; to-night he comes before us as a most successful traveller, as the first man to ascend one of the principal peaks in East Africa, Mount Kenya. I would particularly ask your attention to the illustrations of his paper. This is the first time, I believe, in which the art of colour photography has been applied to the illustration of a scientific expedition; at any rate, it is the first time the results have been shown in this room. I will now ask Mr. Mackinder to read his paper.

After the reading of the paper, the following discussion took place:—

Sir THOMAS HOLDICH: Mr. Mackinder's story of difficulties met and overcome in his plucky ascent of Mount Kenya, together with the delightful series of illustrations he has given us, may, I think, be considered a model of descriptive illustration. His expedition was so well armed at all points to meet the scientific requirements of an expedition of this nature, that it does, to a certain extent, in a way which an expedition less well equipped would hardly do, challenge, not criticism, but discussion. Dr. Gregory, who was some years ago in East Africa, whose name you have heard mentioned by Mr. Mackinder in connection with this particular peak, has written a few words of comment on the altitudes obtained, which I will read to you, and after reading them, I hope that some of the gentlemen here present will speak. Mr. Hinde, the resident in Masailand; Captain Smith, the surveyor of the route from Mombasa; Dr. Bowdler Sharpe, who can tell us something of the natural history of these regions; and Mr. Ravenstein, the well-known geographer, will, I trust, give us some of their views. I will now read Dr. Gregory's letter.

"I much regret that the necessity for my reaching Melbourne well before the end of February, prevents my attending next Monday's meeting to personally congratulate Mr. Mackinder on the success of his expedition to Kenya. I can offer him my sincerest congratulations, as I have heard from him an account of his work and results. As a couple of years ago doubt was thrown on my explanation of the mountain, I am glad to hear from Mr. Mackinder that we are fully in accord as to its structure. The only point where we do not agree is as to the absolute height of the highest peak. Mr. Mackinder, from his result with the Watkin aneroid, supports Captain Smith's determination of 17,200 feet, whereas from a rough triangulation with an Abney level from some bases in the alpine zone determined by boiling-point observations, I accepted Lieut. von Höhnel's result of little over 19,000 feet. Smith and von Höhnel's results were both based on careful triangulation, and the question is whose data was the most reliable. Von Höhnel's observations were made at the west foot of the mountain, whence the peak rose above him with an elevation of about 29° (as I write in train, I can only trust to memory for these figures). This base-line was short, and the errors of observation and refraction under such circumstances were at a minimum. Captain Smith's conditions were less favourable; his base-line was many times longer, and the angular elevation of the mountain small. The country between him and Kenya was occupied by alternate belts of veldt and forest; accordingly the atmosphere consists of belts alternately more or less humid. Refraction under these circumstances would be at its maximum, and the amount indeterminable with precision. Captain Smith's results, therefore, do not seem to me to command the same confidence as von Höhnel's.

"That refraction alters the apparent elevation of African mountains to the extent of hundreds and even thousands of feet is well known; it may be illustrated by the cases in which distant mountains sometimes rise above and fall below the horizon of a given spot, according to the condition of the atmosphere.

"Moreover, the lower estimate seems to me inherently improbable, as it would introduce anomalies in the distribution of the ground-line. Mawenzi, the lower peak of Kilimanjaro, is about 17,000 feet high—some estimates have placed it a little higher—but Mawenzi, though 280 miles further south than Kenya, has no glaciers at all. Meru, well over 16,000 feet high, owes its name to its summit being occasionally whitened by snow, but it has no glaciers or permanent snow. If Kenya be only 17,200 feet high, how can we explain the existence of fourteen glaciers on it, if mountains much further north, and only a little lower, have none?

"Hence it seems to me that von Höhnel not only had the more favourable position for reliable results, but that his results are in better agreement with the general geography of the country. I am, therefore, still inclined to accept the earlier and higher estimate of the altitude of Kenya.

"But this is a mere detail, which may not be settled until a mercurial barometer has paid a visit to Kenya. And I can only renew my congratulations to Mr. Mackinder on the success of his boldly planned and well-achieved expedition, which I hope will tempt other equally trained observers to devote their summer vacations to monographing some of the now accessible and little-known areas of British East Africa.

"I should like to add a word of congratulation to Mr. Saunders on his plucky first traverse of the mountain block of Settima."

Beyond a remark that Dr. Gregory has certainly vastly over-estimated the value of the corrections which refraction may render necessary to the observation of altitudes, I will add nothing to what has been said, but will leave Mr. Mackinder to answer this criticism himself.

Mr. S. L. Hinde: After having seen something of the start and finish of the expedition, I have had the great pleasure to-night and the very good fortune of hearing the details of Mr. Mackinder's most successful exploration. Unfortunately, I have not had the opportunity of talking them over with him, but I think he has said too little of the difficulties he had to overcome. He came into the country at a time when it was famine-stricken. A famine had been raging for over two years, and, as a consequence, great difficulty was experienced in getting food for the natives, and very great trouble in collecting food for a number of men in any given district. It was considered necessary to go through Meranga. This small but rich country is perhaps the only part of East Africa which had not suffered from famine during these two years, but shortly before Mr. Mackinder's expedition started, we had been involved in trouble with the natives, whom we know to be very treacherous. We lost one officer and a number of men, and for that reason did not perhaps encourage Mr. Mackinder to go to Mount Kenya as much as we might have done. We appealed to this country for help for the famine among our people, but unfortunately found that the eyes of the public were directed towards another part of Africa. With famine among primitive natives, small-pox almost invariably goes hand-in-hand, and an epidemic was raging from Mombasa to the Uganda border. It was only with the greatest care and most stringent precautions that Mr. Mackinder succeeded in getting his caravan through the country without contamination. He has laid no stress on these points, but his pluck in dealing with difficult situations, and the assistance he received from his colleagues before he actually attempted the mountain, have, I think, had more to do with his success than he implied in his paper. I must congratulate all the members of the expedition on their exceedingly successful geographical work.

Captain G. E. Smith: I am most interested to be present at the excellent descriptive lecture on East Africa this evening, having spent over two years in that part of the world. I was never nearer than 90 miles from the peak of Kenya, but I have seen it from many points, and it was one of the most important points in my triangulation. I now propose to defend Mr. Mackinder's estimate for its height, thereby defending my own estimate of 17,200 feet. Dr. Gregory states that Lieut. Höhnel's height, with which his own agrees, was 19,000 feet; that it was obtained from observations of the summit on the north side, where the side is steep and the angle of elevation is great. Now, that would be a good way of measuring the summit if you knew for certain the height of the point from which you take your observations, but I do not think he had any better method of obtaining his height at that point than with aneroids, or some sort of barometrical determination. On the other hand, my own work depended on the sea-level, which does not vary very much in different parts of the world. It depends on a triangulation as far as the northern slopes of Kilimanjaro, including that peak itself, by Consul C. S. Smith in 1892, which was carried further north in 1896 and 1897 as far as the lake by myself. From seven different points I observed the summit of Kenya, and the values I obtained from these different points agreed very closely. The probable error I got was 20 feet from these seven observations. That does not absolutely say that my height was within 20 feet, but I think it fairly safe to maintain that the height is not more than 100 feet from my determination. With regard to the refraction of the atmosphere, I can only say that Dr. Gregory is mistaken, because, from a whole series of observations beginning at one point and going round many hilltops up to the lake and back again, a distance of 700 miles, you would expect an error. Well, the error was 23 feet. If the refractions were as he says, nothing of this sort could have been arrived at. I think, speaking from memory, that Dr. Gregory very much overestimated the height of Mount Kimawenzi. He stated the height to be 17,000; I think I am right in saying it is 16,000 feet. Then the general formation is different from Kenya; it has a still more pointed peak, and no high valleys where snow and glaciers can collect, which, even if it has the same height, is an explanation of the lack of glaciers.

Dr. Bowdler Sharpe: I have only to say a few words to-night about the natural history collections which Mr. Mackinder has brought to the British Museum, and which have turned out to be of very great interest, considering the short time Mr. Mackinder was able to be on the mountain. The collections are not very large, but are of great value, as proving the relation between Mount Kenya and the rest of the high mountain system of East Africa. As regards zoology, we have not yet got a report on the mammals from Mr. Oldfield Thomas, but there is a new kind of Hyrax, or coney. I have worked the birds out, and find that if Mr. Jackson had not explored Mount Elgon in 1890, nearly every bird that Mr. Mackinder got would have been new; but the fauna of Mount Kenya is undoubtedly similar to that of Mount Elgon, and in a lesser degree to that of Mount Kilimanjaro; and thus, as I have often explained before, there is a kind of separate mountain-fauna which extends right across Africa to the Cameroons. A very curious little bird was found by Mr. Jackson on Mount Elgon at a height of 11,000 feet, and I remember saying to Mr. Mackinder that he was bound to find the same sort of little chat on Mount Kenya, at a height of 11,000 feet. This he did, and it was the same species as the Mount Elgon bird, an ordinary-looking little brown chat, with a good deal of white in the tail. It is only found at high elevations, and occurs in the mountains of Abyssinia at an equally high altitude. I now discover the Kilimanjaro bird is not the same as that found by Mr. Mackinder on Mount Kenya. Thus the high fauna of Kilimanjaro is proved to differ a little from that of Mount Kenya. The finest bird he obtained was a splendid Eagle-owl, as big as the European species, *Bubo bubo;* this new species he met with high up the mountain, at a height of 14,000 feet. I have named it after Mr. Mackinder, and I feel very proud of having done so after hearing what he has gone through, and listening to the account of his adventurous journey. He also procured three other new birds, and the names which I have bestowed on them will, I hope, be acceptable to the three other English companions of his travels.

Mr. E. G. Ravenstein: We have heard to-night a most interesting account of a very important expedition, an expedition which I feel sure will be found to have yielded excellent results in at least two departments of science. What I wanted to say with regard to the altitude of Mount Kenya has been anticipated by Captain Smith. For the present, at least, I stick by the results obtained by Captain Smith. I know perfectly well what Höhnel has done, and thoroughly appreciate his work. But if I tell you that Höhnel himself admits his uncertainty about the exact position of the mountain, you will perceive that the result of his observation for its altitude must be uncertain. As far as the glaciers are concerned, it is not the highest mountain that carries the most glaciers, nor is it the oldest head that carries most grey hairs. Water runs off ducks' backs, and there is no chance for glaciers where the slopes are steep, and there are no resting-places for snow to accumulate. Naturally Kenya and Kilimanjaro present in many respects the same features: the southern face is exposed to moisture-bearing winds, and is covered with luxuriant vegetation; the northern slope, deprived of these rain-bearers, is arid, but the quantity of rain and snow and the declivity of the slopes all determine the formation and extent of glaciers. Therefore for the present I adhere to Captain Smith's results, and am glad to find that Mr. Mackinder's rough observations agree with them. I should like to draw attention to the fact that in Kikuyu, near Fort Smith, there is a station which has been occupied for some time by Scottish missionaries, who own an excellent mercurial barometer. Whether this instrument is of use in converting the natives I don't know, but it affords an excellent means of converting aneroid observations into altitudes.

Mr. Mackinder: In reply to very kind comments to-night, I have only to say one or two words on Dr. Gregory's letter. I should like to say, first, how much I feel his generous and valued recognition of the work that has been done; but I am afraid he has misrepresented, through lack of knowledge of the facts, the material I had on which to base my opinion of the height of the mountain. I did not take to the summit only a Watkin aneroid; I took a boiling-point thermometer, and a sling thermometer. Further than this, in the alpine zone, where Dr. Gregory determined the altitude of his base by boiling-point, I also determined the altitude by boiling-point, and came to nearly the same result as Dr. Gregory. He obtained the altitude of the peak above by means of an Abney's level, and I did so by means of a theodolite and a plane-table. I think surveyors will agree that the chance of my being able to obtain the correct result was greater. I may say I calculated the height from four different combinations, and obtained four slightly different results, all of them something over 17,000 feet. I am not prepared yet to state what is the exact height, because of temperature corrections still to be made. At the same time, I would point out that Captain Smith computed from seven triangles, and that I had four different methods of calculation, and in the whole of these eleven computations, there is nothing that carries us near to 19,000 feet.

Sir THOMAS HOLDICH: I think Captain Smith and Mr. Mackinder have sufficiently well disposed of Dr. Gregory's criticism. I have nothing more to say than to call your attention to the immense importance of fixing correctly the heights of mountains in such positions as Kenya and Kilimanjaro. It is not merely the abstract scientific result which is important; but these mountains, standing as they do as bulwarks to an immense amount of country in Central Africa, give a value for the altitude of any country from which they can be seen. So long as a short base can be measured, and triangulation can be made, by any one working within the radius of visibility, he can at once determine his own altitude. I will say nothing more, but ask you to join me in thanking Mr. Mackinder for his excellent paper, and to congratulate him on being the first man to ascend Mount Kenya.

APPENDIX.

Preliminary Notes by Mr. Mackinder on the Scientific Results of the Mount Kenya Expedition.

CARTOGRAPHY.

The general map showing the route followed by the expedition has been constructed from a route survey made with prismatic compass and watch. Observations for latitude by double altitude were obtained with sextant at camp 17 (18′ 16″ S.), but unfortunately not at camp 11, owing to meteorological conditions. This, however, matters less because when the positions of Donyo Sabuk and Naivasha, as plotted from the route survey, are superimposed upon Captain Smith's positions for those points, my position for Kenya peak, as determined by dead reckoning, differs less than half a minute of latitude and less than two minutes of longitude from that obtained by Captain Smith by triangulation from the Uganda road. The colouring is, of course, exact only in the immediate neighbourhood of the route followed.

The detailed map of the upper portion of Kenya has been constructed from a plane-table sketch. A base of 500 feet was measured, and extended by means of theodolite to 5224 feet. The circuit of about 14 miles very nearly closed. The original sketch was on a scale of 3 inches to the mile.

No native name has been placed upon the maps which was not ascertained or verified by me upon the spot.

ALTITUDES.

Altitudes were measured by means of a Watkin aneroid, checked at short intervals by boiling-points. The aneroid worked very satisfactorily, giving consistent readings. All the readings have been reduced on the basis of a height of

17,200 feet for Kenya peak. This appeared more expedient than a direct comparison with assumed conditions at sea-level, since I had my own observations for temperature up to the summit, and the daily *régime* was very regular.

For the altitude of Kenya, I depend on six measurements by triangulation from the Uganda road made by Captain G. E. Smith, and four measurements made by myself on the spot, although by less rigorous methods. Captain Smith's mean result was 17,184 feet, with a probable error of 20 feet. Since doubt was thrown on this result at the meeting of the Society on January 22, I give my own observations in detail. They may be grouped in pairs, thus:

A. 1.—Boiling-point on summit at 12.30 p.m., September 13, 1900—observed, 181·6°; corrected, 182·2°. Temperature by sling thermometer, 40° Fahr. Assumed temperature at sea-level, 80°. Assumed pressure at sea-level, 29·9 inches (= boiling-point, 212°). Inferred average temperature of intermediate air, 57°. Result, 17,204 feet.

Note.—The pressure observed, being between the morning maximum and the afternoon minimum, would be average; the temperature observed would, of course, be above the average.

A. 2.—Boiling-point at camp 22 in Teleki valley (average of three readings at different hours, checked by seven intermediate aneroid readings)—observed, 187·6°; corrected, 188°. Temperature (average of observations at different hours), 32°; but this exceptionally low owing to position. Inferred average temperature of intermediate air, 60°. Deduced altitude of camp 22, 13,806 feet. Difference of altitudes of peak and camp 22, deduced from difference of pressures, with intermediate air at average temperature 35°, 3322 feet. Result, 17,128 feet.

B. 1.—Altitude of camp 22 assumed at 13,806 feet. Angle of elevation of peak measured at camp 22 by theodolite, 23° 59′. Base measured on plane-table, 8216 feet. Computed height of peak above camp 22, 3655 feet. Result, 17,461 feet.

B. 2.—Boiling-point on hill north of camp 22 at 10.30 a.m., September 15—observed, 185·8°; corrected, 186·2°; reduced (because read at time of morning maximum), 186·1°. Temperature, 41·5°. Inferred temperature of intermediate air, 60°. Deduced altitude of station, 14,948 feet. Angle of elevation of peak above station measured by theodolite, 22° 35′. Base measured on plane-table, 5803 feet. Computed difference of altitudes of peak and station, 2410 feet. Result, 17,358 feet.

Note on B. 1 *and* B. 2.—The triangles of error in this portion of the plane-table sketch were imperceptible, but both the measurements were in the same direction, and the paper may very likely have stretched a little.

The altitudes of Naivasha, Sattima, and Nandarua, given upon the map, have been accepted from Captain Smith. The altitude of Nairobi has been obtained from the railway engineers, and has been corrected for the difference of the coast and Kikuyu base-levels. All the remaining altitudes are from my own observations.

GEOLOGY.

The rock specimens brought back are being examined by Prof. W. J. Sollas, F.R.S., and have not yet been compared with Dr. Gregory's collection; nor have I yet seen Dr. Gregory's paper read before the Geological Society on January 24, 1900, only an abstract having as yet been published in the *Geological Magazine*. But there is ground for the following preliminary statements:—

1. The rock at the summit of the point Batian is apparently identical with that found at a lower level on the central peak, and described by Gregory as a nepheline-syenite. The specimen from the summit is holocrystalline, and justifies the inference that the core of the volcano rose far above the present peak. If we assume that the core has been destroyed to the extent of 1000 feet, which would probably suffice to produce the observed results, and that the crater walls rose another 1000 feet above the core, then the original height of Kenya may have equalled that of the still complete Kibo summit of Kilimanjaro.

2. Lavas were observed dipping at low angles—5° to 15°—away from the central peak, in north-easterly, north-westerly, south-westerly, and south-easterly directions. This tends to support Gregory's conclusion that Kenya is a *single* dissected volcanic mass; but the east mountain, upon which we looked from the eastern shoulders of Kenya proper, although low when compared with the similarly placed Mawenzi peak of Kilimanjaro, appears almost too massive to be merely parasitic.

3. The major axis of the central peak strikes in a very straight line for nearly 2 miles from the point Lenana west-north-westward, and throws the glaciers down northern and southern slopes. It is remarkable, however, that the chief water-parting of the mountain runs for more than 5 miles in a direction at right angles to this, through Lenana, and past the eastern foot of the central peak, with the effect that the valleys descend eastward and westward, and that the whole of the existing glacial drainage belongs to the western slope. From a series of specimens obtained at widely separated spots on the summit of the craggy ridge which constitutes the divide, it appears that the lie of the water-parting has been determined by a system of great dykes, whose main direction is from north-north-east to south-south-west. These dykes must have almost split the mountain in two, while cracking it in other directions. It is probably pertinent to note in this connection that while there are small cones along the northern, eastern, and southern margins of the *massif*, there are none immediately at the western foot, under the lee, as it were, of the central peak and core. At the heads of the valleys abutting on the main dykes are grand, almost geometrically perfect *cirques*.

4. In Meranga, the valley of the Ragati, below Kangoso, is floored by what appears to be a lava-stream. As this portion of the valley is cut back from an escarpment overlooking the plain in which the Ragati and Sagana join, it would appear that since the denudation of the surface approximately to its present form, there have been volcanic eruptions on a grander scale than is implied by such minor cones as Kairungu, Nians, and Kehari.

5. At the confluence of the Sagana and the Ragati is a fine section of the lava which constitutes the plain, resting upon the gneiss, which here rises into the hill Kamuti. The surface of the gneiss is smooth and burnt. There is no evidence of a soil between the two rocks.

6. The elevated tract of the Markham downs is defined by two parallel escarpments striking with remarkable straightness for many miles in a direction parallel to the great Rift valley. These are doubtless fault scarps, and the elevation of the block between them is no doubt complementary to the drop in the bed of the Rift valley.

Glaciers and Glaciation.

There are fifteen existing glaciers on Mount Kenya. The Lewis glacier is a mile long, the Gregory glacier is rather shorter, and the remainder are small. The lower ends reach to the following levels:—

Teleki valley,	Tyndall glacier	... ...	14,820 feet.
" "	Lewis "	... ...	14,850 "
" "	Darwin "	... ...	14,880 "
Mackinder "	Gregory "	... ...	14,900 "
Hausburg "	César "	... ...	14,450 "

The glacier cols, leading over from the Lewis to the Gregory glaciers, are at an altitude of about 16,100 feet, so that the average slope of the former is about 1 in 4, and of the latter about 1 in 3. There were few important crevasses in the Lewis glacier, except at a point a short distance from its lower end; but the Gregory glacier was much fissured, and exhibited fine seracs.

Everywhere and at all hours the surfaces were dry and crisp. Comparatively little water flowed from the snouts, and the stream-banks gave small indications of floods. The ice was intensely hard, and fed by fine hail rather than snow.

Evidence of past glaciation was most conspicuous in the Gorges and Hausburg valleys, the rocks in which were everywhere beautifully ice-worn down to a level of 14,000 feet. The glaciation is on a grand scale 2 miles below the head of the Gorges valley, on the rock floor into which the Michaelson gorge has been cut. A glacier formerly rode over the Two Tarn col in a westerly direction, and has imparted to its western face an arching curve and glassy smoothness as of a great waterfall. At lower levels, down to about 9000 feet, are large boulders, but I found none lower than that recorded by Gregory. Old moraines were observed down to 12,000 feet.

Meteorology.

A considerable series of cloud observations was taken upon Kenya, extending over the whole of our stay on and near the mountain, but it would be unprofitable to deal with these until the general reports of last year's monsoon have been published.

A barograph was working during sixteen days at elevations of 7000 and 8000 feet. The resulting curves show that the pressure was remarkably steady, that the daily oscillation did not exceed the tenth of an inch, and that there were regular maxima and minima at 10 a.m. and 4 p.m. respectively, and minor maxima and minima at 10 p.m. and 4 a.m. respectively.

The air-temperature at the summit at noon on September 13 was 40°; the lowest temperature in the previous night at 16,700 feet was 28°; the lowest temperature in the night of August 31 at 16,800 feet was 29°.

At Camp 22 (13,800 feet) the night temperatures fell to less than 30°, but the morning sun rapidly raised the air to over 50°, the afternoon cloud lowering it again to 40° or less. The minimum thermometer, exposed to radiation into the cloudless night sky, registered as low as 16°, the ground being covered with hoar frost, and bottom ice forming in the Nairobi stream. The lobelias closed their head of leaves at night-time just like daisies. The air was usually dry, the relative humidity falling on more than one occasion to as low as 54 and 52 per cent. There was no considerable rain or snow fall during our stay at high altitudes (August 20 to September 20), but a little fine wind-driven hail on most afternoons, preceded by a sharp drop in temperature about 2 p.m.

The Sagana at camp 11, measured on August 9, was estimated to have a flow of between 1,500,000 and 2,000,000 cubic feet an hour.

Photography.

A large series of photographs—half and quarter plates—were taken by Mr. Hausburg both on the road and on Kenya, and a few films were exposed by me on the summit and on the east side of Kenya. Mr. Hausburg also took colour photographs by the Ives process, and of these three are here reproduced, though the prints hardly do justice to the originals as exhibited in the chromoscope. We owe many thanks to Mr. J. Thomson for the very considerable trouble which he has taken in connection with these Ives photographs. The third of the colour prints is of a scene in the Nyika, the scrub-desert, which extends for a hundred miles inland in rear of the fertile coastal belt. The soil is of a redder colour than here represented.

Zoology.

Mammals.—The skins and skulls collected have been described in a paper read before the Zoological Society on February 20 by Mr. Oldfield Thomas. Fourteen species from Kenya are enumerated, besides five others, specimens of which were obtained from Nairobi. The most interesting are two new species of Dassy (*Procavia*). Of these the larger (*P. Mackinderi*) belongs to the rock-inhabiting section of the genus. It is abundant above the forest zone up to 14,500 feet, and has for its nearest relative another new species of smaller size (*P. Jacksoni*) just sent home from the Ravine station by Mr. F. J. Jackson. Apart from these two species, no rock-dassies have been found in any part of East Africa, nor are they known further to the south. The second new dassy obtained by our expedition (*P. Crawshayi*) belongs to the forest-inhabiting group (*Dendrohyrax*). It occurs in the Kenya forest, and has a near ally in *P. valida*, of the lower slopes of Kilimanjaro. An additional specimen was received from Mr. Richard Crawshay, while our material was being worked out. The large size of *P. Mackinderi*, as compared with *P. Jacksoni*, is not without interest in connection with the retreat of the glaciers.

A new sub-species of rat (*Otomys irroratus orestes*) was obtained from the upper edge of the Alpine zone of Kenya.

We observed elephant tracks at an elevation of 11,500 feet on the west side of Kenya, and a complete skeleton of buffalo in the Gorges valley at an elevation of 14,200 feet. A leopard was seen at a height of about 14,000 feet south of the Höhnel lake, and leopard and buffalo tracks at 14,500 feet in the Gorges valley.

Birds.—The collection of birds was referred to by Dr. Bowdler Sharpe in the course of the discussion reported at p. 478. The new species from Mount Kenya are *Bubo Mackinderi*, *Campothera Hausburgi*, *Hyphantornis Camburni*, and *Pinachroa Ernesti*. They have been described by Dr. Sharpe in the *Bulletins* of the British Ornithological Club for December and January last.

Insects.—Prof. E. B. Poulton, F.R.S., has kindly examined the insects collected, and sent me the following statement:—

"The insects collected by Mr. Mackinder's Expedition were not numerous, but included some interesting forms. Among the butterflies, the only two individuals of *Limnas chrysippus* were of the *Klugü* form without the black and white tip to the wings. Further south this form disappears, while it is apparently universal in the north-east in Somaliland. A specimen of the very rare *Synchloe Johnstonii* (Crawley) was captured in Nairobi forest, from which also an individual of *Amauris echeria*, var. *Albimaculata*, was also obtained, indistinguishable from the specimens from Natal. I believe this to be the most north-easterly range yet recorded for this species. Among the *Acræinæ*, a specimen of the beautiful *A. regalis* was captured. All the butterflies were captured in the dry season, and many of them exhibit marked seasonal variation in colour, pattern, and size. Among other groups two

THE NYIKA.

new species of *Phytophaga* (Coleoptera) have been described by Mr. Jacoby, and an extremely interesting species of Forficulidæ will be described by Mr. Malcolm Burr. Of the few Hymenoptera, some are apparently new; but the hopeless state of the Ethiopian species of this order forbids the hope that they will be worked out in the immediate future."

Botany.

Several species of lichen, some of them brilliantly coloured, were found on the summit of Kenya. These, together with the mosses collected in the Alpine zone and in the forest, are being described under the direction of Mr. George Murray, F.R.S.

Unfortunately, the greater number of the dried specimens of flowering plants were lost on the road home, but seeds of the giant lobelias and groundsels have been saved.

The highest flowering plant was the everlasting, gathered at about 16,500 feet. There were two very distinct species of giant groundsel and two of giant lobelia.

Anthropology.

The most interesting point noted was the occurrence of Wanderobo at high levels on Mount Kenya. As stated in the paper, they visited some of our men at an elevation of over 12,000 feet, but the remains of grass hut sand of fires, together with the occurrence of footprints, proved that they commonly frequent the upper limit of forest at rather more than 10,000 feet.

On Certain Native Place-Names.

Kápoti = the northern portion of the Athi plains, inhabited by the Kapoti Masai. One of my Masai belonged to the Kapoti, and he told me on the spot that the Thuge brook was the northern boundary of Kapoti. The station on the Uganda railway of this name is many miles from any part of the Kapoti plains.

Meránga = the country between the Sagana at Magonie's and the Ragati east of Wangombe's. The *g* is pronounced as in German (Merang-a, not Meran-ga). Meranga has an alternative name, Ilyaini, which Gregory has attributed to a river in the neighbourhood.

Kaléti = Wangombe's country. South-west of this are the Wa-túmu-túmu. Both Wangombe and the Wa-tumu-tumu are feared by the Wameránga.

Ndóro, Laikípia, now vacated by the Masai.

Ondagóbbus, Kínangóp, Masai pastures west of the Aberdare range.

Kandúndu, Kambijo, Kamúti, a group of gneissic hills.

Kairúngu, Niána, Kehári, minor extinct volcanic cones.

Kargéna, Kámisséru, ? outliers of the Laikipian lava plateau.

Kangóso, Kandége (or *Chandege*), hills marked by tree clumps, on which periodical markets are held.

Nándarúa, the Kikuyu name of the mountain which is miscalled on the maps "Kinangop." The Naivasha Masai informed me that it is partially occupied with Kikuyu shambas, and is known to the Masai in question as El Donyo Giguyu, "the Kikuyu mountain."

Thúge, Thégu, Itthánga. The *Th* in these names is thick, as in "those." The *g* in the last of them is pronounced as in German (Ithang-a, not Ithan-ga).

Kenáu, the name of a ford across the Sagana on the road from Meranga to Machako's, and not, as shown in some maps, a local name of the river.

Ruíru, Darúku, considerable tributaries of the Athi, which we crossed close to the main river. They must come from the Kikuyu escarpment, since Mr. F. G. Hall records the names in that neighbourhood in a MS. map which he kindly lent me.

Nairóbi (= (Masai) "cold water" (Mrs. Hinde)). There are two rivers of this name, the one coming out of the cool Kikuyu forest where the Uganda railway enters it, the other originating in the southern glaciers of Kenya. The spelling of the railway station "Nyrobi" is indefensible and calls for remonstrance, before it becomes stereotyped, and before "Nyvasha" is perpetrated.

JOURNEYS IN THE CHINESE SHAN STATES.*

By FRED. W. CAREY.

I. I Bang and I Wu Tea-districts.

Though the muleteers raised hopes of an early start by putting in an appearance shortly after daybreak on the morning of December 4, 1898, there was, of course, the usual delay; for, after strapping all our belongings on to the saddle-frames, they disappeared, and we saw no more of them for several hours. To the inexperienced this kind of thing is trying; but good temper and patience are as indispensable to the traveller in Yunnan as an absence of nerves. These mental qualities, with some silver, a few tinned edibles, and a camp-bed, may be considered necessities; if, in addition, the traveller possesses a knowledge of the customs and language of the country, he is splendidly equipped.

The "Mafus" turned up again about 10 a.m., with their animals and pack-saddles. Two mules and three horses sufficed to carry everything necessary for a three weeks' trip—including a servant, "boy" and cook combined, who, having packed his clothes and bedding on a horse, climbed up on top, and remained a fixure, so to speak, during the whole trip. The steepest ascent or the most perilous descent had no terrors for him. Perched on the top of his belongings, he simply held on tight, and the horse did the rest. A coolie to carry my camera, and a soldier to act as a guard, also accompanied me.

From Semao the road to I Bang leads south-east, and, as usual in Yun-nan, the way lies over mountain ranges or through valleys in a series of ups and downs that becomes monotonous. We stopped for the first night at Huang Tsao-pa, a small village reputed to be the resort of evil-doers and horse-thieves. My passport gave me right to two guards from village to village and at each resting-place; but my servant demanded twenty men from the headman, to guard our valuable baggage. Apparently, there weren't so many men in the whole village, so we compromised and were satisfied with our landlord's son, who kept

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* Read at the Royal Geographical Society, February 19, 1900. Map, p. 564.

watch outside the house all night. There was, of course, not the slightest danger, and only once during the trip did I show my passport—to ensure civility. All foreigners travelling in these regions are treated as officials; and in proportion as my importance was magnified, so did the rank of my "boy" grow, until I began to have some hesitation in asking him to perform his ordinary menial duties.

Next day the weather changed, and we made our way over the interminable mountain ranges in a drizzling, bitterly cold rain. The road was so slippery that I thought it safer to walk; but my "boy" kept his seat, and studied how best to protect his bedding from the piercing drizzle.

On arriving at Pa-pa, a hamlet of ten houses, I found an "official rest-house," in the shape of a miserable straw hut with more ventilation than shelter, and divided into two by a bamboo partition. I and my horse took possession of one room, while the rest of the caravan tried to make themselves comfortable in the other. At the risk of a general conflagration, we lit a huge fire, and spent the rest of the day drying ourselves and hoping for less inclement weather.

Leaving Pa-pa next day, we followed for some distance the sharp crest of a hill, which led us gradually down until we came to the plain of Meng Wang. This is, I believe, the smallest of the "Sip Song Panna"—the district under the control of the Tussu being unimportant in every respect. We stopped for a time at the village temple, and were visited by the young Tussu—a lad about twelve years of age. He speaks Chinese well, and told me that he had a Chinese tutor. His father had died only a month previously. The little fellow was delighted when I allowed him to look through my binoculars, and asked me to stay the night at Meng Wang; but I was obliged to make a somewhat longer stage, and so pushed on to Wu Lu-ho—a collection of three or four houses, simple shelter for the occasional traveller, with Chinese inhabitants.

Next day the roads were wretched, but the weather was beautifully clear and fresh after the rains. We passed some curious graves—the family vaults of the Pen-jen, or original inhabitants of the country. These graves were shaped like Shan houses, and in front of them, swaying about in the wind, was a varied collection of offerings attached to strings. A long descent and a trying ascent brought us to Pu Yuan, a big village inhabited by Chinese and Pen-jen.

The Pen-jen race belong most probably to the "Woni" race, like many of the hill-tribes in this part of Yun-nan. Indeed, I think it would be possible to classify the numerous aboriginal tribes of Yun-nan and Indo-China under, at the most, four generical headings; and the future traveller would be doing work of scientific merit if he could ascertain, by comparing the language, customs, and dresses, etc., of the tribes met with, the parent-race of each. At present the nomenclature employed by different travellers is most confusing. Each tribe calls the other by a different name, which often merely refers to some peculiarity of dress or custom; and the same people are frequently described under various names. The ordinary observer, for instance, would see no resemblance between two such apparently distinct tribes as the picturesque Akka—or hill people to the west of the Mekong—and the Ma He, the wretched firewood-carriers of Pu Erh and Semao. Yet they are undoubtedly the same people, speaking the same language, and differing only in name and dress.

In dealing with the so-called aboriginal races of Yun-nan and Indo-China, the two main facts to be taken into account are the gradual intrusion of the Lolos from the north, and the retrogressive movement of the Shans, who were formerly masters of a large part of south and west Yun-nan before the Chinese. Rebellions and petty wars, with the consequent breaking up of once powerful races into scattered tribes, and even the mountainous and unproductive nature of the country itself, have also been main factors in producing an apparently inextricable medley of hybrid. But to return to Pu Yuan.

The costume of the Pu Yuan Pen-jen women is very striking, consisting of a cloth hood, an open jacket, and a pair of short white trousers reaching barely to the knee. But the most important, though the least noticeable, part of their costume is their coloured cloth gaiters. These the women are obliged to wear, as without them it is believed they would be able to fly away, leaving their husbands and sweethearts sorrowful. This legend recalls a custom of ancient Carthage—where the unmarried women wore metal leg-gyves, which were severed only during the marriage ceremony. The Akkas—also a Woni tribe—wear similar gaiters, though I do not think the same importance is attached to them. It is probably an emblem of some old custom of which the true significance has been forgotten.

Leaving Pu Yuan, we descended to the Nam Ban, known locally as the Pu Yuan-kiang. Nam Ban is the Shan name, and Loso is, I think, the Chinese translation of the Pen-jen word for "river." There was no proper ferry-boat, but our luggage was piled up on a bamboo raft, on which we also crossed. The animals were urged by the muleteers into the water, and made to swim across under a shower of stones and profanity. Every Chinese muleteer has an unequalled stock of the latter, no one specimen of which is fit for publication.

In the thick forests which border the banks of the Nam Ban there is said to live an old white elephant. He may some day have a companion, if the French carry out their new project of bringing a railway up the Nam Ban valley.

From the river the road was mostly uphill—splendid exercise for the men, but hard on the poor animals. We stayed at Ki Ka, and the following morning reached I Bang.

I Bang consists of one straggling market street, situated on the ridge of a mountain, and surrounded by deep valleys. The population is about 1000, mostly Chinese engaged in the tea trade; but a little cloth is also made and dyed locally. I visited the tea-plantations—simply clearings on the hill-sides—and obtained specimens of the leaf, flowers, and seeds. To make a plantation, old dried seeds are planted and carefully nourished. When the young plants are sufficiently strong they are transplanted in rows at equal distances. Cuttings will not grow.

At I Bang there are three tea-hills, and from six to eight qualities of tea to each hill. Each locality is supposed to impart its own particular

"HEI PA-I," OR BLACK-SKIRTED SHANS.

flavour to the various qualities. I Bang tea is said to be much better than that produced in the I Wu or Meng Hai districts, though the trees are identical and the cultivation practically the same. But reputation is everything in trade.

The very finest tea is known as "Sheng Ya," and consists of the young unopened leaf-tips, greyish-green in colour, and covered with a silky down. This is the only quality which undergoes no preparation beyond drying in the sun. All the other kinds are much alike, and go to make up the "Pu Erh tea" of commerce.

There is a likin station at I Bang, and likin is paid on all tea prepared and pressed into cakes before leaving; but loose tea going to Semao pays likin on arrival there. The output of the I Bang district is about 1500 piculs annually. Most of the merchants at I Bang and I Wu, as at Semao, are natives of Shih Ping.

The Tussu and natives of the I Bang district are Pen-jen, who have adopted a dress very much like the Shans. Their name for themselves is "Ve-Niu," which is simply a variation of "Oi-ni," or "Woni."

The weather was not favourable for photography, but I brought my camera out at I Bang. The Chinese regarded it with a good deal of suspicion, there being a widespread belief in Yun-nan that foreigners have an instrument (chao pao ching) by means of which they are able to discover hidden treasures, and carry away the luck of a place in the shape of precious stones. But having seen the Likin Weiyuan go through the ordeal of having his portrait taken with equanimity, they were reassured, and the crowd which had been following me in the hope of seeing something extraordinary gradually dispersed. Most of the Chinese along the way had heard of a telescope, and to distract their attention I used to give them my binoculars to play with. The natives were much simpler, and, though many of them had never before seen a foreigner, I found them more hospitable than curious.

Between I Bang and I Wu I slept at a little "Hsiang Tan" (a Lolo tribe) village. The inhabitants were pleased to receive a "great man," who, like themselves, was an "I Chia-jen;"* and when I asked for a vocabulary, they tumbled over each other in their eagerness to supply me with the required information. Like most of the Lolo tribes, the "Hsiang Tan" are fond of music and dancing, and were delighted when I played some simple tunes on my banjo. The young girls of the village started dancing outside the house, and though the only illumination came from my candle-lamp and some pine-wood torches, they kept it up until a late hour. In the first of the 'Etudes Sino-Orientales,' lately published at Shanghai, Pére Wial, speaking of the Lolos, says "the men dance, but the women never." This is not at all our experience of the Lolos in this part of Yun-nan. Dancing is looked upon as a healthy amusement to be indulged in by both sexes, and I have never seen the slightest suggestion of immodesty. Indeed, the Lolos are pre-eminently a moral race—very different from their neighbours the Shans.

I Wu is situated on the site of a hill overlooking a valley, and is a slightly larger and more important place than I Bang, with a population of about 2000. The district produces from 3000 to 4000 piculs of tea a year. Some cotton passes through I Wu on its way to Ching Tung, Yun-nanfu, etc., *viâ* Mo Hei; and iron pans, walnuts, and the usual exports also come down by the same route. At Man Nai—two days north of I Wu on the Mo Hei road—there is a likin station, which

* "I Chia," or "I-jen," Chinese for barbarians—a term formerly employed by the Chinese to designate all foreigners, but now forbidden by treaty to be used in official documents.

collects likin on all native produce passing through. At I Wu I met some men and women of the "Yao" tribe. They were up from the "Meng La" district on a hunting excursion, and were awaiting the return of some of their party who were away chasing a wounded elephant. The men were finely built, manly fellows, in appearance not unlike the Cantonese, whilst the women were good looking, and as fearless and independent as the men, with whom socially they are on an equal footing. I wrote down a short vocabulary of their language, and became quite friendly with them. They are not on terms of good-fellowship with the Chinese, and will not answer to the ordinary form of Chinese salutation. Those Chinese who have any

THE MEKONG AT HSIN TU-KON FERRY.

dealings with them address the men as "Las Ken"—a term which they seem to appreciate.

The "Yao" are a hardy race living amongst the mountains, and may be found almost anywhere between the West river in Kwang-si and the Mekong in Yun-nan. They are nomadic in their habits, staying only two or three years in one place. They cultivate valuable medicinal plants for sale to the Chinese, and hunt the elephant for his ivory and the tiger for his bones, which occupy—with deer-horns and other peculiar products of the chase—an important position in the Chinese pharmacopœia. They make their own weapons, and I examined one of their elephant-guns—a kind of cannon in miniature, with a short

The latter, constituting the whole available military force of the district, is composed of Shans, and numbers about three dozen. They are called "soldiers" by courtesy, though their principal occupation during my visit was the making of mud bricks and mortar for the new residences which the Europeans are constructing. There is nothing remarkable about Meng Wu except the climate, which is exceptionally trying. Malária is encouraged, if not engendered, by the dense forests with which the hills around are covered, and from early evening till late in the morning the plain is enveloped in a thick misty fog, which is only dispelled by a scorching sun. In the summer the place is subject to terrific storms, which often unroof the frail bamboo houses and flood out the inhabitants. There is no commerce, except in pigs, and no local market. Large droves of "porkers" are sent north into Chinese territory, many of them eventually reaching the markets of Semao, Pu Erh, or Talang. Likin is collected on pigs by agents from the Man Nai and Meng Lieh stations.

Personally, *i.e.* in their face and figure, the Shans resemble the Japanese, and the women are, to say the least, just as unconventional and fascinating. But there the resemblance ends. The men are lazy, good-for-nothing fellows, who never, unless absolutely obliged, do any work. The women toil during the summer in the rice-fields, and when at home are industriously employed weaving cloth. Their costume is very pretty, consisting of a turban embroidered with gold thread, a short tight-sleeved jacket, a long white petticoat, and a coloured skirt. Their skirts are so much more becoming than the ugly misshapen trousers of the Chinese women, and it is this difference in costume which strikes the eye of the traveller coming from China.

At Meng Wu the girls were already providing themselves with cotton-seed balls, and I was pelted with these love-missiles whenever I made my appearance in the valley. They were not, of course, intended to convey any message to me; but at the festivities which take place during the Shan New Year these coloured balls play an important part, the unmarried girls throwing them at the young men of their choice. By continually catching or missing them the youths show their preference, and marriage engagements are the result. At other times this game resolves itself into a mode of flirtation, the one who misses the ball having to pay a forfeit to the thrower. All the Shan boys spend a part of their lives in the village temple, where they learn to read and write, and become lazy.

On leaving French territory, the route was, to use a French word, *épouvantable*, and during the greater part of the year must be absolutely impassable. We followed the valley of the Nam Wu up to its source, and then struck over the dividing range which forms the frontier. The evening was drawing in, when one of the horses got embedded in a mud-hole, and we had great difficulty in extricating him. We got him out at last, and made a fresh start. But a huge slippery boulder lying right across the path at a particularly narrow spot, proved a stumbling-block to the first mule, that slid and rolled down the side of the ravine until stopped by the long grass. It took some time to get the poor beast with its burden back to the road again, and then the muleteers—both young fellows—gave up and commenced to cry. I told them to camp out, and having seen the whole party comfortably around a blazing fire, which was soon made, I started on foot, with my servant, to find our proper stopping-place, Paka. It was by this time quite dark, the path was full of holes, and we had to find our way sometimes by the aid of matches.

"HSIANG TAN" LOLOS OF IWU.

We came at last on the telegraph poles, and then to the stone marking the frontier. A few li further on we found the village of Paka. Here I easily arranged with four or five Chinese to go back and help our caravan; and by 11 p.m. the last of the party had straggled in, and we were once more in good spirits. I was really glad to get back into Chinese territory, for I felt that the hardships and difficulties encountered in French Laos were barely compensated for by the courtesy and hospitality of the acting political agent and his colleague at Meng Wu.

From Paka we followed a fairly good road leading level for several days, and planted the whole way with telegraph poles. The mountains had been cleared by fire of their dense forests; but though the aspect was not so grateful to the eye, we were glad of the change. The inhabitants of the villages we passed were either "Han Pa I" or Chinese, hospitable but uninteresting. Some of the latter were formerly beggars of Semao, who, having saved a little money by industriously following their vocation, had emigrated to these parts, and were eking out a wretched though perhaps honester existence by cultivating the little watered valleys.

I must not forget to mention a labour-saving device, used by the "Han Pa I" in hulling grain, of which I secured two photographs. The apparatus consists of a wooden log, hollowed at one end, and with a piece of hard wood fastened through the other. This log is evenly balanced, and a stream of water is turned on to the hollow end, which when full sinks down, empties itself and rises again. The other end, falling continually into a receptacle containing grain, performs its work by gradually loosening the husk.

We crossed the Nam Ban again at Na mifa. This time we forded the river, there being nothing in the shape of a ferry so far as I could see. It required a knowledge of the locality which we did not possess, to avoid the deep places, and several of our party wanted drying that evening. From the Nam Ban the country presented its old aspects—hills, valleys, and zigzag roads, and the villages were mostly Chinese. By the occasional use of quinine, the efficacy of which as a preventative of fever needs no endorsement, none of us were ill during the trip; and we arrived back in Semao on December 25, Christmas Day.

II. Meng Lien.

The object of my trip was to obtain as much interesting material as possible for the Semao section of the Paris Exhibition; and my intentions were to visit, if time permitted, the country of the Kawas—that savage people of whom we had heard so much, but knew so little. March and April are not the months *par excellence* for travelling in Yun-nan. They usher in a period of dry and dusty weather, with irritating wind, which continues until the rainy season. The sun appears and disappears daily as a round red ball, and the hills are so wrapped in hazy mist as to be almost invisible. Personally, therefore, I felt less pleased than usual at the prospect of a long journey—a feeling intensified by rumours of the head-hunting propensities of the savages already alluded to, whose acquaintance it was part of my mission to make.

Leaving Semao on March 7, 1899, we struck south-west through a region never before traversed by Europeans, along a road followed by cotton caravans coming up from Burma. My own small caravan was composed of seven pack-animals with two muleteers, my servant, a coolie, and one soldier. The muleteers were fine, strapping young Mohammedans, well up in every detail of their calling. To the soldier—

a picked man from the Prefect's Yamên—I entrusted my shot-gun, in lieu of his old service blunderbuss; and the coolie had charge of my snap-shot camera.

Our first stage should have been Nakolo. But, as usual, we were late in starting, and were obliged to make a *détour*, and put up for the night in the little Lolo village of Lao Wang-chai, 30 li out from Semao. The Lolos proper, who call themselves Ni Su, exist in the Semao district in small scattered villages only, and are very much mixed by

SHAN GIRL OF MENG LIEN.

intermarriage with other native tribes, and even the Chinese. Their ancestors ruled over a large part of this province, and there are still powerful independent Lolo tribes inhabiting North Yun-nan and South-Western Szechuan, with whom the Ni Su of Semao claim affinity. They possess a scanty literature, in the shape of written manuscripts, showing evidence of their vanished greatness; but now only the "Perma," or village soothsayers, are able to read and explain their peculiar characters.

We returned to the main road next morning, and continued all day "up hill and down dale" through charming scenery to Nakolo, a Chinese village of about fifteen houses. From there the road leads up over the Hsiao Lu Shan, a continuation of the Ta-Lu Shan range of mountains which runs from north to south in an unbroken line for miles. We crossed it at a height of 6200 feet, and descended to the town of Mêng Pang, inhabited by "Hua Yao Pa I," or "Coloured Bodice" Shans. Here I obtained my first contribution to the Paris Exhibition—the pretty costume of the Hua Yao Pa I women, which I purchased without exciting suspicion as to my motives.

The Shans, called Pa I by the Chinese, style themselves "Tai," adding the distinctive name of their clan. The following varieties occur in the vicinity of Semao:—

Tai Lu, or Shui Pa I, including the majority of the inhabitants of the Chinese Shan States;

Tai Ya, or Hua Yao Pa I, so named from the coloured bodice worn by the women;

Tai Ne, Hei Pa I and Han Pa I, immigrants from Wei Yuan wearing black skirts, or Shans who have adopted Chinese dress and custom; and

Tai Lem, the people of Meng Lien, or Meng Lem.

In this paper remarks on dress apply particularly to the women's costumes; the men as a rule wear the blue jacket and trousers common to the poorer classes throughout China.

Leaving Meng Pang, we passed through Chen Le-pa, a large plain with a Shan (Lu) population. The Lu women are fond of gay colours, and their dress is very striking. The Liu Shun Tussu, or hereditary chief, was staying in the principal village, and as we were travelling through his territory we sent him cards. This piece of formality brought a messenger from him to wish us a pleasant journey. Our next stopping-place was Hsiao Ho Kung, a small village inhabited by Hei Pa I, immigrants from Wei Yuan, a district north of Pu Erh. These people were very poor, and their houses, instead of being perched up on piles in the usual Shan fashion, were built on the ground, and resembled magnified beehives of the old-fashioned straw-thatched kind. The interiors were dark and smoky, and the entrances so low and narrow that for days afterwards we suffered from sore fore-heads and a tendency to stoop.

Villages were not a prominent feature of the country through which we passed next day, and for 30 li or more we did not see a human being. At a place called Tang Pa-shan, where the road overlooks the Mekong valley, there is a settlement of poor Chinese, who manage somehow to make a living from the bare hillsides. Descending to the Mekong, we found the ferry working at a point known as Hsiu Tu-kow, where the distance from bank to bank is somewhat lessened by projecting rocks; but the current is strong, and the water very deep. On the left bank above the river is a straw hut flying the likin flag, where a tax is collected on all goods passing to and fro. The ferry-charges, which pertain to the Lui Shun Tussu, are high, and must amount to a considerable sum yearly. We were a long time crossing owing to the unwillingness of the pack-animals to enter the boat, and it was evening when we started to climb the steep hills on the right bank of the river. On our way up we disturbed a number of peacock, jungle-fowl, and pheasants that had come out of the dense thicket clothing the hillsides for their evening wrangle and strut. Thirteen hundred feet above the Mekong we stopped at the village of Nan Pien Hsin-chai. The inhabitants, like those of Hsiao Ho-kung, were immigrants from Wei Yuan, and the women wore the same sombre costume—a long skirt of some black stuff, relieved by widths of green and dark-red cloth, a black bodice, and a turban. We noticed many drivelling cretins of both sexes, and more than half of the inhabitants were disfigured with goitre. In Yun-nan one becomes accustomed to the sight of this horrible deformity, but in this little place the proportion of persons afflicted was unusually great. The villagers objected to the presence of our dogs inside their houses, and we noticed that their own gaunt beasts were never allowed to enter. Having remarked the same circumstance at Hsiao Ho-kung, I was at first inclined to attribute it to some superstitious or religious prejudice, but I found it was really fear of the fleas.

AKKA WOMAN WITH PECULIAR HEAD-DRESS.

From Nan Pien Hsin-chai we continued, alternately ascending and descending, passing here a Lo Hei, there a Chinese village, until we struck the Nam Wang, a stream flowing through the Meng Wang plain; and, following up its course, we soon reached that place. Meng Wang is one of those fertile, populous plateaux which occur here and there like oases in the mountainous desert of Yun-nan. When their altitude is over 4000 feet above the sea, these plains are usually inhabited by Chinese, below that height by Shans, whilst various aboriginal tribes occupy and cultivate the intervening mountain ranges. Meng Wang is an important Shan centre belonging to the Liu Shun "panna." The population of the place—that is to say, of the eight or ten villages scattered over the plain, for the Shans dislike living in large communities—must be nearly 8000.

Leaving Meng Wang, we made but a short stage, stopping at the Akka village of Pasang, which lies up in the hills overlooking the Meng Wang plain. The Akkas belong to the Woni division or offshoot of the Lolo race, and their language is practically the same as that of the Ma He, the poor firewood-carriers of Pu Erh and Semao. I had passed through Pasang on a former occasion, and being recognized by some of

LOLOS DANCING.

the men, we were cordially welcomed, taking up our quarters in the headman's house. The Akka women wear a very picturesque costume. It consists of an open jacket, an embroidered bodice, a very short skirt reaching scarcely to the knees, a pair of cloth gaiters, and a curious head-dress. This last is a towering mass of complicated beadwork on a bamboo and cloth foundation, ornamented with cowrie shells and silver beads, and for height and general prominence the equal of the modern *matinée* hat. It is worn only by the married women, having much the same significance as the wedding-ring. From the day of their marriage they spend their leisure time in its decoration, and when they die it is buried with them, the silver ornaments only being taken off. Except on special occasions, such as a visit to the neighbouring market of Meng Wang, the hat is covered with a piece of blue cloth to protect it from the sun and rain.

I knew there would be great difficulty in purchasing a complete costume for the exhibition. When the French first established a post at Meng Wu, there were several tribes of these Akkas in that district, and at the request of the French Consul at Semao the Meng Wu resident obtained a woman's dress and hat. But the transaction was distasteful to the Akkas, and resulted in their flight from that part of French territory. Most of their superstitious beliefs seem centred in this remarkable

"PA-I" SHANS PLAYING AT THE LOVE-GAME OF THROWING COLOURED BALLS.

head-dress; and, though I approached the question as delicately as possible, my proposal to purchase one was received with a good deal of suspicion. I did not touch on the subject again until the evening, when, having created a favourable impression by various little presents, I suggested to our host that a costume, including a hat which had not been worn, might surely be found or made in such a large village; and he eventually promised to do his best for me. At eleven o'clock the next morning, when I was preparing to leave, there were no signs of the coveted costume. But soon after my patience was rewarded, for, followed by a crowd of villagers, the headman at length appeared, bringing a complete dress with the hat. He told me, that nearly all the women of Pasang had been engaged during the night making the things, which lacked the silver beads and buttons only. These I could purchase separately and fix on myself; so I paid the price demanded, which, considering the circumstances, was not exorbitant. Then, bidding these simple people good-bye, I started off to try and find a direct route through the high mountains, known as the Lo Hei-shan, lying to the east of Meng Wang. That day and the next I spent in vain endeavours to find a suitable road for pack-animals through the hills, eventually reaching the "Hsiang Tan" village of Lao Hsiung-tien.

The "Hsiang Tan" are a tribe of Lolos—indeed, they are the only people who style themselves "Lolo," the term being considered opprobrious by the Nisu, Pula, and other tribes. They are allied to the Nisu, and have a similar dress and language. Their customs and amusements are also much the same, but I could find no trace of a literature past or present, and the children of the richer peasants are learning Chinese. Outside one of the houses at Lao Hsiung-tien there was posted a Chinese proclamation issued by the Tussu of Lo Hei. It was addressed to the women of the district, exhorting them to live virtuous and industrious lives, and to refrain from all immoral amusements. Like other Lolo tribes, the "Hsiang Tan" are fond of dancing, which is contrary to Chinese ideas of propriety, and this proclamation was evidently directed against this innocent diversion. But a lecture on conduct to a people so well-behaved as the Lolos was as unfair as it was offensive, for the Chinese of South-Western Yun-nan are themselves unusually immoral. It is this intolerance of harmless customs, coupled with their contempt for native costumes, which has created such a wide gulf between the Chinese as a whole and the aboriginal races of Yun-nan; and it is probably the reason why, during the Mohammedan rebellion, nearly all the hill tribes ranged themselves on the side of the rebels. The Tussu of Lo Hei—the hereditary chief who rules over the district known as the Lo Hei-shan, and who, like the Shan chieftains, owns allegiance to the Chinese—resides at Ta Ya-ku.

Whilst we were at Lao Hsiung-tien, a band of eight cattle-thieves paid a visit to the village. In the middle of the night they entered the house where we were sleeping, and were evidently much surprised to see a foreigner in possession. They did not attempt to molest us, but seemed, on the contrary, glad to get away from a dangerous spot; for, apart from the fact that they are treated as officials, foreigners are credited throughout Yun-nan with superhuman fierceness and daring. In the morning I found that my white metal soap-box, which had been lying on the table, had disappeared.

There being no good direct route to Meng Lien, I turned north to Ta Ya-ku, and struck west along the Chen Pien road, which had been widened and repaired for the passage of the Chinese party of the Southern Boundary Commission. We crossed and recrossed their track several times on our way to Meng Lien; indeed, by tacitly allowing it to be understood that I was going to join the Taotais' party, I was saved the annoyance of explaining at every village the reasons of my journey. At Nan Ma-chai, our first stopping-place west of Ta Ya-ku, we were awakened during the night by an alarm of fire. Six houses below us were destroyed; but fortunately there was no wind, and the flames did not spread. Fires are of frequent occurrence in this part of the country, sometimes resulting in the destruction of the whole village. Yet despite these warnings and the knowledge that their houses are built of the most inflammable materials, the villagers are careless

HUA YAO PA-I GIRLS OF HSIAO MENG YANG.

with their cooking arrangements, and take no precautions against accidents.

The inhabitants of Nan Ma-chai are "La Hu," a Lolo tribe known to the Chinese as the Lo Hei of Lo Hei-shan. They are akin to the Hsiang Tan, and are to be found spread over a wide area, from the Mekong to the Salwin. In their villages I found no outward evidence of any literature or religion. The Lolos do not build temples. They believe in spirits, and at certain seasons of the year they perform curious rites and offer sacrifices to propitiate the evil or reward the beneficent *nats*.

A very long stage brought us to Shang Ching-chang, a settlement of "Chia Kawa," situated on the top of a mountain 6100 feet above

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sea-level. These are the civilized as opposed to the "Yeh" or savage Kawas. In appearance they are tall swarthy people, with oval faces and prominent features, quite unlike the Lolo tribes around them. Their language contains a percentage of Shan words; but they have no knowledge of writing, and I could glean little of their beliefs. Although they disclaim any affinity with the "Yeh Kawas," and have partly adopted the Chinese and Lolo dress, manners, etc., they are a distinct race, and must be, as their name implies, of Kawa stock. Races west of the Mekong are very much mixed. The Chinese settlers, too poor to import their own women from Eastern centres, intermarry freely with the Lo Hei and Hsiang Tan tribes, who in their turn mix with other native peoples. The result is a confusion of language and customs most difficult to analyze, and the fleeting traveller can only endeavour, by careful comparison, to guess at the parent race of each tribe. It is improbable that there are more than five or six distinct races in Yun-nan, though there are nearly a hundred differently named tribes.

The following day we passed quite close to the village of I Sung, marked on the maps as Chen pien, the capital of the Chen pien prefecture. The yamen of the first prefect, a Cantonese, was built down in the Meng Lang plain; but he was carried off by malaria, and his successor removed the official residence to a healthier spot on the hills, 30 li away. The quality of the opium, which is extensively cultivated on the hill-sides in this district, has quite a reputation amongst consumers in South-Western Yun-nan. This year the crop will be a failure, owing to the want of sufficient rain during the eleventh and twelfth Chinese months. We passed through two hamlets where some Hunan men have settled down with Lo Hei wives, and off the route were several Akka villages. In the afternoon we ascended to a height of 7000 feet, our highest point during the trip. From this elevation we could see some big mountains to the west, the Kung Ming-shan range, which forms the Burma-Yun-nan frontier, being plainly visible no great distance away; and behind it, showing dimly through the haze, a higher range, at least 9000 feet above the level of the sea.

On our arrival at Nan Tieh, a Lohei village, we met a caravan of cotton in charge of some Mahommedan muleteers, who had come from a place in Burma, north-west of Meng Lien, and were making their way by a roundabout route to Ta Ya-ku. They had been obliged to skirt the edges of the Kawa country, and told me many stories illustrative of the fierceness of this head-hunting tribe. At present only the Shans are able to enter the Kawa country without being molested; and some Chinese officials, whilst making a preliminary survey of the frontier which runs through their territory, were only recently attacked, and obliged to flee for their lives. The Kawas build up near the hilltops, and their villages are so arranged that the only entrance is through a tunnel-like passage cut into the solid earth. Their houses are cavern-shaped structures, made by digging a hole in the side of the mountain and erecting a rude porch outside. They cultivate mountain rice and maize, and make a curious cloth of strong texture which they sell to the Shans. Their ordinary costume, men and women, is a ridiculously small loin-cloth and a pair of huge earrings; but when visiting the markets, they fold a piece of cloth skirt-like around their bodies, and the women wear in addition a loose short-sleeved jacket and a pointed cloth hood. These and many other details I learnt from the Mohammedan muleteers. They were British subjects, and

THE TEN HILLS OF IBANG, SHOWING TEA-TREES.

must have been proud of the fact to acknowledge it, for they were dressed exactly like other Chinese, including the queue.

We left the main road at Nan Tieh, and struck south across a deep valley and up the opposite hill-side to a "Chei Kru," Akka village. This is a variety known to the Chinese as "Ping Fu," or Level-heads, from the women wearing a less imposing head-dress than the "Chien Fu," or Pointed-heads. I tried hard to procure another dress, but failed. My *modus operandi* in this instance was as follows: the headman of Nan Tieh, our stopping-place, was a Lohei well known to the Akkas of the village, and I persuaded him to start some time before us in the morning, and to try and arrange for the purchase of a woman's costume. I made no limit as to the price of the articles; he was to be remunerated for his trouble if he failed, and to receive a stated sum if he succeeded. I think he understood that my motives were quite friendly, and tried honestly enough to earn his reward; yet the scheme had no result, except to bring the whole of the villagers out to the roadside to watch us pass. We stopped to rest at Chiu Fang, a Lohei village, the capital of a small hill district ruled over by a Chinese, who is married to a native woman. He was away with the Chinese frontier party, at the head of a number of his subjects; but his son had returned the previous day, and gave us a full account of the progress of the commission.

The Tao-tai of Pu Erh was in charge of the Chinese party, and the British officials must have been impressed by the number, if not by the martial appearance, of his following. Soldiers were summoned from all parts of the prefecture to act as his escort, whilst a percentage of the inhabitants of every little village along or near the route accompanied him headed by their local chiefs. The armament of this motley crowd was varied, consisting of weapons old and new, from the latest-pattern Winchester (manufactured in the arsenal at Yun-nan fu) to the spear, trident, and blunderbuss. Everything was working smoothly, we heard, except for the little difficulties connected with the division of doubtful territory; and the British party, with their smart escort of Sikhs, created a very favourable impression. We noticed many proofs, in the shape of bottles and empty preserve-tins, of the recent passage of foreigners through the country; and once we came upon the coloured picture, "Joseph's Dream" (*Truth* Christmas Number, 1898), stuck up in a conspicuous place outside the hut of an untutored savage. The contrast in this wild wilderness was startling.

Thieving bands of Kawas were known to be in the vicinity of Chiu Fang, as a few days before a neighbouring village had been raided and some cattle driven off by these savages, who are said to be able to cleave a pig in two with one stroke of their keen-edged swords. When we left, our young host insisted on sending eight men as guards, who accompanied us down to Meng Ping, a plain inhabited entirely by Shans. Like Chiu Fang, it is one of those little semi-independent communities so common in this region, appertaining to no particular state, but paying a nominal tribute either to the Chen Pien prefect or to the Tussu of Lohei. These small districts are under chiefs who have been given control of morsels of territory as reward for their help to the Chinese at some critical period. The headman of Meng Ping was with the Chen Pien prefect at the frontier. Like many of the Shans, he has the reputation of being invulnerable.

The belief in the potency of charms, etc., is very widespread amongst the lower class Chinese and the Shans in this part of Yun-nan. The latter, in particular, have all kinds of amulets to ward off evil, the gem of their collection being one which confers invulnerability on the wearer.

This useful quality may also be obtained, I was informed, by undergoing a very painful process of tattooing. During my trip I was shown a "dragon's nest"—which looked like a bit of the horsehair stuffing from a foreign saddle—guaranteed to render the purchaser's house safe from fire; and a "female deer's horn," which would enable the fortunate owner to walk great distances without fatigue. Not being a landed proprietor or a professional sprinter, I had no use for these things; and though I entered into negotiations with several people for

"LEVEL-HEAD AKKA" WOMAN.

the talisman which would render me invulnerable, none of them were willing to stand the test of Western scepticism—a revolver at thirty paces—even though I offered them an enormous sum and a handsome funeral in case of accident.

We travelled through some wild country next day, and towards evening came again to the main road. At one place we saw, working in the fields, some Kawa girls, who appeared to be *in puris naturalibus;* a closer inspection, however, revealed the customary loin-rag. I might have spent the night in one of their villages, but my Shan guide advised me not to do so. He said that it was usual for strangers to take a guard of Shans with them when intending to visit the Kawas in their houses; so, leaving the mountains, we descended to the Shan town of Nang He. From there the road was level the whole way to Meng Lien.* The principal town of Meng Lien is situated on the side of a sloping hill at the northern end of a large cultivated plain, 3600 feet above the level of the sea. The mountains around are covered with thick forest, and the plain is watered by the Nam Lien, a cool, limpid, and sluggish river, which runs at the foot of the incline on which the town is built. It was certainly the prettiest place that we had visited during our trip. In the plain, nestling amongst the woods, are many other villages, and the total population must be nearly 20,000.

The district of Meng Lien comprises a large tract of territory, whose western boundary forms for some distance the Burmese frontier. The present Tussu of Meng Lien is a young man of twenty-one, on whom the Taotai, when passing through on his way to the frontier, conferred civil rank of the third class. He was married the day we arrived, and invited me to the wedding festivities, which were taking place at the bride's home some distance away. But I was anxious to visit the market on the morrow, and was obliged to refuse. In an interview with him, I learnt that the boundary commission had started at Meng Ah, a point south-west of Meng Lien, and were working south. That part of the frontier running through the Kawa country has not been defined, and will be left over until next year. Unless some arrangement is made by then, fighting between the savage inhabitants and the Boundary Commission is, I am assured, inevitable, and the Indian Government will probably despatch an expedition to the frontier. We found accommodation in a temple near the Tussu's yamen, and the chief bonzes, the junior priests, and students quartered in the building received us with curiosity, but cordially. All the Shan boys enter a temple at an early age, where they learn to read, write, and chant prayers. Should they elect to stay, they are gradually promoted, and so many pupils are entrusted to their care. Every morning these youngsters may be seen chanting the contents of their books aloud to their instructors, or pricking letters on to palm-leaf booklets with a steel stencil.

Amongst the other races of this part of Yun-nan the immorality of the Shans is proverbial; but it is not at first apparent to the passing stranger, who is often at a loss to know how such a bad reputation has been established. The fact that both sexes mix freely together, and are on terms of social equality, however contrary to Chinese ideas, does

* Meng Lien, or Meng Lem.

not offend the foreigners' sense of propriety. Further acquaintance, however, will show him that the Shan girls, outwardly so pleasing, modest, and industrious, are utterly wanting in virtue; whilst the men are dissolute, even the students in the temples throwing off their priestly dress and demeanour at nightfall. The unmarried women are allowed the most absolute freedom, and have many lovers; but once married, they become, as a rule, good and faithful wives, and take a prominent part in the management of the household.

It was very cold in the early morning at Meng Lien, and I remarked that at low altitudes the temperature was much higher during the day and lower at night than on the hills. During our stay in the temple

A SHAN HOUSE.

we were awakened regularly at daybreak by the priests and students, who, kneeling in front of the great gilt Buddha, yelled their morning orisons with more vehemence than harmony. Then the women of the place entered in twos and threes, and, first removing their turbans, also performed their devotions. They bring with them offerings to the gods—little balls of glutinous rice and a handful of chillies. We visited the market, which is held once every six days at Meng Lien, and is frequented by many different kinds of people, some of whom come from distant places. I obtained several curiosities, including the gala dresses of the Kawa and Lohei women. Amongst the foreign things for sale on the stalls, I noticed all sorts of woollen, silk, and cotton piece-goods, in much greater variety than can be found at Semao; condensed milk, candles, umbrellas, lead-pencils, and buttons. These articles are brought from Mandalay or Rangoon by Shan traders, who frequent all the big markets of the Chinese Shan States. They never go to Semao, fearing the intolerance and jealousy of the Chinese merchants there.

Leaving Meng Lien on the morning of March 21, we crossed the plain in a south-easterly direction, and found ourselves once more amongst mountain ranges—here covered with dense forest. About noon we encountered a forest fire, and had barely time to rush past the point of danger, the flames already licking the long grass at the side of the narrow path. The last horse threw his pack into the fire, and in rescuing it one of the muleteers burnt his hand rather badly. Further on huge branches of fallen trees, still burning, blocked the path and stopped our progress. We were on the slope of a mountain, and could go neither up nor down. Behind and below us the woods were on fire, and it needed our united efforts to move aside the blazing logs and start on again. Then the strong wind rushed the flames up in front of us from below, separating three of our party from the caravan. The heat was almost unbearable, and we had difficulty in keeping the horses quiet; but at last, after an anxious time, we were able to pass through, and made all haste to get away from the burning area.

We rested awhile in a Kawa village, the villagers belonging to the semi-civilized kind to be met with on the outskirts of the Kawa country. From one of the men—a ferocious-looking old savage, with unkempt hair falling over his shoulders—I obtained a short vocabulary of their language, my desire in this direction being limited by his ignorance of Chinese and my imperfect knowledge of Shan. He accompanied us as a guide to the next Shan village, and I bought from him an old fuse-gun, made locally, the stock of which was smeared with blood and ornamented with the feathers of birds which he had shot. Our route led through a mountainous barren country with few inhabitants until we arrived at the Pu Meng-shan village of Nong Kang, situated in the centre of an important tea-district. This place belongs to Meng Che, but the adjacent villages of Ching Mai, Meng Ping, and Man Kieng form part of the territory ruled over by Mr. Yang, a Chinese merchant of Ta Ya-ku, who was given official rank and obtained a grant of land for his services in the war against the hill tribes of Lohei. These three villages were lately made over to him by the Meng Che Tusau, with whom he is on very friendly terms.

From Nong Kang we descended to the Shan town of Meng Mang, situated in a big plain. Game of every kind is plentiful in the thick woods which cover the hills around, and on leaving the plain I obtained a shot at a peacock. Between Meng Mang and Meng Che there are no villages near the road, and as we arrived late at the summit of the high range which divides these two plains, we decided to camp out. We found a pleasant sheltered gully with grass and running water, where we spent a good night, the atmosphere at that height (5500 feet) being dry, with no sign of the heavy mist which nightly envelops the low-lying plains. The weekly market was in full swing when we arrived the following morning at Meng Che. I noticed the same variety of foreign goods exposed for sale as at Meng Lien, and amongst the crowd of frequenters were some Hunanese pedlars, with their usual stock of matches, percussion-caps, Chinese buttons, and the odds and ends peculiar to a pedlar's stock-in-trade.

From Meng Che to Meng Hai it is only 50 li. On our arrival we

AKKAS OF CHEN YANG, WEST OF MEKONG.

found hundreds of Shan men and women and a few Chinese crowding the market, and preparing to camp under the small straw sheds which serve as scanty protection against the sun and rain and heavy night dew. The market was to be held next day, and these people, who had come in from a distance, would be ready to wrangle and barter at an early hour. At night I visited the place again, and found many of them lying around on the ground fast asleep, while others, including most of the Chinese, were huddled up near their opium lamps. Before daybreak the market was astir, and people were coming in from all directions. There are two roads from Meng Hai to Kiang Hung—one through the Meng Sung tea-districts, the other curving round to the south in a semicircle. Having already been over the former, I this time chose the more southerly route, which led for some distance through tea-plantations. Outside one of the large villages which we passed were the corpses of six Chinese surrounded by vultures. These men belonged to one of the numerous small bands of robbers and horse-thieves living around Semao and Pu Erh, who overrun the Shan states during the dry season, attacking small caravans and stealing horses and cattle. Sometimes, as in this instance, punishment overtakes them before they can get away with their booty; but it was a common occurrence during our trip to meet parties of villagers armed with spears or old guns, looking for lost cattle. The Shans, when they catch these thieves, cut off their heads without reference to the officials. At one place *en route* I saw the headless bodies of two horse-thieves lying out beyond the village limits. During the morning we twice forded the Nam Ha, a stream which, rising above Meng Che and flowing through both that and the Meng Hai plains, empties itself into the Mekong at Kiang Hung. Then a steep ascent brought us to Nang No, a "level head" Akka centre of three or four good-sized villages. The district produces a lot of tea of excellent quality, and the inhabitants were well-to-do and would listen to no suggestion for the purchase of their garments. At I Bang and I Wu the Chinese make a close distinction between the tea-leaves according to the age or time of picking, and they have gained a reputation by certain of the finer young qualities; but in all other districts the natives wait until the trees have put forth all their leaves before commencing the harvest. The tea is bruised and dried after picking, and sold loose to traders, who carry it up to Semao, where it is carefully sorted into three qualities. The output of the tea-districts west of the Mekong is many times greater than that of I Bang and I Wu combined, amounting to about 25,000 piculs annually. There were two curious gates to the village where we stopped. On the top of the first, facing the road, was the skin of a dog with head intact, its mouth open and its teeth grinning defiance to the evil spirits who are always so eager to enter Akka villages. The other gate, which was of curious make, had as ornaments, and probably with the same idea of scaring away ghosts, the model of a rat, and the nude figure of a man roughly carved from the branches of a tree. I inquired carefully as to the beliefs or religion of the Akkas, but could get no information beyond the string of legends about good and evil spirits common to most of the races in Asia; even these would have been interesting, but that no two people could relate them alike.

At Nang No, as elsewhere, the Akka women work hard in the fields and at home; but the men have acquired a facility for loafing foreign to the natives of poorer districts, and which must be put down to the pernicious influence of wealth. The altitude of Nang No is 5800 feet above sea-level, and we climbed another 300 feet before commencing the trying descent into the Kiang Hung plain, where we arrived at mid-day. In the afternoon we passed Kasai, the residence of the prince, who is constantly surrounded by a numerous body-guard of men drawn by conscription from the villages in the plain. The people were in a very excited state. It was rumoured that the powerful Meng Che Tussu intended to come and attack them; the prince had also received news that the Tao-tai was going to pay him a visit on his return to Pu Erh from the frontier. We stopped for the night at Katlang-kai, near the Mekong. After the freshness of higher levels, we found it unpleasantly warm in the plain, which lies at an altitude of 2200 feet above the sea only—the lowest point of our

A SHAN TEMPLE AT CHEN LE-PA.

journey. Next day we ferried the Mekong, and, crossing the dividing range, slept at Man Hoko in the plains of Hsiao Meng-yang. The inhabitants are "Hua Yao Pa-i," a Shan tribe which I have already described; and I purchased without difficulty another of their costumes, trimmed with silver and elaborately embroidered.

The hills around Hsiao Meng-yang are covered with virgin forest, the haunt of wild beasts—the elephant, tiger, panther, wild buffalo, bear, and pig, and feathered game in great variety. Fifty li to the north-east of the plain is the tea-district and former city of Yulo, now an unimportant village mentioned in old Chinese chronicles dealing with South-West Yun-nan.

Leaving Man Ho-ko, we were undecided whether to travel slowly and camp out for the night, or push on to the next village, 90 li distant; but an adventure which befell us whilst we were at our mid-day meal obliged us to adopt the former plan. We had travelled during the morning through thick woods, following up the sinuous course of a small stream. There were no houses of any description along or near the road, and the only human beings we met were six Shans. We stopped at noon in a suitable spot, and as usual the horses were turned loose to graze, whilst the muleteers and men prepared their rice. Presently we heard one of the horses neighing, and, as they were generally too hungry to make a noise, one of the muleteers went to see the cause. To be brief, six of our animals had been stolen by the Shans we met the same morning. They had followed us, seized their opportunity and six of our horses, and were on their way back to Hsiao Meng Yang. Fortunately my men were all strong, active fellows, and, picking up their weapons, they were soon in full pursuit. At first I disliked leaving the baggage unprotected, but I eventually joined in the chase. It was long and discomforting; but the nature of the ground aided us, whilst it prevented the tired horses from going very fast, and my men at last overtook the thieves. The fighting was mostly over by the time I arrived, for the Shans were no match for our muscular Mohammedans, and after receiving a few hard knocks they cleared off into the bush before our firearms were brought into play, though the soldier in his zeal sent two charges of small shot after them from my gun. However, there were no casualties, and, having recaptured the horses, we returned perspiring but triumphant to our interrupted repast. The thieves belonged to the local class, who, though very cunning, are as a rule not courageous enough to be really dangerous.

In the afternoon we let off a dynamite cartridge, purchased at Meng Lien, in a deep pool near the road, and obtained about 10 lbs. weight of delicious fish. We camped out in an open space, first destroying the long grass all around, and then lighting four big fires to keep off predatory wild beasts. We were still at a low altitude, and a thick mist enveloped us from sunset until after sunrise the following morning. From our camp we ascended, and found ourselves once more amongst Chinese villages, and next day arrived at Pu Teng, the capital of the Shan state of that name. The town lies, as usual, in a long low plain (altitude 3000 feet), watered by the Ta Keng, a tributary of the Nam Ban river.

The distance from Pu Teng to Semao is 110 li, two short stages over hilly country, but a person unencumbered can cover it easily in one day; so, leaving my caravan to follow on slowly, I started from Pu Teng shortly after sunrise, and arrived back at Semao in the afternoon, after an absence of thirty-three days. Except the little mishaps which I have mentioned, we met with no trouble or sickness *en route*. The trip was an enjoyable one, and the results will most probably be on view to visitors to the Chinese Court of the Paris Exhibition, 1900.

Before the reading of the paper, Admiral Sir W. J. L. Wharton (Vice-President) said: I will call upon Mr. Warington Smyth to read the paper we are going to hear this evening. Mr. Carey is unfortunately not here, being still in China, and we are very much obliged to Mr. Smyth for reading his paper. Mr. Smyth has been in the southern parts of the Shan States, and will therefore be able to read the paper with sympathy. Mr. Carey is an officer in the Chinese Customs, stationed in the western part of Yunnan amongst the Shans; and the paper describes expeditions made from his centre at Semao to the westward, over the Mekong, and into British territory over the Burmese frontier.

After the reading of the paper, the following discussion took place:—

Lord Lamington: I think I may safely say that the paper gives a very close and succinct description of the northern portion of the Shan States. Many of the scenes depicted remind me very forcibly of my own experiences when I once went through the southern portion of the Shan States. Of course the chief interest at that time was political, as to the possible destination of the states, to which of the great Powers they would belong, but that is not a point to be touched on here. From the density of the population, it is to be supposed that they are very fertile, and could be rendered more so under different conditions; the time is coming when we shall see some European power in control of that portion of Yunnan. Travel is certainly at times very trying, and I remember well, after the rains, how excessively difficult it was to surmount the continual hills that lie in the way; they become so greasy as to be impracticable, until the sun comes out strong enough to dry up this greasy mud. I also remember the instrument used to thrash out the paddy which was described in the paper; it is rather ingenious and very simple. The water falls into a hollow log, and as it empties, the pestle falls on to the grain, removing the husk. I have no other remarks to make on the paper. I am very glad to hear again of these regions, for I was able to spend a very happy portion of my life travelling there, and I think we all owe a debt of gratitude to Mr. Carey for his having compiled his experiences for our benefit.

Major A. C. Yate: In the autumn of 1887 I was serving in Burma, and was instructed to proceed to Mandalay, and report myself there to the Intelligence division. On arrival I was told I should either have to go to Bangkok and travel northwards to explore the country, or join one of two Shan expeditions about to annex the territory between the Mandalay and Salwin rivers. Ultimately, I went with the northern Shan expedition under Major (now Colonel) Yates, R.A. The southern column was under Colonel Swetenham. We took, more or less, the route now followed by that railway to the Kunlon ferry on the Salween that many people think will end on the Yangtse Kiang. We crossed the great Gokteik defile, one of the most difficult points on the projected line, several hundred feet deep, and very difficult for engineers to negotiate. They have, however, negotiated it, and are now putting a bridge over it. Thence we went to Thibaw, where we were entertained by the well-known Tsawbwa. In his own territory he had been accustomed to regard the life of his subjects as of little importance. During a visit to Rangoon some twenty to thirty years ago, he had two or three of his men put to death, thereby bringing himself within the reach of British law. However, he received timely warning to clear out, which he did; and I have understood that his gratitude to the British Government for not interfering with his prerogative is one reason for the friendly attitude which he has always adopted.

Some of the tribes through whose territory we marched gave us trouble, but as we had strict injunctions not to fight if we could avoid it—we had 150 men and two guns—we tried the pacific policy as far as possible, although at Theinni the Tsawbwa, who had approached the Chinese with a view to obtaining their aid in checking us, only sent in his submission when we were within a few miles of his chief town. From Theinni we went about 150 miles to the Kunlon ferry on the Salween. The road had fallen into complete disuse. The pictures which I have just seen on the screen reminded me of many things I saw and heard of there. As intelligence officer I had to find out what I could, and any one who has been amongst Shans will understand the difficulty of getting intelligence out of them. I made careful note of the Salwin suspension bridges, however, from their descriptions, and I now see that what they told me was correct.

Having reached Kunlon, we had done our duty, and having annexed from 10,000 to 15,000 square miles of territory, we returned to Mandalay. As we marched in, Sir George White came out to meet us. The British part of the escort consisted of fifty Munster Fusiliers, and never did men look fitter than they did, after their three months' hard work. That, very briefly, is how we annexed the territory between Burma and the Salween. It was done almost unnoticed.

Mr. Warington Smyth: I feel that one duty I have to do is to explain shortly the nature of these innumerable tribes. Mr. Carey, in his most interesting paper, mentions a great many names, which must have left you in a mixed condition as regards the tribes mentioned; for practical purposes there are two main divisions—the first the Ka, who call themselves Woni, such as the Akka people and several other very primitive tribes, who are practically the aborigines of the country; and, secondly, the Shans, who are called by the Chinese Pa I, and who call themselves Tai. They are found all over Indo-China from 7° to 28° N. lat., even to the headwaters of the Irrawaddy valley. Many of these have been described by Mr. McCarthy, the late General Woodthorpe, who is missed so much all round the Indian frontier, Mr. J. G. Scott, and other travellers who are mostly unfortunately unable to be present this evening, or we might have heard more of this, to my mind, most fascinating country.

Mr. Carey remarks on the extraordinary credulity of these people with regard to talismans. I obtained one once from the head of a monastery, a very valuable little piece of wood, which defends me from falling trees and sword-cuts. I tried to get one to protect me from motors and bicycles, but he was unable to supply the want. I will not detain you longer, but will give you on the Lao mouth-organ a short piece of music played by the Siamese Shans in the valley of the Me Kong.

Sir W. J. L. Wharton: I am sure we shall all agree that, whatever else the Shans may not have done, they have obtained a certain proficiency in musical instruments. For savage instruments, the tune just played us by Mr. Warington Smyth had a most pleasant tone.

The paper we have just heard is a little difficult to follow with the maps we have here, because to look at the map you would think this a plain country, whereas it is a mountainous one, the mountains running down in long ridges parallel to the valleys. It is necessary to realize that what we have gone through is very mountainous country, interspersed with valleys and fertile areas of tea cultivation. It is an interesting country that created some stir a little time ago, when Major Yate told us it was doubtful where the boundary would be drawn, and it may still possibly come to the front some day. This will be a very valuable record in the Society's *Journal*, as it contains very many points of interest; and I am sure the meeting will agree with me in communicating to Mr. Carey our obligations for his having written and sent this paper to us.

COLONEL DURAND'S 'THE MAKING OF A FRONTIER.'*

In this book Colonel "Algy" Durand has given a most charming account of his stewardship as warden of the Gilgit frontier for about five years subsequent to the establishment of the Gilgit agency in March, 1889.

No stranger country exists in all Asia than this borderland of mingled magnificence and horror—a land of magnificent mountains seamed with unmeasured glaciers, overshadowing valleys as beautiful as any in Kashmir; valleys whose sweet loveliness warms the author to enthusiastic description, and which are well illustrated by some admirable photographs in the pages of his book. Colonel Durand traversed the country with the eye of an artist, no less than that of a soldier; and as he possesses the gift of an attractive style in writing and a power of vivid description, his book is interesting from beginning to end.

But his administrative duties demanded much more of him than devotion to the picturesque aspects of nature, or to the interests of sport, and his story of the ghastly nature of those political revolutions which occur periodically in the ungoverned wilderness which lies beyond the Gilgit border, is a revelation of the extraordinary mixture of bloodthirsty ferocity and inconsequent light heartedness which still animates the unredeemed portion of Asiatic humanity.

"Half monkey and half tiger" is Durand's estimate of Chitráli character. A Chitráli, or Kanjuti, chief will sell his own people into slavery; he will murder all his nearest relations with ruthless ferocity; he will face death (when he must) with dignity and pluck; and he will (at least the Chitráli will) charm a European visitor by his frank, cordial good nature, and his fascinating manners. The "monkey" is usually predominant; but no tiger that ever lived can equal his deliberate, murderous bloodthirstiness when he has accounts to square with his own familiar friends and family.

Opinions may possibly differ as to the practical political or military gain of such advanced positions as Chitrál, but there can be little doubt about the moral responsibility of a government that might extend its hand, and yet would leave such a country to stew in its own seething cauldron of misrule.

In 1888 there were already gathered together thousands of Kashmir

* 'The Making of a Frontier.' By A. G. Durand. London: Murray. 1899.

soldiers, with little discipline and with most inadequate military arrangements made for their welfare, prepared to enforce the rule of Kashmir in those border districts which had been conquered or annexed by the Sikhs, but which had broken loose from Dogra ascendency. For the time being peace was patched up; but such patchwork never lasts long on the frontier; and it fell to Durand in 1891 to reassert the rights of Kashmir in Hunza. This story he does not tell; it has been already well told by Knight; but he does tell of those proceedings which led to our occupation of Chilas, and this part of his book is sufficiently instructive. It illustrates forcibly the difficulty of drawing a line when once a frontier is overstepped, and we begin to meddle with "the tribes."

Colonel Durand's suggestion that in 1888 (this was before the inauguration of Imperial service in the native states) a thousand Cossacks might have made their way to Srinagar to the astonishment of the peaceful inhabitants of the Kashmir valley, is rather startling to any one who has digested his description of the nature of trans-Gilgit frontier roads. We know now that fifty good fighting men could certainly hold such roads; and it is hardly credible that Sikhs, Gurkhas, and Dogras were reduced to a condition of such utter imbecility by bad management as to have rendered it impossible to maintain a defensive position in such a country against such a force.

T. H. H.

THE OCEANOGRAPHICAL AND METEOROLOGICAL WORK OF THE GERMAN "VALDIVIA" EXPEDITION.*

By Dr. G. SCHOTT, Deutsche Seewarte, Hamburg.

[Abstract of a paper read at the British Association for the Advancement of Science, Dover, September 16, 1899.]

I CONSIDER it a great honour to give an account of the *Valdivia* expedition in this assembly, especially under the presidency of your chief authority on oceanography, Sir John Murray.

England has a considerable interest in our German deep-sea expedition;

* The *Geographical Journal* has given several notices of this expedition—in vol. xii. p. 494, on the ship and the scientific staff; p. 569, on the voyage from Hamburg to Granton and Canary islands; in vol. xiii. p. 297, on the rediscovery of Bouvet island; on p. 336 will be found a chart showing the track of the *Valdivia* in the Southern ocean along the ice-boundary, and also the deep-sea soundings; and finally, p. 640, an extensive summary of the scientific work, also of the zoological investigations, of the whole voyage between Cape Town and Sumatra. We give here some concluding remarks relating to the above-named inquiries.

some important items of our equipment were made in England, and the leader of the expedition, Prof. Chun of Leipzig, has pointed out on several occasions how valuable the advice of Sir John Murray has been to him. Moreover, in the summer of 1898, when the *Valdivia* was starting on her voyage, she anchored at Granton, and all the members of the expedition enjoyed on this occasion the hospitality of the scientific men of Edinburgh; and on her return, in April, 1899, the *Valdivia* anchored here just outside Dover for a day. I did not then think that I should six months later be in this very place to give an account of the oceanographical and meteorological observations which had been made under my care.

1. Soundings.

At most of those stations where important oceanographical or zoological work was to be done, the depth of the sea had first to be sounded. Even where, according to the charts, the depth of the sea was known more or less accurately, we had first to sound, to ascertain the nature of the bottom before the nets were let down, and also to guard against surprises. Especially in recent years local shallows have been found in the deepest regions, banks of only 300 fathoms or less. For example, on October 17, 1898, we were in the South Atlantic, between Great Fish bay and Cape Town. The charts led us to expect at least 2500 fathoms, so we confidently let the great vertical net down to 800 fathoms; however, it came up full of foraminiferal sand, showing that it had been on the ground. Soundings on the spot showed a depth of about 500 fathoms, but the following day we obtained nearly 2800 fathoms, the area of the discovered submarine bank being therefore doubtless very small.

It is unnecessary in this country, which by its surveying ships and cable steamers has taken many thousand deep-sea soundings in all the oceans, both by hemp line and by steel wire, to give a description of the methods of deep-sea sounding. I need only mention that we had two sounding-machines, a French apparatus by Le Blanc, used by the *Belgica* and other ships, which, however, did not prove satisfactory in a rough sea, and needs alteration; and an American machine on the Sigsbee principle. The latter worked excellently; we have sounded with good results even in a whole gale. There were some new features, notably an electro-motor, which wound up the wire with quietness and certainty, and is much to be preferred to the steam-engine. In polar regions, especially where steam-pipes are liable to freeze, electric power seems the best; we made use of it for the first time for this purpose.

The piano-wire employed on our sounding-machines was of German manufacture, and of marvellous strength; several times we unintentionally brought the iron 60-lb. weight up again to the surface from depths of about 3000 fathoms in a heavy sea without breaking the wire. In the latter part of the voyage the Sigsbee machine was the most frequently used, and during the whole nine months we only lost 20 fathoms of wire, and that really through want of attention.

Most of the new deep-sea soundings were obtained on the route Cape Town—Bouvet island—ice-limit—Kerguelen, where our expectations were exceeded first as regards the possibility of working. On account of the prevailing stormy weather in the higher degrees of southern latitude, we did not expect to make a great many soundings; nevertheless we managed to sound forty times on this route in deep water where scarcely a single sounding existed before. The results were rather surprising.

We went from Cape Town towards the south quite sure of encountering lessening depths, and of being able to dredge beyond 50° S. lat. in a depth of 1000 to 1500 fathoms, or even less than 1000 fathoms. We discussed this subject every day, so much has been written about the antarctic plateau, and even the Crozet islands, Prince Edward island, and Kerguelen have been considered outposts of this shallow sea. However, the result proved to be contrary to our anticipation; already between Cape Town and Bouvet we found sometimes more than 2500 fathoms and a very irregular bottom (even up to 1480 fathoms), whereas Bouvet island is placed on a large base of little more than about 1500 fathoms. But as we went on towards the south-east, we met with a succession of surprises during the entire course through the ice. With the exception of two soundings of nearly 2200 fathoms, we got always, up to Enderby land, depths of more than 2500 fathoms, and often more than 3000 fathoms (greatest depth, 5733 metres = 3135 fathoms, in 58° S. lat. and 38° E. long.).

When going northward from Enderby land to Kerguelen, we found an increasing depth—more than 1000 fathoms, more than 1500 fathoms, and sometimes more than 2000 fathoms, and on one spot, where we were obliged to break off, more than 2300 fathoms. As between Cape Town and Bouvet, we found a very irregular bottom; and it is remarkable that the shallow sea between Kerguelen and McDonald island and Heard island, which was investigated by H.M.S. *Challenger*, has a very steep slope down to the antarctic basin.

We may conclude that at least between 0° and 50° E. long., southward from lat. 55° or 56° S., there is a fairly regular and very deep antarctic depression, with no suggestion of a plateau.

It is hardly necessary to point out the geographical or geophysical importance of the new soundings, but I may remark that the mean depth of the south polar sea must be somewhat greater than has hitherto been supposed. In 1896 Dr. Karstens estimated the mean depth at 800 fathoms, which is much too little. There is the same difference as in the case of the arctic basin, where, as we know from Nansen, the depths are greater than they were thought to be.

The voyage from St. Paul and Amsterdam towards the north to Padang resulted in much that is interesting. By keeping our route to the east, we went just between the soundings of the *Gazelle* (1875) and of the *Egeria* (1887). Here our soundings gave varying results compared with those of further south; there deeper than we expected, here shallower. For instance, in 30° S. lat., 88° E. long., instead of 2700 fathoms as expected, we got only about 1100 fathoms.

The great depths of the eastern part of the Indian ocean do not reach so far to the south-west as we believed. We found between the Maldive and Chagos islands much smaller depths than we expected; further, we explored the most interesting inland sea between the Nias islands and the west coast of Sumatra, and sounded nearly all the passages; then we examined the slope of the ground at the northern part of west Sumatra by a series of soundings, which, at a distance of 60 sea miles from the land, showed over 2800 fathoms; and, lastly, the slope on the south-west edge of the Agulhas bank down to the deep sea has been examined.

The following table contains all our deep-sea soundings except those between Cape Town—Bouvet—Kerguelen, which are published in this *Journal*, vol. xiii. p. 647:—

LIST OF THE DEEP-SEA SOUNDINGS OF THE "VALDIVIA" EXPEDITION, 1898-99, IN THE ATLANTIC AND INDIAN OCEANS.

N.B.—For the soundings in the Antarctic ocean, see vol. xiii. p. 647.

Station. No.	Date. 1898.	Latitude.	Longitude.	Depth. Fathoms.	Bottom temperature. Degrees Fahr.	
			Hamburg—Cameroons.			
		N.	W.			
4	Aug. 6	60° 42′·0	3° 10′·8	266	42·7	
6	„ 7	60° 40′·0	5° 35′·5	356	—	
7	„ 7	60° 37′·0	5° 42′·0	322	35·3	
8	„ 8	59° 54′·0	8° 7′·0	299	47·2	
10	„ 8	59° 37′·0	8° 50′·0	725	41·8	
11	„ 9	58° 36′·6	11° 33′·0	957	38·7	
17	„ 17	36° 53′·4	14° 13′·0	972	43·9	
18	„ 17	36° 48′·0	14° 10′·1	86	—	? } Sounding not exact.
18A	„ 17	36° 48′·0	14° 10′·0	290	—	? }
19	„ 17	36° 41′·2	14° 8′·4	187	—	
20	„ 17	36° 40′·1	14° 8′·0	+574	—	No bottom.
21	„ 18	33° 48′·9	14° 21′·5	106	—	} Seine bank.
23	„ 18	33° 47′·5	14° 17′·5	527	—	}
24	„ 18	33° 47′·0	14° 20′·7	92	—	}
29	„ 24	26° 12′·9	14° 53′·4	173	56·9	} Off Cape Bojador.
30	„ 24	26° 6′·1	15° 10′·1	191	58·3	}
31	„ 24	26° 5′·5	15° 18′·1	267	52·2	}
32	„ 25	24° 43′·4	17° 1′·3	1356	38·3	
37	„ 29	16° 14′·1	22° 38′·3	926	38·7	Near Bonavista, C.V.
40	„ 31	12° 38′·3	20° 14′·9	2620	—	
41	Sept. 2	8° 58′·0	16° 27′·9	964	36·4	
45	„ 5	2° 56′·4	11° 40′·5	2729	32·8	
		S.				
48	„ 7	9° 3′·0	8° 29′·5	3114	35·5	
		N.				
53	„ 10	1° 14′·2	2° 10′·0	1941	—	
			E.			
55	„ 12	2° 36′·5	3° 27′·5	1921	36·4	
56	„ 13	3° 10′·0	5° 28′·0	1246	38·0	
58	„ 14	3° 31′·0	7° 25′·0	388	41·6	
			Cameroons—Cape Town.			
63	„ 26	2° 0′·0	8° 4′·3	1364	36·7	
		S.				
67	„ 30	5° 6′·2	9° 58′·6	1660	37·1	
68	Oct. 1	5° 47′·4	11° 30′·8	117	—	Congo.
72	„ 6	7° 46′·8	11° 8′·1	1278	—	
75	„ 10	16° 24′·8	11° 8′·9	1217	—	
83	„ 17	25° 25′·3	6° 12′·4	536	38·0	} A submarine bank in mid-ocean, South Atlantic.
84	„ 17	25° 27′·0	6° 8′·2	512	38·3	}
85	„ 18	26° 49′·2	5° 54′·0	2756	33·5	
87	„ 20	30° 34′·9	6° 10′·2	2793	34·0	
89	„ 22	31° 21′·1	9° 45′·9	2889	33·7	
90	„ 25	33° 20′·3	15° 58′·2	1751	36·0	
91	„ 25	33° 23′·4	16° 19′·4	1460	—	
92	„ 26	33° 41′·2	18° 0′·3	97	—	Near Cape Town.
			Cape Town—Agulhas Bank—Cape Town.			
		S.	E.			
97	„ 27	35° 2′·0	20° 7′·0	57	56·5	
102	Nov. 1	34° 31′·2	26° 0′·2	1055	39·1	
103	„ 2	35° 10′·5	23° 2′·0	273	46·1	

Station No.	Date. 1898.		Latitude.	Longitude.	Depth. Fathoms.	Bottom temperature. Degrees Fahr.	
			S.	E.			
105	Nov.	3	35° 29′·0	21° 2′·5	56	57·4	
110	„	4	35° 9′·0	18° 32′·8	308	42·3	
111	„	4	35° 16′·2	18° 26′·7	829	36·4	
112	„	4	35° 32′·8	18° 20′·1	1504	36·0	
113	„	5	34° 33′·3	18° 21′·2	174	44·8	

Cape Town—Bouvet Island—Kerguelen.
(See *Geographical Journal*, vol. xiii. p. 647.)

Kerguelen—Padang.

Station No.	Date.		Latitude.	Longitude.	Depth. Fathoms.	Bottom temperature. Degrees Fahr.	
	1899.		S.	E.			
168	Jan.	5	36° 14′·3	78° 45′·5	1320	35·8	
169	„	6	34° 13′·6	80° 30′·9	1700	35·1	
170	„	7	32° 53′·9	83° 1′·6	1940	34·6	
171	„	8	31° 46′·4	84° 55′·7	1919	34·6	
172	„	9	30° 6′·7	87° 50′·4	1131	36·4	
173	„	10	29° 6′·2	89° 39′·0	2059	34·0	
174	„	11	27° 58′·1	91° 40′·2	2475	34·0	
175	„	12	26° 3′·6	93° 43′·7	2575	34·2	
176	„	13	24° 0′·3	95° 7′·7	2933	32·6	
177	„	14	21° 14′·2	96° 9′·6	2752	34·2	
178	„	15	18° 17′·6	96° 19′·8	3232	—	
179	„	16	15° 8′·1	96° 20′·3	3190	34·4	
181	„	17	12° 6′·8	96° 44′·4	1178	—	Ross island (Cocos) bearing E.S.E. 4 sea miles.
183	„	19	8° 14′·0	98° 21′·6	2870	—	
184	„	20	6° 54′·1	99° 27′·5	2670	34·0	
185	„	21	3° 41′·3	100° 59′·5	336	47·7	
186	„	21	3° 22′·1	101° 11′·5	494	43·9	Between the Nias islands and the west coast of Sumatra.
187	„	22	2° 11′·8	100° 27′·1	914	42·7	

Padang—Colombo.

Station No.	Date.		Latitude.	Longitude.	Depth. Fathoms.	Bottom temperature. Degrees Fahr.	
			S.	E.			
189	„	30	0° 57′·5	99° 51′·1	420	45·2	
190	„	30	0° 58′·2	99° 43′·2	700	42·7	
191	„	31	0° 39′·2	98° 52′·3	410	44·8	
192	„	31	0° 43′·2	98° 33′·8	203	51·8	Siberut channel. In the German lists the longitude must be corrected.
			N.				
193	Feb.	1	0° 30′·2	97° 59′·7	72	74·8	
194	„	1	0° 15′·2	98° 8′·8	336	50·4	Pulo Nias bearing north.
195	„	1	0° 30′·5	98° 14′·2	325	50·6	
196	„	1	0° 27′·3	98° 7′·4	353	—	
197	„	2	0° 23′·0	97° 57′·0	146	—	
198	„	2	0° 16′·5	98° 7′·5	370	—	
199	„	2	0° 15′·5	98° 4′·0	257	50·6	
200	„	3	0° 46′·2	96° 23′·2	2851	34·2	
201	„	3	1° 13′·7	96° 43′·8	1710	35·5	
202	„	4	1° 48′·1	97° 6′·0	77	60·8	
203	„	4	1° 47′·1	96° 58′·7	361	48·4	Bangkaru bearing north.
204	„	4	1° 52′·3	97° 1′·6	46	80·6	
205	„	4	1° 48′·9	96° 53′·0	625	43·0	
206	„	5	2° 12′·3	95° 41′·3	817	40·0	
207	„	6	5° 23′·2	94° 48′·1	560	—	
208	„	7	6° 54′·0	93° 28′·8	162	52·6	
209	„	7	6° 56′·3	93° 32′·7	198	50·6	Great Nicobar bearing N.E.
210	„	7	6° 53′·1	93° 33′·5	411	46·8	
211	„	8	7° 48′·8	93° 7′·6	440	44·8	West entrance of Sombrero channel.

Station No.	Date. 1899.	Latitude.	Longitude.	Depth. Fathoms.	Bottom temperature. Degrees Fahr.	
		N.	E.			
212	Feb. 8	7° 49'·1	93° 10'·5	165	52·0	Kachal bearing N.E.
213	" 9	7° 57'·9	91° 47'·2	2173	34·2	
214	" 10	7° 43'·2	88° 44'·9	2019	34·2	
			Colombo—Chagos Islands—Seychelle Islands—Dar-es-Salaam.			
216	Feb. 16	6° 59'·1	79° 31'·7	714	41·0	
217	" 17	4° 56'·0	78° 15'·3	2436	—	
218	" 18	2° 29'·9	76° 47'·0	2260	34·6	
		S.				
219	" 20	0° 2'·3	73° 24'·0	1232	36·2	Equatorial channel.
220	" 21	1° 57'·0	73° 19'·1	1596	35·3	
221	" 22	4° 5'·3	73° 24'·8	1600	35·3	
222	" 22	4° 31'·0	73° 19'·7	1380	35·8	
223	" 23	6° 19'·3	73° 18'·9	1857	35·1	
225	" 26	6° 38'·5	70° 58'·1	1163	36·4	
226	" 27	4° 5'·8	70° 1'·9	2258	34·6	
227	" 28	2° 56'·6	67° 59'·0	1500	35·6	
228	Mar. 1	2° 38'·7	65° 59'·2	1895	35·3	
229	" 2	2° 38'·9	63° 37'·9	2515	35·3	
235	" 9	4° 34'·8	53° 42'·8	1300	35·8	
237	" 11	4° 45'·0	48° 58'·6	2773	34·2	
240	" 14	6° 12'·9	41° 17'·3	1618	35·6	
242	" 20	6° 34'·8	39° 35'·5	221	52·0	
			Dar-es-Salaam—Aden.			
245	" 22	5° 27'·9	39° 18'·8	253	50·0	Zanzibar channel.
246	" 22	5° 24'·0	39° 19'·8	447	46·4	Pemba channel.
247	" 23	3° 38'·8	40° 16'·0	472	45·0	
248	" 23	3° 17'·3	40° 42'·7	228	52·7	
249	" 23	3° 7'·0	40° 45'·8	409	47·2	
250	" 24	1° 47'·8	41° 58'·8	912	38·9	
251	" 24	1° 40'·6	41° 47'·1	379	48·2	
252	" 25	0° 24'·5	42° 49'·4	557	—	
253	" 25	0° 27'·4	42° 47'·3	349	49·3	
254	" 25	0° 29'·3	42° 47'·6	534	46·4	
		N.				
256	" 27	1° 49'·0	45° 29'·5	620	45·7	
257	" 27	1° 48'·2	45° 42'·5	899	40·3	
258	" 28	2° 58'·5	46° 50'·8	745	42·8	
259	" 28	2° 58'·8	47° 6'·1	705	43·4	
260	" 29	4° 33'·5	48° 23'·1	165	59·0	
261	" 29	4° 36'·1	48° 37'·6	663	44·1	
262	" 29	4° 40'·8	48° 39'·6	679	43·9	
263	" 29	4° 41'·9	48° 38'·9	450	—	
264	" 30	6° 18'·8	49° 32'·5	590	46·8	
265	" 30	6° 24'·1	49° 31'·6	343	50·0	
266	" 30	6° 44'·2	49° 43'·8	405	48·6	
268	April 1	9° 6'·1	53° 41'·2	2769	34·2	
270	" 4	13° 1'·0	47° 10'·9	1006	38·7	Gulf of Aden.
271	" 4	13° 2'·8	46° 41'·6	803	43·0	

2. Deep-sea Temperatures.

The measurements of deep-sea temperature and the chemical analyses of the sea-water were placed in the second rank of importance in the work of the expedition. We employed principally the English deep-sea thermometers of Negretti and Zambra, —first the reversing thermometers, which, after a little alteration, we used with success in the antarctic water, where they are indeed indispensable; then we used index-thermometers of the double-tube principle. Besides, we had some good Casella instruments. The trials of an electrical thermometer supplied by Siemens Brothers proved extremely interesting. In this instrument the variations with temperature of a platinum spiral are observed by means of a Wheatstone bridge, using the zero method, and hence we have a measure of variations of the deep-sea temperature. We had only 400 fathoms of cable, and, owing to some technical defects, the instrument was not employed to any great extent; however, these defects can be remedied, and then, as far as we have ascertained, the instrument will probably give excellent results. There remains, it is true, an inevitable disadvantage—that is, the size of the cable, which is about half an inch in diameter, and even in a weak current is deflected in uncertain angles, so that without a manometer the true depth of the spiral cannot be ascertained. But amongst the ice, especially near a south polar winter station, wherever small but important differences of temperature in the deep water are to be expected, and there is no current, I should think such an apparatus most valuable.

We have made complete serial temperature observations from surface to bottom at fifty-nine stations; twenty-one series in the northern and southern Indian ocean alone.

As it is impossible here to discuss at length results which are different for the different parts of the oceans, I may be allowed to give only a few series of deep-sea temperatures taken by the *Valdivia* in the various regions and currents.

The observations at the ice-limit are most interesting, as giving a typical polar temperature series. We have from the surface to 50 fathoms very cold water (29° or 30° Fahr.), the water of the melting ice; then follows a layer of warm water (32° to 35° Fahr.), down to about 1000 fathoms; and lastly, towards the bottom, again temperatures under 32° Fahr., but not so cold as the surface layer. Further, we have in the western part of our antarctic voyage, near Bouvet island, somewhat lower temperatures than in the eastern part, in the vicinity of Enderby land, showing that Bouvet island has, in spite of its relatively lower latitude, a pronounced antarctic character, whereas near Enderby land warming influences seem to prevail. The importance of these temperatures is obvious; the existence of a layer of relatively warm water more than 1000 fathoms in thickness is extraordinary, especially if in 60° S. lat. you still find a temperature of 35° Fahr. at a depth of nearly 1000 fathoms. The big icebergs all dip into this layer of temperatures above 32° Fahr., and these facts may also suggest important conclusions in interpreting the results of some of the plankton observations and the catches with the closing nets.

The greater salinity in the warm layer accounts for the fact that this distribution of temperatures (disregarding vertical currents, which would effect a compensation) is stable. The well-known series of temperatures observed by the *Challenger* in the south of Kerguelen towards the ice-limit has not been found by us, perhaps because the *Valdivia* was not far enough to the east, or because we were in the ice at another season (November and December). On the whole there is a resemblance in the temperatures found by the *Challenger* and *Valdivia*, since we have also found a minimum of temperature at a depth of about 50 fathoms, but our surface water was much colder, and our warm layer much warmer, than that of the *Challenger*.

At any rate, it is important, in view of antarctic exploration, to point out that in the longitude of Kerguelen, before Enderby land and close to the pack-ice, we have found higher temperatures of the water than anywhere else on the entire ice-route, higher even than the *Challenger* observed further to the east, and this is one reason why the German antarctic expedition of 1901 will attempt to go south in the longitudes of Kerguelen.

Fathoms.	Station No. 6. Date. Aug. 7, 1898. Lat. 60° 40′ N. Long. 5° 36′ W.	Station No. 135. Date. Dec. 2, 1898. Lat. 56° 30′ S. Long. 14° 29′ E.	Station No. 26. Date. Aug. 19, 1898. Lat. 31° 59′ N. Long. 15° 5′ W.	Station No. 90. Date. Oct. 25, 1898. Lat. 33° 20′ S. Long. 15° 58′ S.	Station No. 169. Date. Jan. 5, 1899. Lat. 36° 14′ S. Long. 78° 46′ E.	Station No. 41. Date. Sept. 2, 1898. Lat. 8° 58′ N. Long. 16° 28′ W.	Station No. 221. Date. Feb. 22, 1899. Lat. 4° 5′ S. Long. 75° 25′ E.	Stations No. 73, 74. Date. Oct. 7, 8, 1898. Lat. 10° S. Long. 10° E.	Stations No. 179, 180. Date. Jan. 16, 17, 1899. Lat. c. 15° S. Long. c. 96° E.	Fathoms.
	North of Wyville Thomson ridge.	Near Bouvet Island.	Near Madeira, North Atlantic.	Benguela current, South Atlantic.	Near New Amsterdam, South Indian Ocean.	Countercurrent (West monsoon).		South equatorial current (south-east trade).		
						Atlantic Ocean.	Indian Ocean.	Atlantic Ocean.	Indian Ocean.	
	Polar region.		Temperate zone.			In the tropics.				
	Degrees Fahrenheit.									
0	49·7	29·3	71·1	61·4	63·5	79·9	81·5	72·4	81·4	0
10	—	29·2	—	—	—	—	—	—	—	10
20	48·8	29·1	70·6	60·5	60·3	65·0	79·7	61·9	80·8	20
30	—	29·1	—	—	—	—	—	—	—	30
40	47·2	29·2	63·9	58·5	57·2	63·0	71·6	58·1	78·7	40
50	—	29·2	—	—	—	—	—	—	—	50
60	46·1	29·6	62·1	56·2	55·3	57·2	68·0	57·6	77·0	60
70	—	31·0	—	—	—	—	—	—	—	70
80	45·7	31·1	60·7	55·3	54·9	55·4	64·1	56·9	75·4	80
90	—	31·5	—	—	—	—	—	—	—	90
100	45·7	32·6	60·1	54·2	54·5	54·2	58·3	55·8	73·8	100
150	45·2	33·0	57·8	51·8	54·2	52·4	52·7	52·7	58·7	150
200	40·9	33·1	56·3	49·0	53·1	50·0	51·8	49·0	52·9	200
300	32·0	33·1	53·8	44·8	51·8	46·6	48·6	43·7	47·7	300
400	—	33·3	51·3	41·9	47·9	42·8	45·9	40·9	45·0	400
500	—	33·4	50·0	39·1	42·7	41·0	44·3	39·8	42·8	500
600	—	33·4	49·7	—	39·6	40·1	41·9	39·4	41·0	600
700	—	32·9	48·6	—	38·2	39·6	40·7	39·2	39·6	700
800	—	32·3	47·9	—	37·8	38·5	39·6	39·1	38·2	800
900	—	32·0	45·4	—	37·4	47·1	38·7	—	37·6	900
1000	—	31·8	42·8	—	37·1	—	37·4	—	37·1	1000
1500	—	31·6	—	—	—	—	35·6	—	35·6	1500
Depth in fathoms	—	2785	—	1751	1320	964	1600	—	3190	Depth in fathoms
Bottom temp.	—	30·9	—	36·0	35·8	36·4	35·3	—	34·4	Bottom temp.

3. Antarctic Ice.

Now I may give a short description of the state of the ice observed by the *Valdivia* in November and December, 1898.

The ice between Bouvet island and Enderby land in those latitudes was observed outside the usual routes for the first time for many years. The extraordinarily strong drift of the ice and icebergs which took place from 1892 to 1897 in the South Atlantic and in the Indian ocean, had just ceased. It is most likely that we met with relatively favourable ice-conditions, because during the last few years an unusual amount had drifted northward. We saw about one hundred and eighty bergs of different sizes; their exact positions were recorded, and their approximate dimensions measured or estimated; a good many icebergs were sketched, a still greater number photographed.

The *Valdivia* remained nearly four weeks in the ice, although she was not built of wood, had only one screw, and was not rigged for sailing.

The first iceberg was sighted shortly before Bouvet island on November 25. We met with the first drift-ice on November 30, the temperature of the water being 29° Fahr. Whenever icebergs occurred, as a rule drift-ice, often in wide irregular fields, appeared; this consisted of pieces of totally crushed ice, all of nearly uniform small height, and often forming a sort of what we call "Eisbrei." The specific gravity of this ice and other things make it probable that it consists in great part of fragments of glaciers—that is to say, of fresh-water ice; once we saw many such fragments falling from an iceberg. This drift-ice was most abundant and compact north-east of Bouvet island; then followed a very remarkable decrease in the number of icebergs, and at intervals the total absence of drift-ice, between 20° and 40° E. long., beyond which both the icebergs and the ice-fields increased again.

The pack-ice, which was easily recognized as sea-water ice by its greenish colour, presented a totally new and peculiar phenomenon, for it rose sometimes level with the deck of the steamer and showed obvious layers, one upon the other. We only met with it near Enderby Land, about 100 sea miles to the north; it of course compelled us to go back.

Regarding the icebergs, it is remarkable that those in the western part of our voyage, near Bouvet island, looked weather-beaten, with grotesque forms, full of clefts and caves. Most frequently there was a low forefoot of ice spread in front of the berg, often occupied by penguins; more rarely the berg had retained its original centre of gravity, and the hollows made by the waves lay exposed. The table-form drawn by the *Challenger* was very rare in the western part of our ice-route; briefly, everything suggested that those icebergs had already made a long voyage, whence it follows, I think—and I am supported by the absence of ice between 20° and 40° E. long., and by the depth of the antarctic ocean—that no land exists between 0° and 40° E. long., except, perhaps, in very high polar latitudes. This has already been shown, to some extent, by the explorations of Ross and Bellinghausen. Between 40° and 62° E. long., where the icebergs increase again, another important fact appears. The further we went to the east, the more we found the remarkably regular tabular icebergs like those drawn in the *Challenger* narrative. Some of them, as before Enderby Land, were to all appearance just broken off the land, and showed no clefts.

The height of the icebergs was measured by the sextant after the distance had been found by the sound of a shot or of the steam-whistle; the average height was between 100 and 180 feet above the water, so that 1200 to 1500 feet of ice dipped below the surface. The longest iceberg, which, however, we saw only at a great distance, was 3 to 4 sea miles long, and fully reproduced the effect of Ross's well-known antarctic ice-barrier.

The *Valdivia* expedition has nowhere in the higher southern latitude met with drifting seaweed, whereas in the accounts of Cook and Ross this weed is said to be abundant; however, the great depths and the want of land-masses made it most unlikely that we should meet with it.

4. Various Observations.

As to other oceanographical observations, determinations of specific gravity and salinity of the sea-water were made twice daily, besides frequent observations of the transparency and colour of the water; the results of all these can only be made intelligible with the help of charts. There remain experiments with drifters: direct current observations were very difficult on the *Valdivia*, because during the fishing the engines were seldom completely at rest.

I am sorry I cannot now say anything about the distribution of the deep-sea deposits, as our physician and bacteriologist, Dr. Bachmann, who had taken up this part of the work, died, and after his death the specimens of the deposits were packed away, and have not yet been even superficially examined. On the whole, however, our results agree with those already known. Special attention has been paid to the existence of diatom earth within the region of the antarctic ocean from Bouvet island up to near Kerguelen.

5. Meteorology.

The meteorological equipment had been supplied from the "Seewarte" at Hamburg. A meteorological journal was kept, the observations being registered every four hours day and night by the officer on the bridge. Besides these important observations, we had three registering instruments, a thermograph, a hygrograph, and a barograph (by Richard frères), which showed themselves very correct during the entire voyage. Thus for every hour of our way we shall be enabled to give the most important climatic elements. A hygrograph, especially in the high southern latitude, is, perhaps, a new thing at sea.

The variations of the barometer in the squalls of the tropics, at the change of the winds, etc., have been observed, and some observations of insolation and radiation have been made, besides measurements of the amount of rainfall, etc.

I will here describe only the state of the weather near the ice-limit, as we know it for a relatively large distance from 0° to 60° E. long. Here the limit between the stormy region of the "brave west winds" and the light east winds south of about 55°–57° S. lat. has a particular interest.

When we left Cape Town in November, on a south-south-west course, we had variable and often stormy weather, frequently a heavy sea, and sometimes heavy storms from the west-north-west. Not later than near Bouvet island we got temperatures of the water of 30° Fahr. and of the air under 32° Fahr.—that is to say, in the southern summer and in a latitude like the northern part of England. Add thereto a continuous storm from north-west or west-north-west, and you may see that it was terrible weather; the deck was frozen or covered with slush and ice. When going along close to the ice during the next three weeks we got continually an air-temperature under 32° Fahr.; the minimum was only 27°·5 Fahr., but this was sufficient to produce some disadvantages. The pumps, the fresh-water tanks, the steam-pipes which supplied one of the sounding-machines, were frozen, and sometimes the ship was totally covered with snow as in the hardest winter.

As to the details, we got the west winds up to about 20° E. long., in 55½° S. lat. On December 4 we seemed to lose the stormy west winds and to reach their polar side, for the character of the weather for the entire distance from 20° to 60° E. long. to 65° S. lat. was totally altered. We had light winds, mostly from the east, of force 1–3 of Beaufort's scale at most, with calms and often perfectly smooth sea, not even a ripple, on December 5, 6, 7, 8, 10, 11, 12, 14, 15, 17, 21; that is, on 70 per cent. of the seventeen days we spent south of 55° lat. On the remaining 30 per cent. of those days we had moderate to strong winds, but also from the east, north-east, and north, and even storm from the east; at any rate, no sign of west winds during all these weeks.

This weather by itself was favourable for our work, but the frequent fog and overcast grey sky prevented us sometimes, on the other hand, from going on. As soon as we had passed 55° S. lat. on our way northward, this time to the east, in the longitude of Kerguelen, we again met with the stormy west winds, and westerly storms accompanied us up to Kerguelen. There remains still one remarkable thing, that is, the change of the barometer. You might expect that, beyond the stormy west winds, that is, south to about 55° lat., in the light east winds and good weather the barometer rose again, and that we had a relatively high pressure of the air. To my surprise, we got the following results from the registering instrument:—

Within the west-wind region, mean, 29″·51; and in their western part (Bouvet), 29″·63; and in their eastern part (Kerguelen), 29″·40.

Within the east-wind region, mean, 29″·32.

The most southerly regions had the lowest average of atmospheric pressure; we have not yet found a rising of the barometer towards the pole or a trace of an antarctic anti-cyclone, even not near Enderby land.

NOTES ON A MAP OF PART OF THE CORDILLERA REAL OF BOLIVIA.*

By Sir MARTIN CONWAY.

THE part of the Cordillera Real contained in this map includes the highest portion of the range. The mountains and the whole south-west slope for a width of about 25 miles were surveyed by me in 1898, and had not been previously surveyed. The approach of the rainy season prevented me from making a close inspection of the somewhat tangled ridges between the Chisel peak and Condoriri, where some errors may have crept into the map. I did not visit the north-east side of the range. My own work is based upon a careful triangulation, the net of which is deposited for reference in the Royal Geographical Society. Details were filled in by means of a plane-table sketch, but the small scale upon which my work is here reproduced prevents the smaller forms from being reproduced. This is unfortunate, because the details of mountain form are in many respects even more important, from an orographical point of view, than the general configuration of the country, which they would explain and account for. My original large-scale drawing, however, is in the Society's collection and can be referred to. The nomenclature of the peaks is very imperfect. All the mountains, I believe, have native names. Being ignorant of the Aymara language, I was unable to find them out, and none of the educated Bolivians I met could tell me what they were. The only names, of peaks along the main chain, of which I am certain are Illampu, Ancohuma (Hankuma), Condoriri (or Murumamani), Caca-aca, Mururata, Illimani, and Laicacollo. Chachacomane exists in the neighbourhood where the name is written, but may be the next peak to north or south. The other names are very doubtful.

* Map, p. 564.

The remainder of the map is from various unpublished surveys by different individuals, which were given to me in Bolivia. I have deposited the original documents in the Society's collection. The Pauchinto, Coriaguira, and Tipuani valleys are from an excellent survey by Mr. J. B. Minchin, made in 1880. The Amaguaya and Challana valleys are from a map by Señor Ed. Idiaquez, made to represent the line of a projected road from La Paz to Huanay. The Zongo and Coroico valleys were surveyed by Señor Deodoro Moegle. The Rio de la Paz from below Las Juntas and the Rio Beni are from Heath's survey. The route from La Paz to the Rio Undavi is from a very rough sketch-map by R. R. Harris, to indicate the route of a proposed railway to Yungas. A line of route from Desaguadero to La Paz is from a most accurate survey by Señor Bustamante. Some details of the Puna south of Quenco are from Mr. Minchin. Finally, the outline of Lake Titicaca, beyond the parts I touched, is borrowed either from Herr Stübel's map in *Petermanns Mitteilungen*, or from Mr. Minchin. I have not reproduced any portion of Pentland's map. I have adopted for the altitudes of the peaks on the main range the means of my own and the best other observations I could find. I have not taken in account such measurements as give to Sorata and Illimani heights of 25,000 feet, whereof several might be quoted. The following are the observations from which the means have been deduced:—

Name of peak.	Authority.	Altitude.	Mean altitude.
		Feet.	Feet.
North outlier of Illampu ...	Conway	17,237	17,237
Illampu (Mount Sorata) ...	—	—	21,275
	Conway	187 feet below Ancohuma	—
	Pentland	243 " "	—
Ancohuma (Mount Sorata) ...	—	—	21,490
	Pentland	21,286	—
	Minchin	21,470	—
	Conway	21,710	—
Haukaña peak (Mount Sorata)	Conway	20,518	20,518
Corpapato (?)	Conway	19,697	19,697
Chachacomane	—	—	20,590
	Pentland	20,355	—
	Conway	20,822	—
Chisel peak	—	—	20,100
	Pentland	20,115	—
	Conway	20,090	—
Condoriri	—	—	20,030
	Reck	20,115	—
	Conway	19,943	—
Caca-aca	—	—	20,320
	Pentland	20,260	—
	Reck	20,292	—
	Minchin	20,170	—
	Conway	20,560	—
Mururata	Conway	18,980	18,980
Illimani	—	—	21,190
	Pentland	21,181	—
	Pissis	21,355	—
	Reiss	21,040	—
	Minchin	21,224	—
	Reck	21,339	—
	Conway	21,015	—
Quimza Cruz	—	—	18,280
	Reck	18,363	—
	Moegle	18,195	—

THE MONTHLY RECORD.

EUROPE.

Glacial Erosion at Loch Lochy.—At a recent meeting of the Geological Society, Dr. W. T. Blanford directed attention to a form of surface, apparently the result of glacial, with subsequent fresh-water, erosion, of which a particularly striking instance occurs on the side of the great glen of Scotland near the head of Loch Lochy (*Quarterly Journal Geol. Soc.*, February, 1900). At that point, and especially on the south-east side of the glen, the glaciated slope is singularly regular, inclined at an angle of about 35°, and presents the appearance of having been planed by glacier action to a greater extent than is usual. The streams that drain the slope have cut numerous channels, not more than 10 or 15 feet deep on the average, though in exceptional cases they may reach a depth of 50 feet. The crests of the hills, which rise to a height of 2000 feet above the sea, are intersected by glens 500 feet deep, or even more, the lower parts of which are clearly truncated by the sloping plane above alluded to. The surface of this is formed by a narrow band of Devonian strata, composed at the spot in question of a hard but easily disintegrated sandstone, to the lithological character of which Dr. Blanford suggests both the even slope and the extent of furrowing by watercourses may be due. Dr. Blanford regards the features described as especially worthy of attention, firstly as supplying an instance of extensive erosion by a glacier, and secondly as affording a possible means of estimating the approximate date of the termination of the glacial epoch. For the latter object careful observations of the present rate of deepening of the ravines would be necessary, and as this may only amount to about 6 inches in a century, a certain number of years must elapse before any definite results could be attained. Dr. Blanford is inclined to minimize the amount of post-glacial erosion by which the whole slope has been affected, but the possibility does not seem excluded that the lithological character of the rock may have favoured the removal, under the action of frost, of the surface layers at a rate which would keep pace, to a certain extent, with the deepening of the channels. Again, might it not be possible that the present ravines may be of recent origin, due in the first instance to exceptional downpours of rain, such as opened out a new gully on the side of Helvellyn in a single night in the autumn of 1898?

Lakes of the Snowdon District.—Mr. J. R. Dakyns gives in the *Geological Magazine* (February, 1900) some account of his investigations of the lakes and tarns of Snowdon, with especial reference to their mode of origin. Mr. Dakyns has so far been unable to make a full examination of the lakes and their surroundings, but his observations of level by means of an aneroid lead him to dissent from the opinions expressed by Messrs. Marr and Adie in their paper on the lakes of Snowdon, and to regard all the lakes examined as true rock basins. For the settlement of the question soundings are of course necessary, and the hope is expressed that such may be executed during the coming summer, possibly by the writer himself. In the case of Glaslyn, Mr. Dakyns says that solid rock extends entirely across the outlet on a line the lowest point of which is no more than 40 feet below the level of the lake, and is seen in the bed of the stream at less than 6 feet below that level. The present stream, which Messrs. Marr and Adie show to be above the bottom of the drift-filled depression, is, he says, an artificial watercourse. Again, in all possible outlets to Llydaw solid rock is reached no lower than 40 to 50 feet below the lake-surface, while evidence exists that the depth of the lake is very much greater. In the case of the other tarns and lakes, Mr. Dakyns holds that the estimates of the thickness of drift made by Messrs. Marr and Adie are unsupported by facts, while as regards the surroundings of Llyn Quellyn, he says that statements of those writers are incorrect.

Agriculture in Kent.—The *Journal of the Royal Agricultural Society* contains a "Sketch of the Agriculture of Kent," by Mr. Charles Whitehead, which contains much information of geographical interest. Mr. Whitehead divides the county into four divisions—East Kent, Mid-Kent, North Kent, and the Weald of Kent; and four subdivisions—Romney Marsh, the Isle of Thanet, the Isle of Sheppey, and the Hundred of Hoo. A good summary of the geology of each division is given, and the soil and agriculture are brought into relation with the different geological formations. The study of this aspect of the subject is particularly interesting as an illustration of the manner in which the effect of such natural factors are modified by artificial conditions imposed from without, *e.g.* the dominating influence of London as a market for fruit and dairy produce, and as a centre of attraction, making it almost impossible to obtain agricultural labour at a reasonable cost. Besides the geology, Mr. Whitehead discusses the influence of surface relief in different parts of the county, but the importance of this element is hardly sufficiently emphasized, and it is a great pity that no attempt has been made to discuss the climatology of Kent. Besides mean values of temperature and rainfall, given for the whole county, we have merely a few general remarks, just sufficient to show how valuable a review of agriculture from this point of view would have been, but little more. Mr. Whitehead's conclusions are very significant. "There is probably no county in the kingdom in which there are so many kinds of crops and industries in connection with the cultivation of land. . . . Some of them may be classified as minor industries . . . but they are of the greatest importance to Kentish cultivators, without which they would have been in an almost hopeless state of depression. These 'minor industries' . . . will be further developed as the wealth of the country and the prosperity of all classes increase, and many of the Kent cultivators are availing themselves skilfully and energetically of the opportunities which their soil, climate, and traditions offer."

The Railways of Hungary.—At the end of 1897 the total length of the Hungarian railways amounted to 15,752 kilometres (9766 miles), of which total about 13,000 kilometres (8060 miles) were under State control, and only some 2800 kilometres (1736 miles), chiefly local lines, under that of private companies. The rapid extension of the railway system has brought with it, as a direct result, a development of Hungarian industry, inasmuch as the greater part of the railway material is now produced in Hungary—at the works at Budapest, Diósgyör (at the southern foot of the Hungarian Erzgebirge, between Waitzen and Tokaj), and Reschitza (in the Banat). In a country so rich in natural products as Hungary, where the carriage of corn gives rise to an extraordinarily brisk traffic for several months together, and goods are mainly despatched in bulk, a very large rolling-stock is indispensable. Thus the number of goods waggons reached some 50,000 in 1896, representing a total cost of 90 milliards of florins, while the passenger carriages had only involved an outlay of 34 milliards. The following table shows the number of ton-kilometres representing goods forwarded, at intervals of ten years:—

1877	...	1,300,800,000 = 192,000	per kilometre open.
1887	...	2,420,900,000 = 249,000	" "
1897	...	4,772,200,000 = 314,000	" "

The number of ton-kilometres has thus nearly quadrupled within two decades, and has nearly doubled even in proportion to the total length of railway open for traffic.

Races of Europe.*—The necessity of taking into consideration the physical features of a district when dealing, not only with the migrations of people, but

* 'Races of Europe: a Sociological Study.' By William Z. Ripley, PH.D. London: Kegan Paul, Trench, Trubner, & Co. 1900.

with the evolution and social condition, is being increasingly recognized, and it constitutes the keynote of the memorable work on the races of Europe which Dr. W. Z. Ripley has recently offered to his fellow-workers. Before dealing with the inhabitants of a country, Dr. Ripley's first care is to give a brief sketch of its salient physical features, often accompanied by a map, and all through the book he keeps, so to speak, one eye on the geographical features of the area in question. To take a chance example, in describing the detailed map of the distribution of cephalic index in Liguria, he says, "It is curious to note how the sharpness of the ethnic boundary is softened where the physical barriers against intercourse between north and south are modified. Thus north of Genoa there is a decided break in the distinct racial frontier of the province; for just here is, as one topographical map of the country indicates, a broad opening in the mountains leading over to the north. The pass is easily traversed by rail to-day. Over it many invasions in either direction have served to confound the population upon either side." Dr. Ripley discusses in various places the problem of the direct or indirect effect of environment on certain physical characteristics. The very general observation that mountaineers are shorter than people living in plains is probably mainly a question of food; but even the fact is not universal. In Thuringia, for example, the proportionately higher stature of the mountaineers is due to the later occupation of the valleys by the relatively short Slav invaders from the east. "In addition to the direct effect of environment, a selective process is also at work. Only thus can we account for the fact that, while the populations at moderate altitudes seem to be physically depressed by their surroundings, those from regions of the greatest elevation seem to be rather above the normal stature. It seems permissible to assume with Ranke that only those of decided vigour are able to withstand the rigours and privations in this latter case, leaving an abnormally tall, selected population as a result." Wherever the geology of a district has produced a poor soil, or where the climate is unfavourable to prosperity, the influence is reflected on the physical characteristics of the people. All over Europe may be found these "misery spots," where the environment acts directly upon stature through poor food-supply and unfavourable social conditions; but physical degeneration is not the only effect of these "black areas." The chapters on environment *versus* race, acclimatization, and urban selection, or that tendency towards long-headedness, shortness of stature, and brunetness that characterizes most large towns, are of especial interest to the sociologist who endeavours to trace the effects of climate, soil, food-supply, the density of the population, and other more or less physical factors, on the bodily, social, and moral characteristics of human societies. Dr. Ripley clearly exposes the weakness of that crude conception which exalts the influence of race as opposed to other data which is the favourite doctrine of certain enthusiastic temperaments and patriotic societies. Dr. Ripley recognizes three European races: the tall, fair dolichocephals (long-heads), northern, or Teutonic race, as he prefers to call it; the short dark brachycephals (round-heads), Alpine race; and the shortish, dark dolichocephals, Mediterranean race. The different peoples of Europe are believed to be the result of more or less mixture of these races, modified by local conditions and sometimes intensified by artificial selection. The author has had to deal with a very intricate series of problems, and he has produced a fascinating work, which, though crammed with facts, is eminently readable owing to an easy style, clear arrangement, and a lavish supply of distributed maps. The reader's interest in the subject is further increased by the 222 portraits of well-chosen national types. A unique feature of the book is the selected bibliography of nearly two thousand works and papers on the anthropology and ethnology of Europe. It is difficult to speak too highly of the work. Dr. Ripley has taken an infinitude of trouble, not only in collecting his material, but in the manner of its presentation—a matter of no small importance to his readers.

ASIA.

M. Saint-Yves' Journey to Kashgar and the Pamirs.—The second number of *La Géographie* contains the account by M. G. Saint-Yves of his journey to Chinese Turkestan and the Pamirs undertaken during the latter half of 1899. The route followed was in great part over known ground, unforeseen difficulties having curtailed the programme, but in one or two localities the beaten track was left and some new geographical results obtained. The alteration of plans prevented the attainment of great results as regards the historical geography of the country, which had been the primary object of the expedition. From Andijan, the terminus of the Trans-Caspian Railway, M. Saint-Yves proceeded by Osh to Gulcha, examining the ruins, which date from the time of the independent Khans of Khokand. At Gulcha the Russian military road to the Pamirs commences, from which the route to Kashgar diverges at Suffi Kurgan. It was followed, however, some distance further, as the traveller wished to investigate the passes of the Alai west of the Terek davan. He succeeded in discovering three new passes, all high and difficult, and also found that the principal stream on the south side of the mountains is not the Terek-su, as is shown on Russian maps, but the Suguat-su, of which the former is an affluent. There is also a Suguat-su on the north side of the Alai, as the Kirghiz adopt the confusing practice of calling all streams which descend from the same crest by the same name. At Irkishtam, the Russo-Chinese frontier post, M. Saint-Yves again diverged from the usual route with a view to exploring the little-known Maltabar range, belonging to the system of the Mustag-tau. In crossing this range a series of snow-peaks and glaciers was seen to the west, rising in the pyramidal Dutrueil de Rhins peak to a height of some 18,000 feet. Between this chain and that of the Kovan-tau to the south runs the fine valley of the Kovan, a hitherto undescribed tributary of the Kizil-su, or Kashgar river, to which its course was followed. The Kovan-tau also contains a series of snow-peaks, varying from 15,000 to almost 20,000 feet in height. An attempt to explore the Kizil-su down to its confluence with the Markan-su failed, and the ordinary route to Kashgar was rejoined. From Kashgar M. Saint-Yves proceeded south by the valley of the Kenkol river and the Chichiklik pass, and, after searching in vain for a new pass across the snowy chain which bounds the Pamirs on the east, reached the Aksu by a northerly *détour*. On the return journey from the great Pamir to Margilan, M. Saint-Yves avoided the Taldik pass, crossing the Alai further west by that of Jiptik. It afforded a marvellous panorama of the Trans-Alai, and on the north led to the Khoja Balan-su, which flows for 30 miles through frightful gorges.

AFRICA.

Exploration South of Abyssinia.—An English expedition under Messrs. Harrison and Whitehouse has proceeded southwards from Abyssinia in the direction of Lake Rudolf. The latest news, forwarded by Reuter's agency, states that the party had reached Zuquala, on the Hawash, and was about to proceed to the Walamo country by the chain of lakes running southward through the Galla lands. Camels are being employed for transport purposes. From Lake Rudolf the Expedition will strike westward for Nasser, on the Sobat. A complete survey of the route will be made. The ruins of an old city had been discovered on a hill, well and closely built, with narrow streets extending for three-quarters of a mile. It seems possible that this was one of the "ambas" or inhabited mountains mentioned by the old travellers.

Exploration in French West Africa.—The arrival in the French Sudan of the Hostains-d'Ollone mission, which set out last year to explore the region of the upper Kavalli from the south, was announced early in April. After passing out of the basin of the Kavalli, the expedition is said to have come upon a hitherto unvisited tribe of cannibals, who, however, in other respects showed a considerable amount of civilization. Their language differs entirely from that of their neighbours. The expedition was treacherously dealt with, and with difficulty escaped in safety.

Northern Nyasaland.—An instructive sketch of the physical geography of the country west of Northern Nyasa—perhaps, generally, the least-known part of the British Protectorate—is given in the *Scottish Geographical Magazine* (February, 1900) by the Rev. James Henderson, who between 1895 and 1899 made several journeys through the country. Mr. Henderson divides the tract in question into three belts, viz. the coast with its fringing plains, the first or "Tumbuka" plateau, and the second or "Nyika" plateau. The coast plains are reduced to a minimum along the greater part of the northern half of the lake, the mountains going sheer down to the water in many places. The soil, except where alluvial, is generally poor. The baobab, and still more the acacia, is the prevailing tree. Cattle have lately been introduced into most of the villages, the tsetse fly having disappeared with the destruction of the buffalo by rinderpest. Game is not abundant. West of the plains a succession of foothills, slopes, and cliffs, covered with second-growth forest of long standing and producing some useful timber, leads to the Tumbuka plateau, about 2000 feet above lake-level. It terminates northwards in Mount Waller, while southwards it declines on the west to the foot of a still higher escarpment. Its southern extension, however, known as the Vipsya plateau, dies away into the plains. In the north the surface consists of rolling selvas, well watered, and fairly fertile, with peaks bearing dwindling tufts of primeval forest. Wheat and European fruit-trees and vegetables have been grown with some success, and coffee is promising. Mlanji cedar and mahogany have been introduced and thrive well. The whole of this plateau seems free from tsetse-fly. The escarpment to the west is that of the Nyika ("uplands"), which on this side has all the appearance of a mountain range with lofty summits. Contrary to the general idea, this has a very definite outline to the west, its edge rising like a wall of rock before the traveller as he approaches it from the Loangwa valley. From Mount Waller northwards it has its base in the plains of the lake-shore. Along the upper half of the eastern face a girdle of primeval forest of exceeding density extends to a varying depth, but its extent is yearly diminished by the grass fires. The surface of the Nyika is exceedingly rugged; apart from patches of scrub in the hollows, it is grass-clad, the icy winds that sweep over it from west and east after sundown being apparently too severe for trees. At its highest, it is over 7000 feet above sea-level, and is frequently shrouded in mist; while perennial streams, clear, cold, and rapid, intersect it in all directions, giving rise to three important rivers. The whole district described is, as a rule, very thinly inhabited.

The Belgian Katanga Expedition.—News of the expedition to Katanga under the command of Lieut. Lemaire, which set out in 1898 *viâ* the east coast, and of which brief reports have been received from time to time from Tanganyika and the south-eastern parts of the Congo State, was received in Brussels at the end of March, bringing our knowledge of its movements down to November last. Valuable work appears to have been accomplished along the southern frontier of the Congo State, as well as further north. In July, 1899, the expedition was on the Lualaba, but was about to start west for Lake Dilolo. This journey has since been successfully accomplished, the Kasai having been struck and ascended to Lake Dilolo, whence the return journey was made along the Congo-Zambezi water-parting.

the sources of the Lulua, Kiloshi Zambezi, Lubudi, Lufupa, Lunga, and Kabompo being visited. Of these the Lubudi is the great western branch of the Lualaba, considered by M. Wauters as the true head-stream of the Congo. It is probably the Luburi or Lububuri of the "Pombeiros," though the last-named writer is inclined to believe that there are two distinct rivers. The Kabompo is, of course, a tributary of the upper Zambezi, while the Lunga has been considered a branch of the Kafukwe. At the time of writing Lieut. Lemaire was at Tenke, on the upper Lufira, *en route* for Lofoi. A careful survey of the route had been made, and positions accurately fixed. Near the Lualaba the expedition had been joined by Major Gibbons, then on his way to Tanganyika and the Nile.

Progress of British South Africa.—The report of the Directors of the British South Africa Company, issued in December last, contains some interesting information on the general state of the country down to the end of 1899, showing that before the outbreak of the present war satisfactory progress was being made towards the development of the territory. The boundary of Southern Rhodesia—now divided into the two provinces of Mashonaland and Matebeleland—with Portuguese East Africa, had been delimited in Manica as far as the Mazoe, where a cessation of work was necessary pending the adjustment of a difference of opinion with the Portuguese representative. The success of the administration as regards the native population was shown by the very extensive immigration into Rhodesia from neighbouring territories. The telegraph system is being rapidly extended, and in addition to the trunk lines from the Cape and from Beira to Salisbury, and from Umtali to Nyasa and Tanganyika, several branch lines are open or constructing, including a loop *viâ* Tuli from Palapye to Salisbury. A branch line 123 miles long is being constructed from Domira bay, Lake Nyasa, to Fort Jameson. New townships have been established at Rusapi, on the Mashonaland railway, and at Gwanda. A marked improvement in the farming industry is recorded, and a heavy harvest was obtained in Matebeleland in 1899. The inoculation for rinderpest has proved very effective, and it is hoped that the disease has been stamped out. The tsetse-fly is also said to be disappearing in districts in which it was formerly prevalent. As a step towards the proposed northern extension of the railway, the construction of a line from Bulawayo to Gwelo (150 miles) has been taken in hand, and the preliminaries have been arranged for the further extension to Lake Tanganyika. A branch line from Bulawayo to Gwanda has also been decided on. The mining outlook is said to be very favourable. Coal of exceptionally good quality and of considerable thickness has been discovered in the Wankie district 160 miles from Bulawayo. It extends over a wide area, and is said to be equal if not superior to any in South Africa. Deposits of rich copper ore have also been reported in the central districts of Northern Rhodesia, a little north of the Zambezi. The report is accompanied by an appendix giving the terms of the supplemental charter of the company, to which, however, no date is assigned.

Journey in Southern Madagascar.—An interesting journey (briefly described in *La Géographie*, No. 2) was made last year by M. Bastard in the territory of the Mahafali, one of the few tribes of Madagascar previously untouched by French influence. Living in the extreme south-west of the island, the Mahafali and Antandroi have kept aloof from their neighbours, and, though visited by Robert Drury and others during the eighteenth century, have remained off the track of modern travellers. Landing at Tulear, north of the Onilahi river, M. Bastard first visited the Antanosi, entering meanwhile into negotiations with the Mahafali king, from whom he at last obtained permission to visit his kingdom. The Mahafali country is traversed from north-east to south-west by the Ilinta, a stream of which only the mouth in the bay of Masikoro was previously known.

put forward as the most important task awaiting the enterprise of the Peruvians. A small beginning has been made by the "Sociedad Sihuaniro," which has undertaken the opening of a route to connect the valleys of Santa Ana and Yanatili with Puerto Samanez. This, the writer holds, is bound from its position to become the nucleus of an energetic commercial population.

Geography of the Puna of Atacama.—A sketch of the physical features of the Puna of Atacama—the portion of the Andine region in which the disputed Chilean-Argentine boundary was fixed last year by the United States minister in Argentina—is contributed to the *Zeitschrift* of the Berlin Geographical Society (1899, pt. 4) by L. Darapsky, the results of whose surveys in the south-west of that region are embodied in a large scale map which accompanies the paper. This part of the Puna was not explored by Bertrand, while it was imperfectly surveyed even by the Chilean "Comision Exploradora" under San Roman, and Herr Darapsky found many of the current ideas as to its geography incorrect. Puna in its widest sense signifies a barren upland region; while the Puna in question, lying on the border region of Bolivia, Chile, and Argentina, is characterized by the absence of drainage to the sea and by the great number of salt basins, dry or partially filled with water, which run in a general direction from north to south. It presents striking analogies with the "Great Basin" in North America. Former accounts filled the region with lines of mountain chains, but closer investigation proves that these are both fewer and less extensive than had been supposed. The idea of Philippi that we have to do with a level plain from which isolated summits rise, is also incorrect, for, though steep slopes are rare, the general contours of the country show much variation. With regard to the Cordillera Domeyko, supposed by San Roman to run continuously from the Copiapo volcano, past the peaks of Maricunga, Doña Ines, Bolson, Sapos, etc., to 23° 9′ S., Herr Darapsky says that the cone of Doña Ines has no continuation to the south, in which direction it falls abruptly to the "salar" of Pedernales. Northwards, however, a continuous range undoubtedly extends to 24° 49′ S., and perhaps further. This is the range often known as the Western Cordillera, which forms the physiographical limit of the "Puna," dividing the region of river valleys to the west from that of isolated salt-basins to the east. In the central region, where some former observers have drawn the main chain or "Cordillera Real de los Andes" through a line of great volcanoes, the writer saw no trace of a continuous range. The country forms a *massif* measuring some 45 miles by 16, and the volcano of Lastarria lies off the culminating line of the plateau. Further south, a single ridge is seen, ending in the double volcano of Los Morros, which falls to the Laguna de las Parrinas. The volcano of Llullaiyaco in the north is an independent peak, towering above the surrounding country, on which it exercises no genetic influence. Herr Darapsky says that the salt basins were, as a rule, exaggerated in size by the "Comision Exploradora," which in some cases threw several into one. They are possibly the remnants of larger basins, which existed when the amount of water in the country was greater. A necessary accompaniment of such a state of things would be a glaciation of the district, of which, however, the traces are not distinct, the universal presence of angular rock masses being easily explained otherwise. The writer suggests as possible that a change of climate has been caused by an alteration in the system of winds since the elevation of the great volcanoes; such an alteration being indicated by the presence of dunes where none are now formed. The paper concludes with tables of altitudes of the principal passes of the region.

of the Newton glacier, which descends between the two main easterly spurs of the mountain, but the earlier section of the route differed from either of those chosen by the American professor. A landing was effected near the western extremity of Yakutat bay, whence the great Malaspina glacier (here 25 miles wide) was crossed in a nearly north direction to the lower end of the Seward glacier. This latter, which, coming from the vicinity of Mount Logan north of the St. Elias chain, forms the largest feeder of the Malaspina glacier, was ascended for a short distance, after which the parallel Agassiz glacier was reached by the Dome pass across an intervening ridge. The Newton glacier (which runs at right angles into that of Agassiz) led the party to the Russell col, which had formed almost the furthest point reached by the duke's predecessor. Thence to the final summit was a distance of less than 2 miles. Among the many striking views which display the great mountain and its glaciers in the most varied aspects, it is difficult to single out any as specially worthy of mention. One of the most impressive is perhaps an evening view from the Seward glacier, while those of the *seracs* of the Newton glacier and of the dispersion of the mists from the summit as seen from the same valley are also particularly fine. The views of Mounts Cook and Augusta from the Seward glacier show that these peaks almost rival St. Elias itself in massive grandeur. A comprehension of the geography of the range is much facilitated by the panoramas given at the end. One of these, looking north from the crest of St. Elias, is of special interest as affording a glimpse into the icy *terra incognita* whence rises the still higher summit of Mount Logan; a more impressive picture of wildness and desolation it would be difficult to imagine. Finally, the illustrations of plant-life during the brief flowering season, and of the forest-clad shores of Yakutat bay, afford a striking contrast to the world of ice to which they approach so nearly.

The Valley of the Urubamba, Peru.—A recent number of the *Boletin* of the Lima Geographical Society contains the report of a paper on the valley of the Urubamba and its commercial possibilities read last year before the Society by Señor Luis Robledo. After pointing out the great importance of the Urubamba valley as a natural line of communication between the populous and productive plateaux and elevated valleys of the Andes and the wooded Trans-andine plains, and between Lake Titicaca at the extreme south of the Republic and the Amazonian ports of the northern borders, the writer gives a detailed sketch of the commercial resources of the valley in its upper, middle, and lower course. The upper Urubamba valley, with the neighbouring Andine plateaux, embraces some of the most productive districts of Peru, its natural resources including the wool, silver, lead, and mercury of the higher zone, the commerce of which converges by railway and road on Cuzco; the cereals of Acomayo and Paruro; the cattle, gold, and other minerals of Quispicanchi and Paucartambo; and the varied agricultural productions of the temperate region below Cuzco. The middle Urubamba, as defined by Señor Robledo, begins with the passage of the river through the Cordillera by a cañon offering the finest scenery of the Andes of Cuzco, and ends at the famous Pongo de Mainique. During the intervening stretch the river takes a zigzag course with many rapids, while the Torontoy road follows its rocky banks. In the valley of Santa Ana, which extends to the confluence of the Yanatili, much of the tropical forest has been cleared for the plantations of cacao, coca, and sugar-cane which have been established. The populated part of the valley ceases at the Yanatili. The lower Urubamba is navigable from Puerto Samanez, a little below the Pongo de Mainique, traversing the forest-clad plains of the Amazon basin, and receiving many tributaries navigable for canoes. The forests abound in caoutchouc. The great need of the country is the opening of communication by road or railway with the south, and the establishment of such communication is put forward as the most important task awaiting the enterprise of the Peruvians. A small beginning has been made by the "Sociedad Sihuaniro," which has undertaken the opening of a route to connect the valleys of Santa Ana and Yanatili with Puerto Samanez. This, the writer holds, is bound from its position to become the nucleus of an energetic commercial population.

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POLAR REGIONS.

Sir G. Newnes' Antarctic Expedition.—Early in April the intimation was conveyed to us by Sir G. Newnes that the expedition under Mr. Borchgrevink had safely returned to New Zealand, after successfully accomplishing its objects. Telegraphing from Campbelltown, in South island, the leader announced that the highest latitude attained by the sledge-party was 78° 50′, the reaching of which constitutes a record in antarctic discovery, the highest point hitherto attained having been in 78° 10′, Ross's farthest, February, 1842. The most valuable result, however, is the fixing of the present position of the southern magnetic pole. The only misfortune to the party seems to have been the death of the zoologist, Nicolai Hansen, an experienced collector who had for some years worked for the British Museum. The expedition has arrived at Hobart, Tasmania.

Results of the Belgian Antarctic Expedition.—Pending the publication in Belgium of the full results of the Antarctic Expedition of De Gerlache, the summary of the work done, contributed to the second number of *La Géographie* by E. Racovitza, the naturalist of the expedition, supplies some interesting details. It is accompanied by a reproduction of the map of Lieut. Lecointe lately published by the Royal Belgian Geographical Society, showing the discoveries made by the expedition in the region north of Graham Land, with the various tracks of the vessel up and down Belgica strait, as the passage found between Danco Land and the Palmer archipelago has been named. The shores of the strait are mountainous, cut by narrow valleys, one of the peaks having apparently an altitude of 6000 to 7000 feet. The channels separating the various islands are deep, and the whole presents the appearance of a sunken land of which the valleys have been invaded by the sea. The land is composed of ancient crystalline rocks. Danco Land and the larger islands are covered with an ice-cap comparable with that of Greenland, but an examination of the moraines proved that the glaciers are retreating. Another important geographical discovery was that of a submarine plateau south-west of Graham's Land, between 75° and 103° W. and 70° and 71° 35′ S., with a mean depth of 500 metres (about 275 fathoms), while to the north there is a sudden drop to a depth of 1500 metres (820 fathoms). The existence of this continental plateau supports the idea of the continental character of the antarctic lands, while its greater depth, as compared with other continental plateaux, is another indication of subsidence in this region. The sediments obtained from this locality consist, in addition to grey mud, of a large proportion of sand, gravel, and rounded pebbles, which must have been derived from a sea-shore. The result of the voyage is to prove the non-existence of the land laid down by Walker, and also of that supposed by Cook to exist in about 150° E. M. Racovitza also sketches the results obtained in regard to magnetism, meteorology, oceanography, zoology, and botany. After pointing out the extreme scantiness of the fauna and flora of the lands visited (apart from the seals and sea-birds, the latter of which are very abundant in Belgica strait), he expresses the opinion that the antarctic fauna which existed before the invasion of the ice must have been entirely destroyed during subsequent glacial epochs. Even the existing species do not, he thinks, date from a pre-glacial period, but have been introduced by birds from America.

Ice in the Arctic Seas, 1899.—For some years the Danish Meteorological Institute has annually published useful information, derived from captains of ships and others, respecting the condition and movements of the ice in the seas east and west of Greenland, the most recent report giving the results for 1899. The work of the institute in this direction met with cordial recognition at the Berlin meeting of the International Geographical Congress, which passed resolutions in favour of more extended observations, for which end the co-operation of other bodies was asked for, the Danish Institute being designated as the central office for the collection and preparation of information. Communications from observers are therefore appealed for by the latter, to which reports may be sent free of postage, addressed "Meteorological Institute, Copenhagen." The results for 1899 are given (1) for the sea round Spitsbergen and Novaya Zemlya; (2) for the Arctic ocean and Denmark strait; and (3) for Davis strait and Baffin bay, the state of the ice during each month for which observations are available being described. The following general conclusions are arrived at: (1) In the Kara sea, in the western part of Barents sea, and round a portion of Spitsbergen, as well as in Smith sound, more than the normal amount of ice seems to have been present. (2) South of Franz Josef Land, and under the east coast of Greenland, there was considerably less ice than usual. The favourable conditions in the latter regions are considered to be a natural result of the unfavourable conditions in the former, a drift having been set up by special wind-conditions. A good spring season is predicted for the present year off the south-west coast of Greenland. In the southern part of Davis strait icebergs were, last summer, extraordinarily scarce, there having apparently been a retardation of the drift of the bergs, possibly through grounding, a little north of Angmagsalik. The effect of these conditions on North American navigation remains to be seen.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

A Mechanical Theory of the Formation of Mountains.—In a recent number of the *Comptes Rendus* of the French Academy of Science (vol. cxxx. No. 6) M. Marcel Bertrand sketches the outline of an ingenious theory of the origin of mountain ranges, by which the observed phenomena are accounted for by a series of mechanical displacements, each following as the immediate result of that which has preceded it. M. Bertrand's theory has immediate reference to the European system of mountains running from east to west parallel to the Mediterranean depression, but he apparently intends it to apply, with the necessary modifications, to certain of the great meridianal systems, *e.g.* the Urals and the Rocky mountains. The first stage supposed is that of a basin due to excess of weight over a given zone, to the north of which (in the case under consideration) runs a recently elevated mountain chain whence the basin tends to be filled by sedimentation. The excess of weight thus produced leads to the depression of the floor of the basin, and, as a necessary result, to the displacement of an equal mass at a lower level. This takes place in a southerly direction, and the result is a ridging up of the surface to the south of the basin, this constituting the second stage in the process. In the third stage, this ridge, having no counterpoise, is displaced by the force of gravity and the tensions existing within the Earth's crust, and is carried over the surface of the basin by a shearing movement which is sufficient to produce all the essential characters of mountain structure. The last stage consists in the elevation of the mass deposited in the form of a mountain range, which M. Bertrand accounts for thus. In the preceding movements, a substitution has taken place, within a given vertical zone, of less dense surface formations for an equal volume of the denser interior layers, and there is thus a tendency to reduce the original excess of weight. Coupled with this there has been a lateral displacement of the surface layers relatively to the deep-seated zone to which the excess of weight was due. A deficiency in weight is the result, and this occasions the elevation of the mass. M. Bertrand considers that the displacement of the sedimentary material from the mountain range to the depressed basin must be compensated by a displacement of the whole surface, probably affecting the outer layers only, and this in turn will occasion a displacement of the axis of rotation of the Earth. He allows that the conclusions are not absolutely rigorous, but they coincide with the results obtained by a consideration of volcanic phenomena, which has enabled the writer to trace a curve on the globe representing the displacement of the pole in space.

Variation of Latitude at Teramo.—M. J. Boccardo gives in the *Comptes Rendus* (vol. cxxx. No. 6) the results of his observations, during the latter part of 1899, on the variation of latitude at the Observatory of Teramo, Italy. The determinations were made by the Horrebow-Talcott method, and were based on repeated observations of twenty-three pairs of stars, several being continued through four months. The results are based on over five thousand bisections of stars, while the greatest care was taken to eliminate errors by mutual compensation. The maximum variation of latitude obtained was almost 1″, the value for July being 42° 39′ 25″·89 (with probable error of ± 0″·051), and for October (at the end of which it reached a maximum) 42° 39′ 26″·82 (probable error, ±0″·046). M. Boccardo points out that, while the variation obtained may seem excessive, the value (0″·3) commonly assigned to it is merely a mean. The value obtained for the latitude in October closely agrees with that adopted by M. Cerulli, from observations by the same method, stars, and instruments.

Lichtenberg's Contributions to Terrestrial Physics.—The centenary of the death of Georg Christoph Lichtenberg was last year celebrated by the German press, in which attention was principally directed to his work as a satirist and moralist. In the *Abhandlungen* of the Vienna Geographical Society (1899, pts. 2–3) Dr. S. Günther calls attention to Lichtenberg's contributions to the science of geophysics, which, though commonly left somewhat out of sight, are fully deserving of consideration. The German scientist, who was born near Darmstadt in 1742 or 1744, and in time became professor at Göttingen, in fact took a special interest in terrestrial physics, and his work in that direction shows him as an original and unprejudiced thinker. His contributions to the various branches of the science are briefly sketched by Dr. Günther, who points out many instances in which his ideas were distinctly in advance of his time. The progress of geographical discovery aroused in him a keen interest, and connections formed during two visits to England enabled him to keep his countrymen informed of the work of English explorers, especially Cook, of whose voyages he published a lively account. He also paid attention to mathematical geography, and his determinations of positions in Hanover are among the most accurate of his time. His originality as a thinker is shown by his theory of a gaseous interior of the Earth, in regard to which he gave more definite shape to the somewhat vague ideas of Franklin. In the domain of geology, he paid attention to volcanic phenomena, and showed the analogy between those of the Earth and of the moon. The tendency of the lands of the globe to terminate southwards in a point, with an island to the east, was noticed by him, and the search for an explanation recommended. Meteorology seems to have exercised on him a special attraction, and his ideas as to the system of the winds were in great measure correct; while his theory of atmospheric vapour—in close agreement with that now adopted—is considered by Dr. Günther as his most genuine contribution to science. As a teacher Lichtenberg enjoyed a high reputation, and one of his courses was attended by Alexander van Humboldt, who, no doubt, there laid in part the foundation of his future insight into natural laws.

GENERAL.

The River as a Boundary.—The importance of the river as a boundary between civilized and uncivilized peoples is discussed by Oskar Emil Junghans in his inaugural dissertation for the degree of doctor at Leipzig University, recently issued in pamphlet form. After a preliminary glance at the various forms of boundary supplied by natural features, the writer discusses the varying *rôle* played by the river in relation to primitive and civilized man, insisting on its importance as a boundary in the case of the former, and as an aid to culture in the case of the latter. Having then laid down as the requirements of a boundary between the two classes of peoples, (1) that it must present the idea of a boundary in a conspicuous form; (2) that it must afford protection from inroads; (3) that it must allow free intercourse and further the extension of culture; the writer endeavours to prove by historical instances, especially the case of the Romans and Germans, that the river best meets these requirements, possessing decided advantages as compared with the mountain range. He is perhaps inclined to give too wide an application to the principles laid down, and to leave out of account special factors which may help to determine the choice of a river as boundary, *e.g.* the direction of its flow relatively to the line of advance of civilization, its navigability or the reverse, and the nature of the country through which it passes. The instances adduced might easily be matched by others from which a contrary conclusion could be drawn, while the double function of arteries of civilization and boundaries between civilized and uncivilized peoples could rarely be performed by the rivers of one and the same region. The author gives frequent references to the works of Ratzel and other writers on anthropogeography, as well as to the statements of travellers, on both of which his work is to a large extent founded. Few authorities, other than German, seem, however, to have been consulted.

OBITUARY.

General Sir William S. Lockhart.

By Colonel Sir THOMAS H. HOLDICH, K.C.I.E., C.B.

SIR WILLIAM STEPHEN ALEXANDER LOCKHART, who died at Calcutta on March 18, was a Fellow of the Royal Geographical Society, and throughout his adventurous and successful career he was ever an ardent supporter of geographical enterprise. He attained great renown as an able general in the field, and he died Commander-in-Chief in India. Had he given his life to the cause of geography, he would have achieved equal success as an explorer; for he was not only a most close and careful observer, and a good descriptive writer, he was a born leader of men, and he loved the field of adventure.

Sir William was the son of a Scotch laird-parson, the Rev. L. Lockhart, of Milton Lockhart, in the county of Lanark. He was intensely proud of the name he bore and of his descent from an ancient house, and he inherited much of the literary ability of that house; his uncle being John Gibson Lockhart, the well-known author of the 'Life of Scott.' Few even of his best friends knew that Sir William indulged a fancy for poetry as well as for prose.

His military record is part of the recent history of India. In 1858, at the age of seventeen, he entered the service as a lieutenant in the 44th Bengal Infantry, with which regiment he was associated for ten years. He served for a few months in Oudh with the 5th Fusiliers, and his subsequent war services include campaigns in India, Afghanistan, Abyssinia, Burmah, and Sumatra. As adjutant of the 14th Bengal Cavalry, he was in the Bhutan campaign of 1864–66. As aide-de-camp to General Merewether, he was in Abyssinia in 1868, and witnessed the fall of Magdala. As D.A.Q.M.G., he was subsequently with the Hazara field force in the Black Mountain Expedition. In 1875-77 (for want of a field in India) he served in the Dutch war in Achin, and received the Dutch war medal and clasp. There he nearly died, for he was struck down with fever at the end of the campaign, which stretched him helpless at the port of debarkation. He was road commandant in the Khaibar at the commencement of the Afghan war of 1879-80, and finally acted as A.Q.M.G. with Roberts's force at Kabul, where he took part in all the engagements of that winter. By this time he had attained the rank of lieut.-colonel, and the decoration of C.B. During 1885-86 he conducted a political expedition to Chitral, which was, to a certain extent, the complement of the Russo-Afghan Boundary Commission on the Oxus. It was during this expedition that he showed his capacity and courage as an explorer. That adventurous journey through Hunza and across the Hindu Kush (where he was first to show the way) was so fraught with danger from the treacherous hostility of the fierce old Hunza chief, Ghazan Khan, that it is a marvel how his little party (which included his great friend Woodthorpe) escaped the traps that were laid for it. Nor were matters much improved when, after crossing the Kilik with infinite difficulty, and pushing his way down the Wakhan to Ishkashim on the Oxus, he found himself face to face with determined opposition organized at Kabul. Unable to penetrate Badakshan, the party crossed by the Dorah into the Arnawai, or Bashgol, valley of Kafirstan, and so made their way to Chitral. Independently of its political significance, that journey was a great geographical record. Geographically, it was perhaps Woodthorpe's opportunity rather than Lockhart's; but it was Lockhart's earnest and determined support of Woodthorpe that enabled the latter to achieve his brilliant success. In the remote wilds of the Bashgol, Lockhart is still remembered as the typical "Sahib," and it would be well if that type could be ever represented in strange lands as it was then—by commanding personality and chivalrous disposition.

In the winter of 1886-87 he obtained his first command of a brigade in Burmah; and his K.C.B. quickly followed. In March, 1887, he obtained a brigade in the Bengal command, and two years later joined the Headquarter Staff as Assistant Military Secretary. He commanded the two Meranzai expeditions of 1891, and first showed the way into the Khanki valley across the Samana range. This brought him his promotion to the rank of major-general, and after the Isazai expedition of the following year he became lieütenant-general, and attained the Punjab divisional command. The Waziristan campaign of 1894 gave him another opportunity of sweeping a difficult hill country clear of an active enemy, and for the third time he received the thanks of the Government of India.

His last campaign was in 1897, when he found himself in command of 40,000 British and native troops on the Indian frontier with Tirah before him, and perhaps the most difficult series of operations to carry to a successful issue against a well-armed foe that any Indian general had as yet encountered on the frontier. There was much heavy fighting and considerable loss, but the result was a complete and thorough exploitation of all those hitherto unknown highlands at the base of the Sufed Koh; and the final subjugation of a people who were but seldom to be seen, and were never caught asleep. Nothing more could have been done than Lockhart did, and nothing could have been more satisfactory to him than the candid acknowledgment of his foes that he was their master, even in mountain tactics. Shortly after Tirah he succeeded Sir G. White as Commander-in-Chief in India.

The force of Lockhart's character lay not alone in the energy and ability which he brought to bear on his immediate military or political duties. His heart was as sound as his head. A careful adviser, a faithful friend, a genial and kindly companion, whose unswerving honesty of purpose was never to be doubted for an instant—such was

Lockhart. He will be remembered by many for his brilliant qualities as a general and leader. He will be remembered by not a few as a wise and chivalrous friend; as the man who, when leader of an expedition in which baggage was light and tents were scarce, tossed up on equal terms with the whole party for the doubtful privilege of sleeping out—and won; as the man who picked up the worn-out Balti coolie from the snow and carried him into camp (and a Balti coolie is not a sweet burden); as the man who declined the pleasures of a public reception and entertainment to seek out a sick friend who had been suddenly struck down, and sit with him and cheer him for an hour; as the man who could never reconcile himself to the adjustment of a boundary which gave the Bashgol valley to the Amir, because he had himself given the right hand of fellowship to its Kafir chief.

Tall and straight and strong as he looked, Lockhart's constitution was not equal to his appearance. At the close of the Tirah campaign he was so beset with fever that many of his friends doubted if he could ever recover. Perhaps he never did; for when I saw him last (at the Aldershot review of the summer of 1898), and congratulated him on his high appointment as chief in India, he did not speak of the future in terms of his usual hopeful enthusiasm. It was not the Lockhart of Kabul who went to Simla. He married twice—first Caroline Camelia, daughter of Major-General E. Lascelles Dennis; and secondly, in 1888, Mary Katherine, daughter of the late Captain W. Eccles, of the Coldstream Guards.

At the evening meeting of March 19, the PRESIDENT made the following remarks: Before announcing the business of the evening, I cannot help referring to the loss the Society has sustained in the death of the Commander-in-Chief in India. Sir Wm. Lockhart was an old Fellow of this Society. He was a man who took a deep interest throughout his life in geography, having begun exploring when very young with the Bhutan expedition, then with the Abyssinian expedition, afterwards he did most valuable work when attached to the Dutch army in Achin, when he sent home memoirs and very valuable maps. Few men saw more of the various frontiers of India, and in more recent times he commanded the expedition to Chitral and the Pamirs, which was the first to explore the upper course of the true Oxus. Sir Wm. Lockhart as a young man was imaginative and enthusiastic, and no mean poet. I remember that he wrote stanzas on the deed of his ancestor who accompanied Lord Douglas when he took the heart of Robert Bruce to the Holy Land; also, I remember a poem of his of considerable merit in imitation of the Œnone of Tennyson. He was then a most charming companion, well informed, genial, and most obliging. As he was as a young man he continued through life, and made many dear friends who now mourn his loss. It is not for me to speak of his greater and higher qualities as a soldier, but I think I may truly say that in Sir William Lockhart the country has lost a most valuable public servant.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1899-1900.

Afternoon Technical Meeting, Tuesday, March 27, 1900.—Sir CLEMENTS MARKHAM, K.C.B., President, in the Chair.

The Paper read was:—

"Methods adopted in Surveying the Cordilleras of the Andes." By Prof. Bertrand, of the Chilian Survey.

Ninth Ordinary Meeting, April 2, 1900.—Sir CLEMENTS MARKHAM, K.C.B., President, in the Chair.

ELECTIONS.—*Rev. William Esdaile, M.A.; Allan A. Forster; J. H. Hyde Johnson, M.A.* (*Oxon.*); *Robert Nunez Lyne; Donald A. MacAlister; Captain Reginald James Macdonald, R.A.; Lieut.-Colonel Percy Hugh Hamon Massy* (6*th Dragoon Guards*); *Hon. Walter Maxwell.*

The Paper read was:—

"Explorations in Central Asia." By Captain H. H. P. Deasy.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By HUGH ROBERT MILL, D.Sc., LL.D., *Librarian*, R.G.S.

THE following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Com. = Commerce.
C. Rd. = Comptes Rendus.
Erdk. = Erdkunde.
G. = Geography, Geographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. = Memoirs, Mémoires.
Met. = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. = Review, Revue.
S. = Society, Société, Selskab.
Sitzb. = Sitzungsbericht.
T. = Transactions.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Alps—Historical. *Annuaire Club Alpin Français* 25 (1898): 544–555. **Maugin.**
Passage des Alpes et du col de la Faucille par un pèlerin de 1518, d'après la relation de Le Sage. Par M. Gustave Maugin.

Austria—Bohemia. *Globus* 77 (1900): 8-13. **Zemmrich.**
Die Zustände an der Sprachgrenze in Westböhmen. Von Dr. J. Zemmrich. *With Map.*

Austria—Salzkammergut. *Abh. G. Ges. Wien* 1 (1899): 137–178. **Lorenz.**
Aeltere und neuere Lothungen im Hallstätter See. Von Dr. Josef Roman Ritter Lorenz von Liburnau. *With Plates.*

Austria—Tyrol. *Annuaire Club Alpin Français* 25 (1898): 140–200. **Vielliard.**
A travers le Tyrol: Oetzthal et Dolomites occidentales. Par M. Edme Vielliard. *With Illustrations.*

Denmark—Archæology. *Mém. S.R. Antiquaires Nord* (1899): 229–296. **Müller.**
Notice sur les fouilles faites pour le Musée National de Copenhague, pendant les années 1893–1896. Par Sophus Müller, traduite par Eug. Beauvois. *With Illustrations.*

Denmark—Meteorology. ———
Annuaire météorologique pour l'année 1896. Publié par l'Institut météorologique Danois. Deuxième partie (1800, pp. 98); Ditto pour l'année 1898. Première partie. Kjøbenhavn, 1899. Size 14 × 9½, pp. vi. and 140.

Europe—Historical. *B.A.R. Belgique* 35 (1898): 78–92. **Piot.**
Les Frisons en Flandre. Par Ch. Piot.

On the Frisians or Franks, the free north-western German tribes, in Flanders at an early period.

France. *Mém. A. Dijon* 6 (1898): 99–399. **Picard.**
Histoire d'une forêt communale. La Forêt des Crochères à la ville d'Auxonne. Par M. Etienne Picard. *With Map and Plate.*

The history of this forest is traced from 1298 onwards.

France. *Mém. S. Spéléologie* 3 (19) (1899): 1–40. **Martel.**
10^e Campagne souterraine (1897). Première Partie. La Grotte de la Balme (Isère)—Recherches en Savoie et en Suisse. Par M. E. A. Martel. *With Plans and Illustrations.*

France. *Mém. S. Spéléologie* 3 (18) (1899): 1–36. **Mazauric.**
Explorations souterraines dans le Gard, l'Ardèche et l'Hérault (Campagne de 1898). Par M. Félix Mazauric. *With Plans and Illustrations.*

France. *A travers le Monde, Tour du Monde* 6 (1900): 13–14. **Noussanne.**
La Canal des Deux Mers.—De l'Atlantique à la Méditerranée.—Son double avantage commercial et militaire. Par M. H. de Noussanne. *With Map.*

M. Verstraëte's project of a canal uniting the Bay of Biscay and the Gulf of Lions

France—Alps. **Cessole and Maubert.**
Annuaire Club Alpin Français 25 (1898): 332–370.
La vallée de la Gordolasque (Alpes-Maritimes). Par MM. Victor de Cessole et Louis Maubert. *With Illustrations.*

France—Brittany. *A travers le Monde, Tour du Monde* 6 (1900): 9–11. ——
Le Passé, le Présent et l'Avenir de l'Ile de Sein. *With Illustrations.*

This island has suffered much by coast-erosion.

France—Cevennes. *Annuaire Club Alpin Français* 25 (1898): 285–331. **Nauzières.**
Le Sidobre. Par M. Raymond Nauzières. *With Map and Illustrations.*

France—Gard. *C. Rd.* 130 (1900): 218–220. **Bertrand.**
Le bassin houiller du Gard et les phénomènes de charriage. Note de M. Marcel Bertrand.

France—Gascogne. *Deutsche G. Blätter* 22 (1899): 235–256. **Le Mang.**
Die Dünen der Gascogne. Von Richard Le Mang. *With Map.*

France—Meurthe. *B.S.G. de l'Est* (1899): 23–30. **Bleicher.**
La colline de Malzéville. Par M. le professeur Bleicher. *With Plate.*

Particulars of a prehistoric masonry wall found on the Malzéville hill.

France—Mont Blanc. *Spelunca* 4 (1898): 171–176. **Vallot.**
Exploration des Moulins de la Mer de Glace. Par M. J. Vallot. *With Plans.*

France—Rhone Glacier. *Spelunca* 4 (1898): 156–158. **Forel.**
Circulation des Eaux dans le Glacier du Rhône. Par M. F. A. Forel.

Germany—Hamburg. ——
Wegweiser durch Hamburg und Umgebung. Hamburg: F. W. Rademacher [*not dated*]. Size 7 × 4½, pp. 94. *Plan and Illustrations. Presented by Dr. J. Scott Keltie.*

Italy. **Smith.**
A Pilgrimage to Italy. An Account of a Visit to Brindisi, Naples, Mount Vesuvius, Pompeii, Rome, Florence, Venice, and Milan. By the Rev. James Smith, B.D., with Introductory Preface, by the Very Rev. F. W. Farrar, D.D., F.R.S. Aberdeen, 1899. Size 9 × 6, pp. x. and 512. *Maps, Plans, and Illustrations. Price* 8*s.* 6*d. Presented by the Author.*

The record of a trip through Italy, illustrated with unusual richness, and displaying a keen appreciation of the manifold interest of the parts of the country which were visited.

Italy—Sassuolo. *Globus* 77 (1900): 37–42. **Greim.**
Ein Besuch der Schlammsprudel von Sassuolo. Von Dr. G. Greim. *With Illustrations.*

Montenegro. *B.S.R.G. d'Anvers* **23** (1899): 367–390. **Levy.**
Au Monténégro. Par M. Victor Levy.

Norway—Meteorology. **Mohn.**
Jahrbuch des Norwegischen Meteorologischen Instituts für 1898. Herausgegeben von Dr. H. Mohn. Christiania, 1899. Size 13½ × 10, pp. xii. and 122.

Russia—Finland. *Fennia* 15 (1897–1899) (No. 3): 1–210. **Andersson.**
Studier öfver Finlands torfmossar och fossila kvartärflora. Af Gunnar Andersson. German abstract, pp. 181–210. *With Plates.*

On the plants of the peat-mosses of Finland and the Quaternary flora of the country.

Russia—Finland. *Fennia* 14 (1897–1899) (No. 1): 18–20. **Hackman.**
Neue Beobachtungen über die Ausbreitung des Yoldia-meeres in Finland. Von Victor Hackman. *Also* Om i norra Finland iakttagna senglaciala strandmärken, No. 5, pp. 1–8. *With Maps.*

German abstract of a paper in Swedish on the probable limits of the late glacial Yoldia lake in the centre of Finland. The second map indicates the probable extension of the lake on both sides of the Gulf of Bothnia.

Russia—Finland. *Fennia* 14 (1897–1899) (No. 6): 1–31. **Hausen.**
Spridda uppgifter om navigationen samt lots—och båkväsendet vid Finlands sydkust under äldre tider. Af Reinh. Hausen. German abstract, pp. 29–31. *With Map and Plates.*

On the navigation, pilotage, and beacons on the south coast of Finland in early times. The map is the reproduction of a Dutch chart of part of the eastern Baltic, evidently of the early part of the sixteenth century.

Russia—Finland. *Fennia* 14 (1897–1899) (No. 7): 1–71. **Rosberg.**
Ytbildningar i Karelen med särskild hänsyn till ändmoränerna. II. Af J. E. Rosberg. German Abstract 64–71. *With Map.*

On the terminal moraines, eskers, and other glacial remains of Eastern Finland.

Russia—Finland. *Fennia* 15 (1897–1899) (No. 5): 1–195. **Savander.**
Détermination relative de la pesanteur à Helsingfors, précédée d'un Aperçu sur les formules de réduction. Par Otto Savander. *With Plates.*

On gravity observations made at Helsingfors, with details and figures of the pendulums employed in the research.

Russia—Finland. *Fennia* 14 (1897–1899) (No. 4): 1–52. **Saxén.**
Finlands kommuners namn i Svensk skrift. Af Ralf Saxén. *With German abstract.*

This paper in Swedish, and another of 54 pp. in Finnish by Väinö Wallin, discuss the names of the communes of Finland in their Swedish and Finnish forms, giving a complete alphabetical list in each language. The lists were originally compiled by the Finnish Geographical Society, and distributed widely over the country, in order to collect all variations of the names, and the data thus procured were then discussed, and the lists now published indicate the forms which are most probably correct, and which the Society desires to see superseding the haphazard spelling now employed on maps.

Russia—Finland. *Fennia* 14 (1897–1899) (No. 8): 1–19. **Tigerstedt.**
Magnetiska undersökningar i trakten af Jussarö. Af A. F. Tigerstedt. German Abstract, pp. 14–19. *With Maps.*

A remarkably detailed magnetic survey of a small portion of the coast of South-Western Finland.

Russia—Kola Peninsula. *Fennia* 15 (1897–1899) (No. 2): 1–27 (No. 4); 1–15. **Ramsay.**
Das Nephelinsyenitgebiet auf der Halbinsel Kola. II. Von Wilhelm Ramsay. Neue Beiträge zur Geologie der Halbinsel Kola. Von Wilhelm Ramsay.

Describes geological observations at various points on the Murman coast and on the island of Kildin.

Russia—Ladoga. *Fennia* 14 (1897–1899) (No. 2): 1–43. **Ailio.**
Ueber Strandbildungen des Litorinameeres auf der Insel Mantsinsaari. Von Julius Ailio. *With Map.*

The island of Mantsinsaari lies in the north-east of Lake Lodoga, and is largely formed of deposits left by the Litorina sea, the recession of which may be studied by the lines of ancient beaches.

Russia—Novgorod. *Tour du Monde* 5 (1899): 613–624. **Albizzi.**
Visite à Novgorod la Grande (une ancienne capitale de la Russie). Par M. le Marquis degli Albizzi. *With Illustrations.*

Spain. *B.S.G. Madrid* 41 (1899): 242–248. **Blázquez.**
Vias romanas españolas. Por D. Antonio Blázquez y Delgado Aguilera. Vias numeros 19 y 20.

Spain—Sierra Nevada. *Abh. G. Ges. Wien* 1 (1899): 179–326. **Rein.**
Beiträge zur Kenntnis der Spanischen Sierra Nevada. Von Dr. Johannes Rein. *With Maps. Also separate copy, presented by the Author.*

A thorough geographical study of the Sierra Nevada with regard to all the conditions of the range and of its inhabitants. The memoir concludes with a bibliography of the region.

United Kingdom—England. *Quarterly J. Geolog. S.* 56 (1900): 138–197. **Groom.**
On the Geological Structure of Portions of the Malvern and Abberley Hills. By Prof. T. T. Groom. *With Map.*

United Kingdom—England. **Davison.**
Quarterly J. Geolog. S. 56 (1900): 1–7.
On the Cornish Earthquakes of March 29 to April 2, 1898. By Charles Davison, SC.D. *With Map.*

United Kingdom—England. ——
Sixtieth Annual Report of the Registrar-General of Births, Deaths, and Marriages in England (1897). London: Eyre & Spottiswoode, 1899. Size 10 × 6½, pp. cxliv. and 308. *Price* 1s. 10d.

United Kingdom—North Wales. *Gelog. Mag.* 7 (1900): 18–20. **Dakyns.**
Modern Denudation in North Wales. By J. R. Dakyns.

ASIA.

Asia—Historical. *Rev. Scientifique* 13 (1900): 204–207. **Saint-Yves.**
Les peuples retrouvés de l'Asie Centrale. Par M. G. Saint-Yves.

This article, which is translated from the Russian, deals with the deductions from two ancient monuments on the shores of Lake Tsaïdam and one at Orkhon.

China. **Cholnoky.**
Vándorlásaim a Mennyei Birodalomban. [Cholnoky Jenö.] (Különlenyomat a "Természettudományi Közlöny" 356-ik füzetéböl.) Size 10 × 7, pp. 169–192. *Illustrations. Presented by the Author.*

China—Railways. *Questions Dipl. et Colon.* 8 (1899): 459–468. **Fauvel.**
Les Chemins de fer chinois.—Travail d'organisation. Par M. A. A. Fauvel.

China—Yunnan. *B.S.G. Com. Paris* 21 (1899): 315–324. **Angoulvant.**
Les voies d'accès au Yunnan et le commerce avec ce pays. Par M. Gabriel Angoulvant.

Chinese Geography. **Schlegel.**
Geographical Notes. XIII. Tan-tan or Dan-dan, Dondin? XIV. Ko-la or Ko-la Pu-sa-lo, Kora or Kora Bĕsar. XV. Moa-la-ka, Malacca. By G. Schlegel. Reprinted from the *T'oung-Pao,* vol. x. No. 5. Leyden: E. J. Brill, 1899. Size 10 × 6½, pp. 22. *Presented by the Author.*

Chinese Studies. **Cordier.**
Les études chinoises (1895–1898). Par Henri Cordier. (Extrait du Supplément au Volume ix. du 'T'oung-pao,' No. 5.) Leide: E. J. Brill, 1898. Size 10 × 6½, pp. 142.

Chinese Turkestan. *La G., B.S.G. Paris* (1900): 93–110. **Saint-Yves.**
Turkestan chinois et Pamirs (Juillet-Décembre 1899). Par M. G. Saint-Yves. *With Map and Illustrations.*

Dutch East Indies. **Colenbrander and Van der Chijs.**
Dagh-Register gehouden int Casteel Batavia vant passerende daer ter plaetse als over geheel Nederlandts-India, Anno 1631–1634. (Pp. vi. and 480.) Ditto. Anno 1636. Uitgegeven door het Departement van Kolouiën onder toezicht van Dr. H. T. Colenbrander. 's-Gravenhage, M. Nijhoff, 1898–99. Size 11 × 7½, pp. viii. and

312. Ditto. Anno 1670–1671. Uitgegeven door het Bataviaasch Genootschap van Kunsten en Wetenschappen, met medewerking van de Nederlandsch-Indische Regeering en onder toezicht. Van Mr. J. A. Van der Chijs. 's-Hage: M. Nijhoff, 1898. Size 11 × 7½, pp. 530.

Eastern Asia. **Hannah.**

A Brief History of Eastern Asia. By J. C. Hannah, M.A. London: T. Fisher Unwin, 1900. Size 8 × 5½, pp. xvi. and 304. *Price 7s. 6d. Presented by the Publisher.*

Beginning with China in the remotest ages, the author sketches the history of the whole of Asia, with the exception of Persia and Asiatic Turkey, down to the present day. There is a copious index and a list of books of reference, which would be improved by adding the place and date of publication to the titles.

French Indo-China. *Annuaire Club Alpin Français* **25** (1898): 453–512. **Salles.**

Au Tonkin et en Annam. Par M. A. Salles. *With Illustrations.*

French Indo-China. *Rev. Scientifique* **13** (1900): 11–15, 109–114. **Leclère.**

La culture du riz au Cambodge. Par M. Adhémard Leclère.

French Indo-China—Tonkin. *B.S.G. Paris* **20** (1899): 414–432. **d'Anty.**

De Hanoï à Mongtze. Par M. Bons d'Anty.

India. *B.A.R. Belgique* **34** (1897): 155–208. **Alviella.**

Des influences classiques dans l'art de l'Inde par le comte Goblet d'Alviella. *With Illustrations.*

India. *B.A.R. Belgique* **34** (1897): 484–534. **Alviella.**

Des influences classiques dans la culture scientifique et littéraire de l'Inde. Par le comte Goblet d'Alviella.

India—Andaman Islands. *Indian Antiquary* **28** (1899): 323–331. **Temple.**

Miscellaneous Papers relative to the Settlements in the Andaman Islands in the XVIIIth Century. Preface by R. C. Temple.

India—Historical. *J.E. India Assoc.* **31** (1900): 6–35. **Rattigan.**

The Mogul, Mahratta, and Sikh Empires in their Zenith and Fall. By Sir William Rattigan, Q.C.

India—Railway Communication. *J.S. Arts* **48** (1900): 274–284. **Maclean.**

New Projects of Railway Communication with India. By J. M. Maclean, M.P.

This paper discusses the question of an all-land route to India in its political aspects.

Korea. *La G., B.S.G. Paris* (1900): 35–50. **Monnier.**

A travers la Corée. Par M. Marcel Monnier. *With Map and Illustrations.*

Malay Archipelago. **Van der Kemp.**

Bijd. Taal-, Land- en Volkenk. Med.-Indië **7** (1900): 1–101.

De Commissiën van den Schout-bij-nacht C. J. Wolterbeek naar Malakka en Riouw in Juli—December 1818 en Februari—April 1820. Met aanteekeningen. Door P. H. van der Kemp.

Malay Archipelago—Java. *Ann. Hydrographie* **27** (1899): 581–587. ———

Java, Nordküste.

Malay Archipelago—Java. *B.A.R. Belgique* **34** (1897): 773–781. **Leclercq.**

Les volcans de Java. Par Jules Leclercq.

Malay Archipelago—Lombok. **Faille.**

Tijds. Indische Taal-, Land- en Volkenk. **41** (1899): 416–428.

Bij de situatie-kaart van het lustverblijf te Narmada (Lombok). Door P. de Roo de la Faille. *With Map.*

Persia—Lake Urmi. *J. Linnean S., Zoology* **27** (1899): 345–453. **Günther.**

Contributions to the Natural History of Lake Urmi, N.W. Persia, and its Neighbourhood. By Robert T. Günther, M.A. *With Map and Plates.*

Philippine Islands. *National G. Mag.* **11** (1900): 1–14. **Barrett.**

The Philippine Islands and their Environment. By Hon. John Barrett. *With Map.*

Russia—Turkestan. *Questions Dipl. et Colon.* **9** (1900): 146–162. **Venukoff.**

La Question du Turkestan. Par M. Venukoff.

Sven Hedin's Journeys. Brunner.

Durch Asiens Wüsten. Sven Hedins Reisen und Forschungen 1894–97. Von Heinrich Brunner. Zurich, 1899. Size 7½ × 4½, pp. 70. *Presented by the Author.*

Turkey—Palestine. Clermont-Ganneau.

Archæological Researches in Palestine during the years 1873–74. By Charles Clermont-Ganneau, LL.D. Vol. i. With numerous illustrations from drawings made on the spot by A. Lecomte du Noüy, architect. Translated by Aubrey Stewart, M.A. Published for the committee of the Palestine Exploration Fund, 1899. Size 11½ × 9, pp. xviii. and 528. *Presented by the Palestine Exploration Fund.*

This volume completes the set of the 'Survey of Palestine,' and deals almost exclusively with the archæology of Jerusalem, special prominence being given to the mediæval architecture of the Crusading period.

Turkey—Telos. *Globus* 77 (1900): 46–48. Vincenz.

Ein Besuch auf der Insel Telos. Von Friedrich v. Vincenz. *With Illustrations.*

Yellow Sea. *Ann. Hydrographie* 27 (1899): 577–581. ——

Aus den Reiseberichten Seiner Majestät Schiffe. *With Chart.*

The German men-of-war on the Chinese station are engaged in making additional soundings on the coast of Shantung, and their soundings are being published, as in this instance, on very transparent white tracing paper, intended to be laid over a portion of the British Admiralty chart so as to bring the new soundings into relation with the old.

AFRICA.

Africa—Commerce. ——

Commercial Africa in 1899. Area, Population, Production, Railways, Telegraphs. Transportation Routes, Foreign Commerce, and Commerce of the United States with Africa. [From the summary of Commerce and Finance for August, 1899.] U.S. Treasury Department, Bureau of Statistics. Size 12 × 9½, pp. 321–467. *Map.*

A discussion of the commercial geography of Africa, giving the latest data, with the object of promoting American trade.

British Central Africa. *Scottish G. Mag.* 16 (1900): 82–89. Henderson.

Northern Nyasaland. By the Rev. James Henderson.

An excellent epitome of geographical observations made during several years' missionary work in northern Nyasaland.

Egypt—Fayum. *B S. Khédiv. G.* 5 (1899): 253–295. Zéki.

Une description arabe du Fayoum au VII^{e} siècle de l'hégire. Par Ahmed Zéki Bey.

A description of the Fayum written in the thirteenth century by an Arab writer, Abu Osman el Nabulsi el Safadi.

Egypt—Geography. *B.S. Khédiv. G.* 5 (1899): 297–324. Bonola.

Le Musée de Géographie et d'Ethnographie de la Société. Notice par le Dr. Frédéric Bonola Bey. *With Illustrations.*

The Khedivial Geographical Society opened a museum at Cairo in 1898, containing maps and reliefs of Egypt, and representative collections of the products of all the Egyptian provinces from the Equatorial regions to the Mediterranean.

Egypt—Nile. *Blackwood's Mag.* 167 (1900): 247–249. Wallace

The Low Nile of 1899, in relation to the Cotton Crop of 1900. By S. W. Wallace.

Egyptian Sudan. *Mouvement G.* 17 (1900): 61–63. Henry.

Le commandant Henry sur le haut Nil. *With Map and Portrait.*

Egyptian Sudan. *Scottish G. Mag.* 16 (1900): 89–92. Milne.

The Dry Summer on the Upper Nile. By A. D. Milne, M.B., C.M.

Observations on the rainfall and the volume of the Nile in the Equatorial Province in the summer of 1899.

French Sudan—Timbuktu. Klobb.

Renseignements Colon. Comité l'Afrique Française, No. 9 (1899): 157–168.

La région de Tombouctou : Le dernier rapport du Colonel Klobb.

French West Africa. *J.R. United Service I.* 44 (1900): 111–136. **Hilliard-Atteridge.**
Recent French Expeditions in West Africa, 1894–1899. By Captain A. Hilliard-Atteridge. *With Maps.*

Traces the French explorations and military operations in West Africa from 1894 to 1899.

French West Africa. *B. Comité l'Afrique Française* 9 (1899): 368–372. ———
La réorganisation de l'Afrique occidentale française. *With Map.*

French West Africa. *La G., B.S.G. Paris* (1900): 30–34. **Binger.**
Les Lignes télégraphiques dans l'Afrique occidentale française. Par M. L. G. Binger. *With Map.*

French West Africa. *B. Comité l'Afrique Française* 9 (1899): 362–368. **Bretonnet.**
Le massacre de la mission Bretonnet. *With Portrait.*

German East Africa. *Verh. Ges. Erdk. Berlin* 26 (1899): 437–452. **Bornhardt.**
Herr Berg-Assessor W. Bornhardt: Geographische und geologische Mitteilungen über das deutsche Nyassa Gebiet auf Grund eigener Reisen. *With Map.*

A note on this paper appears in the *Journal* for April, p. 421.

German East Africa. **Oechelhäuser.**
Beiträge Kolonialpolitik u. Kolonialwirtschaft (1899): 1–6.
Die deutsch-ostafrikanische Zentralbahn. Von Dr. Wilhelm Oechelhäuser.

German East Africa—Victoria Nyanza. **Kollmann.**
The Victoria Nyanza. The Land, the Races, and their Customs, with Specimens of some of the Dialects. By Paul Kollmann. London: Sonnenschein & Co., 1899. Size 9½ × 6½, pp. x. and 254. *Map and Illustrations. Price 7s. 6d.*

During his several journeys in the region of the Victoria Nyanza, the author acquired much information regarding the people—their customs and usages, mode of life, and ethnographic relations—and made extensive collections of all kinds. The results are given in the present volume, which is rendered all the more useful by a number of sketches of implements, weapons, etc., used by the natives in this portion of German East Africa. The book is translated by Mr. H. F. Nesbitt.

German South-West Africa. **François.**
Deutsch-Südwest-Afrika. Geschichte der Kolonisation bis zum Ausbruch des Krieges mit Witbooi, April 1893, von C. von François. Berlin: Dietrich Reimer (Ernst Vohsen), 1899. Size 11½ × 8, pp. 224. *Maps. Price 8m. Presented by the Publisher.*

A history of German South-West Africa from the period of its declaration as a German protectorate in 1883 until 1893. The nature of the country and the people are considered, and also the whole question of German colonization during the interesting period when the definite acceptance of its position as a colonial power was still under discussion in Germany.

German West Africa. *Deutsch. Kolonialblatt* 11 (1900): 135–139. **von Kamptz.**
Bericht über die erfolgreiche Beendigung des Wute-Adamaua-Feldzuges. Bericht von Hauptmann von Kamptz.

German West Africa—Togo. **Hupfeld.**
Deutsche Kolonialzeitung 16 (1899): 405–406, 423–424, 433–434.
Die Verkehrsverhältnisse in Togo. Von Fr. Hupfeld. *With Map.*

German West Africa—Togo. **Klose.**
Togo unter Deutscher Flagge. Reisebilder und Betrachtungen von Heinrich Klose. Berlin: Dietrich Reimer (Ernst Vohsen), 1899. Size 10½ × 7, pp. xxii. and 562. *Map and Illustrations. Price 14m. Presented by the Publisher.*

Herr Klose describes the German colony of Togo in considerable detail, both with regard to the country, its productions, and people. The book is richly illustrated.

Madagascar. *La G., B.S.G. Paris* (1900): 1–29, 111–140. **Galliéni.**
Madagascar (1896–1899). Par M. le Général Gallieni. *With Maps.*

Madagascar. **Grandidier.**
Sur les travaux géographiques et cartographiques exécutés à Madagascar par ordre du général Gallieni, de 1897 à 1899. Par M. Alfred Grandidier. (Extrait des *Comptes rendus des séances de l'Académie des Sciences*, t. cxxxix., séance du 10 Juillet 1899.) Size 11 × 9, pp. 8.

Madagascar. *B.S.G. Com. Paris* 21 (1899): 325–337. **Jully.**

Madagascar de 1890 à 1899. Le passé et l'avenir. Par M. Ant. Jully.

Madeira. **Biddle.**

The Madeira Islands. By Anthony J. Drexel Biddle. 2 vols. Volume i., with Forty-seven full-page Illustrations, a Map of Funchal, and a section of the Medici Map, and comprising the History of the Madeiras; Information for the Traveller and Visitor; a Treatise descriptive of the Natives, their characteristics, religion, laws, and customs; and an account of the Commerce. Volume ii., with Twenty-nine full-page Illustrations; Maps of Madeira showing districts devoted to Vine-culture, and the mountains and their heights; and Facsimiles of old Bills of Lading, and treating of the Geography and Geology, the Flora, the Vine and the Wine, and the Fauna. London: Hurst & Blackett, 1900. Size 8½ × 6, pp. (vol. i.) 324; (vol. ii.) 208. *Price 20s. net. Presented by the Publishers.*

In the preparation of these volumes, the writer, we are told in the Preface, had a twofold purpose in view—"to make, on the one hand, a ready-reference book for the student, with a complete set of footnote references and alphabetical lists and indexes; and, on the other hand, a readable narrative for the lover of travel, exploration, and adventure." Judging from the contents, the author appears to have succeeded in these objects, and to have treated his subject very fully. He maintains the early discovery of Madeira by Machin, and supplies a few facts in support of his theory. The large number of illustrations, from photographs, are especially interesting.

Marocco. *Questions Dipl. et Colon* 8 (1899): 321–331. **Kryszanowski.**

Le Maroc français. Par L. Kryszanowski.

The title applies, not to any existing French possession, but to the desirableness of increasing French interests in Marocco.

Niger—Navigation. ——

Renseignements Colon., Comité l'Afrique Française, No. 9 (1899): 174–178.

La navigation du Niger. Rapport sur la flottille du Soudan français.

Northern Rhodesia. *J. Tyneside G. S.* 4 (1900): 264–268. **Hepburn.**

A short account of a Trip to the Kafukwe River. By G. Hepburn.

Sahara—In-Salah. *Questions Dipl. et Colon.* 9 (1900): 65–69. **Bernard.**

L'occupation d'In-Salah. Par Prof. Augustin Bernard. *With Map.*

Sahara—In-Salah. *La G., B.S.G. Paris* (1900): 141–150. **Derrécagaix and Froidevaux.**

In-Salah. Par M. le Général Derrécagaix.

L'occupation d'In-Salah et ses conséquences géographiques. Par M. Henri Froidevaux.

South Africa. **Leclercq.**

A travers l'Afrique Australe. Voyage au Pays des Boers. Por Jules Leclercq. Deuxième Edition. Paris: E. Plon, Nourrit et Cie., 1900. Size 7½ × 5, pp. 336. *Map and Illustrations. Presented by the Author.*

An additional chapter on the history of the Boers is given in the present edition; there is also a larger map of South Africa.

South Africa. *Globus* 77 (1900): 21–24, 42–45. **Fritsch.**

Die Entstehung der südafrikanischen Freistaaten. Von Gustav Fritsch.

Sudan—Indiarubber. ——

Renseignements Colon., Comité l'Afrique Française, No. 9 (1899): 168–172.

Le caoutchouc du Soudan.

Transvaal. *Verh. Ges. Erdk. Berlin* 27 (1900): 60–73. **Schenck.**

Herr Dr. A. Schenck: Transvaal und Umgebungen.

NORTH AMERICA.

America. **Pector.**

Désiré Pector. Notes sur l'Americanisme. Quelques-unes de ses Lacunes en 1900. Préface du Dr. E.-T. Hamy. Paris: J. Maisonneuve, 1900. Size 11 × 7, pp. vi. and 242. *Price 20s.*

This book ranges over the whole of America, from the Arctic to the Antarctic regions, pointing out the gaps in our knowledge of each district, and thus serving to direct attention to explorations and researches which it is desirable to carry out.

Canada—British Columbia. **Hill-Tout.**
P. and T.R.S. Canada 4 (1898) (Sec. 2): 187–231.
Oceanic Origin of the Kwakiutl-Nootka and Salish Stocks of British Columbia and Fundamental Unity of Samo, with Additional Notes on the Déné. By Charles Hill-Tout.

Canada—Quebec. *P. and T.R.S. Canada* 4 (1898) (Sec. 1): 139–216. **Gérin.**
L'Habitant de Saint-Justin. Contribution à la Géographie Sociale du Canada. Par M. Léon Gérin. *With Illustrations.*

A study of the social and economic life of a French Canadian village, giving insight into the relation between the people and their habitat.

Canada—St. Lawrence. *P. and T.R.S. Canada* 4 (1898) (Sec. 3): 3–30. **Keefer.**
Ice Floods and Winter Navigation of the Lower St. Lawrence. (Presidential Address of Section.) By T. C. Keefer, C.M.G. *With Plans and Illustrations.*

Canada—St. Lawrence. *P. and T.R.S. Canada* 4 (1898) (Sec. 2): 107–135. **Sulte.**
The Valley of the Grand River, 1600–1650. By Benjamin Sulte.

A portion of the history of the exploration of Canada, dealing with the opening up of the St. Lawrence valley.

Great Lakes. **Henry and Conger.**
U.S. Department of Agriculture, Weather Bureau. Meteorological Chart of the Great Lakes. Summary for the Season of 1899, vol. ii. No. 9. Prepared . . . by Alfred J. Henry and Norman B. Conger. Washington: Weather Bureau, 1899. Size 12½ × 10, pp. 28. *Charts.*

North America. *B.G.S. Philadelphia* 2 (1899): 55–69. **Russell.**
The Names of the Larger Geographical Features of North America. By Israel C. Russell. *With Map.*

The map is the photograph of a relief model of North America. The paper is referred to in the *Journal* for March, p. 283.

North America—Discovery. *P. and T.R.S. Canada* 4 (1898) (Sec. 2): 77–99. **Howley.**
Vinland Vindicated. By Right Rev. Bishop M. F. Howley. *With Map.*

The author adduces reasons for believing that Helluland was on the west coast of Newfoundland, Markland the Magdalen islands, and Vinland somewhere on the southern shore of the Gulf of St. Lawrence.

North America—Ornithology. **Cory.**
The Birds of Eastern North America. Part ii. Land Birds. Key to the Families and Species. By Charles B. Cory. Special Edition printed for the Field Columbian Museum, Chicago, Ill. 1899. Size 9½ × 7½, pp. x. and 131–387. *Illustrations.*

United States—California. **Bachmann and others.**
Ann. Hydrographie 27 (1899): 587–592.
Port Los Angeles. Nach Berichten der Kapitäne F. Bachmann, R. Mehring, F. Warneke, und C. Christensen. *With Plate.*

The plates show the pier at Los Angeles as it appears from the land and from the sea.

United States—California. *Sierra Club B.* 3 (1900): 109–111. **Jordan.**
The East Basin of Mount Brewer, or Ouzel Basin. By D. S. Jordan. *With Map.*

United States—California. *Sierra Club B.* 3 (1900): 1–107. **Le Conte.**
Ramblings through the High Sierra. (Reprinted from 'A Journal of Ramblings,' privately printed in 1875.) By Joseph Le Conte. *With Illustrations.*

United States—Idaho. *American J. Sci.* 9 (1900): 9–12. **Stone.**
Note on the Glaciation of Central Idaho. By George H. Stone.

United States—Idaho and Montana—Boundary. **Goode.**
National G. Mag. 11 (1900): 23–29.
The Idaho and Montana Boundary Line. By Richard U. Goode. *With Diagram and Illustration.*

A note on this paper appears in the *Journal* for April, p. 422.

United States—Iron Manufacture. *J. Franklin I.* **148** (1899): 437–461. **Fritz.**
The Development of Iron Manufacture in the United States in the Past Seventy-five Years. By John Fritz.

The production of pig-iron in the United States was 53,908 tons in 1810, first reached 1,000,000 tons in 1864, passed 5,000,000 in 1886, and reached 11,773,934 tons in 1898.

United States—New York. *B. American G.S.* **31** (1899): 417–443. **Tarr.**
Physical Geography of New York State. Part ix. The Shore Lines. By R. S. Tarr. *With Illustrations.*

CENTRAL AND SOUTH AMERICA.

Amazon. **Ballesteros.**
Sixto L. Ballesteros. A través del Amazonas. La Paz, 1899. Size 9 × 6, pp. iv. and 104. *Map. Presented by the Author.*

A journey from La Paz down the Rio Beni, Rio Madeira, and Amazon to Pará, executed in the years 1894–95.

Argentina—Locusts. ——
Comisión Central de Extinción de Langosta. Memoria de los trabajos realizados durante el 1er ejercicio con un informe especial de la inspección general, 1897–98. Buenos Aires, 1899. Size 10½ × 7½, pp. 240. *Maps. Presented by Dr. F. P. Moreno.*

On the effort made in the different provinces of the Argentine Republic to stamp out the locust pest. The maps show the position and direction of the locust swarms in each province for several distinct invasions.

Argentina—Pilcomaya River. *S. American Miss. Mag.* **34** (1900): 29–32. **Prida.**
The Ibareta Search Expedition.

Notes of the expedition under Sen. Uriarte in search of the missing explorer, Sen. Ibareta, on the upper Pilcomayo.

Bolivia. **Ballivian.**
La Estadistica de la Goma elástica en Bolivia. (Estudio preliminar.) Por M. V. Ballivian. La Paz, 1899. Size 9½ × 7, pp. 6. *Presented by the Author.*

Bolivia. **Kramer.**
Pedro Kramer. La Industria en Bolivia. (Primera Parte.) La Paz, 1899. Size 9 × 6, pp. 308. *Map. Presented by Don M. V. Ballivian.*

A study of the natural resources of Bolivia, and of the industries which exist in the country or which may be introduced advantageously.

Venezuela—Boundary. ——
Venezuela. Nos. 4, 5, 6 (1899). Venezuela-British Guiana Boundary Arbitration. London: Eyre & Spottiswoode, 1899. Size 10 × 6½, pp. (No. 4) 236, (No. 5) 118, (No. 6) 766 and lxxx. *Price,* (No. 4) 11½*d.*, (No. 5) 6*d.*, (No. 6) 3*s.* 5*d.*

West Indies. ——
West Indies. Further Correspondence relating to the Hurricane on 10th–12th September, 1898, and the Relief of Distress caused thereby. London: Eyre & Spottiswoode, 1899. Size 13½ × 8½, pp. viii. and 96. *Price* 10*d.*

West Indies—Pilot. **Barnett.**
The West India Pilot. Vol. ii. The Caribbean Sea, from Barbados to Cuba; with Florida Strait, Bahama and Bermuda Islands. Originally compiled by Captain E. Barnett, R.N. Fifth Edition. London: J. D. Potter, 1899. Size 9½ × 6, pp. xx. and 686. *Index Chart. Price* 6*s.* *Presented by the Hydrographer, Admiralty.*

AUSTRALASIA AND PACIFIC ISLANDS.

Australia—Aborigines. **Magarey.**
P.R.G.S. Australasia (S. Australia) **3** (1899): 119–126.
Tracking by the Australian Aborigine. By A. T. Magarey.

Australia—Aborigines. *T.R.G.S. Australasia (Victoria)* **17** (1899): 52–63. **Walpole.**
Suggestions as to the Origin and Geographical Distribution of the Aborigines of Australia. By R. S. Walpole. *With Illustrations.*

The author brings forward reasons for his belief that the Australian Aboriginal is descended from the Dravidian tribes now represented in India by the Todas.

Australia—Camels. **Phillipson.**
P.R.G.S. Australasia (S. Australia) 3 (1899): 83–92.
Camels in Australia. By N. E. Phillipson, J.P.

On the introduction of the camel to Australia, and its value in desert travelling.

Australia—Water. **Magarey.**
P.R.G.S. Australasia (S. Australia) 3 (1899): 67–82.
Australian Aborigines' Water-Quest. By A. T. Magarey.

On the art of finding water in the arid desert, especially in the roots of "water-trees."

British Solomon Islands. **Woodford.**
British Solomon Islands. Report for 1898–99. Colonial Reports, Annual No. 275, 1899. Size 10 × 6, pp. 32. *Price 2d.*

Contains report of the journey in Guadalcamar summarized in the *Journal* for January, p. 71.

Paumotu Islands. *Globus* 77 (1900): 13. **Lamprecht.**
Der Name der Paumotu-Inseln. Von G. Lamprecht.

Samoa. *Beiträge Kolonialpolitik u. Kolonialwirtschaft* (1899): 7–12. **Kusserow.**
Zur Samoa-Frage. Von H. v. Kusserow.

South Australia. *T.R.S. South Australia* 23 (1899): 198–207. **Howchin.**
Notes on the Geology of Kangaroo Island, with special reference to Evidences of Extinct Glacial Action. By Walter Howchin. *With Plan and Section.*

South Australia—Tides. **Chapman and Inglis.**
P.R.G.S. Australasia: S. Australian Br. 3 (1899): 93–102.
The Tides of South Australia. By R. W. Chapman, M.A., and Captain Inglis.

Tasmania. **Murray.**
Tasmanian Rivers, Lakes, and Flowers. By A. S. Murray. With Facsimile Reproductions in Colour of numerous Sketches by the Author. Australia: G. Robertson & Co.; London: H. Virtue & Co. 1900. Size 13 × 18, pp. 58. *Presented by the Publishers.*

Striking pictures of the varied scenery of Tasmania, finely printed in colours.

Tasmania—Hobart. *B.S.G. Marseille* 23 (1899): 257–274. **Bourge.**
Les ports d'Australie: Hobart. Par M. Georges Bourge.

Western Australia. ——
The Golden West. Her Mines and Industries, 1899, as represented at the Coolgardie Exhibition. Published by authority of the West Australian Government. Size 17 × 11, pp. 68. *Illustrations.*

Western Australia. ——
Western Australia. Annual Progress Report of the Geological Survey for the year 1898. Perth, 1899. Size 13¼ × 8¼, pp. 64. *Maps. Presented by the Government of Western Australia.*

Western Australia. **Wells.**
P.R.G.S. Australasia: S. Australian Br. 3 (1899): 149–171.
Abstract of Journal of Explorations in Western Australia, 1896–7, under command of L. H. Wells.

POLAR REGIONS.

Antarctic. **Arçtowski.**
Rapport préliminaire sur les recherches océanographiques de l'expédition antarctique belge. Par Henryk Arçtowski. (Extrait des *Bull. de l'Acad. roy. de Belgique* (Classe des Sciences), No. 11, pp. 642–649. 1899.) Size 8½ × 6. *Plates. Presented by the Author.*

Antarctic. *Petermanns M.* 45 (1899): 283–285. **Supan.**
Die erste meteorologische Jahresreihe aus dem Südpolargebiete. Von Prof. Dr. A. Supan.

Summary and discussion of M. Arçtowski's paper in the *Geographical Journal*, vol xiv., p. 418.

Arctic—Andrée Expedition. *Ymer* 19 (1899): 409–443. **Nathorst and Lagerheim.**
Undersökningar beträffande den på Kung Karls land funna stora flytbojen från

Andrée-expeditionen. 1. Den Andréeska polarbojens drift till Kung Karls land. Af A. G. Nathorst. 2. Fyndomständigheter, bojens identifiering, tekniska undersökningar, etc. 3. Om växt- och djurlämningarna i Andrée's polarboj. Af G. Lagerheim. *With Map and Illustrations.*

Full particulars regarding the discovery of the "polar-buoy" of the Andrée expedition, and on the seaweeds with which it was covered.

MATHEMATICAL GEOGRAPHY.

Geodesy. *P. and T.R.S. Canada* 4 (1898) (Sec. 3): 31–37. **Pritchett.**

A Plan for International Measurement of an Arc of the 98th Meridian. By Dr. Henry S. Pritchett. *With Maps.*

Plan for the measurement of an arc of the meridian of 98° W. from 15° N. to 70°, to be undertaken jointly by Mexico, the United States, and Canada.

Latitude Changes. *C. Rd.* 130 (1900): 307–309. **Boccardi.**

Étude sur la variation de la latitude à l'observatoire de Teramo (Italie). Note de M. Jean Boccardi.

Latitude Changes. *B.A.R. Belgique* 36 (1898): 276–281. **Folie.**

Fondements de la théorie de la variation des latitudes. Par F. Folie.

Latitude Changes. *Sitzb. A.W. Wien* 107, Abth. II.a. (1898): 507–514. **Grabowski.**

Einige Bemerkungen zur Erklärung der Polbewegung. Von L. Grabowski. *With Diagram.*

Longitude. *Nautical Mag.* 69 (1900): 98–104. **White.**

Longitude by Eclipses. By J. Dundas White.

Navigation. *Ann. Hydrographie* 28 (1900): 24–28. **Reuter.**

Zur Berechnung der Breiten- und Längenberichtigung nach der Standlinienmethode. Von W. Reuter.

Navigational Instrument. *Rev. Maritime* 143 (1899): 56–60. **Decante.**

Cercle équatorial de relèvement. Par M. E. Decante.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Climate. *Ymer* 19 (1899): 353–403. **Ekholm.**

Om Klimatets ändringar i geologisk och historisk tid samt deras orsaker. Af Nils Ekholm. *With Map.*

On climate-changes and their probable cause.

Geophysics. *B.A.R. Belgique* 35 (1898): 169–172. **Folie.**

Théorie du mouvement de rotation de l'écorce solide du globe. Fondements de l'astronomie sphérique au XX[e] siècle. Par F. Folie.

On the interaction between the solid crust and the inner nucleus of the Earth.

Geophysics. *Scottish G. Mag.* 16 (1900): 60–67. **Geikie.**

A White-hot Liquid Earth and Geological Time. By Prof. James Geikie.

A *résumé* of Prof. Chamberlin's criticism of Lord Kelvin's theory as to the origin and age of the Earth, pointing out that the assumption of the globe having cooled from a white-hot liquid mass is not necessary, but that the Earth might have been built up as a solid body *ab initio* by the slow accretion of meteoric masses.

Glacial Periods. *J. Geology* 7 (1899): 751–787. **Chamberlin.**

An attempt to frame a working hypothesis of the cause of Glacial Periods on an atmospheric basis. III. By T. C. Chamberlin. *With Charts. Also separate copy.*

Mountain Lines. *Rev. Scientifique* 13 (1900): 143–148. **Souleyre.**

Les directions conjuguées des plissements et fractures de l'écorce terrestre. Par M. A. Souleyre.

The author first shows the frequent occurrence of two systems of crust-folds, one at right angles to the other, which he terms conjugated systems; then points out that the two members of a conjugated system are not synchronous, but are associated with igneous rocks of different age; he then finds it necessary to this theory that the movements of the crust should correspond with sunspot periods, and thus it should be possible to predict earthquakes.

Seismology. *Science* 11 (1900): 215–218. **Tucker.**

The Effect of the Mexican Earthquake of January 19, at Mount Hamilton, California. By Prof. R. Tucker.

This records the discovery of an earthquake shock by means of a meridian circle.

Terrestrial Magnetism. *Mém. A.R. Belgique* 53, 2 (1898): 1–40. **Lagrange.**

Magnétisme terrestre. La déclinaison d'une boussole, libre et à l'état statique, est-elle indépendante de son moment magnétique? Observations de déclinomètres à moments différents. Par Charles Lagrange. *With Diagrams.*

Terrestrial Magnetism. *Sitzb. A.W. Wien* 107 Abth. II. a. (1898): 753–776. **Liznar.**

Ueber die Aenderung der erdmagnetischen Kraft mit der Höhe. Von Prof. J. Liznar.

Terrestrial Magnetism. *Terrestrial Magnetism* 4 (1899): 237–239. **Tillo.**

Sur la Rélation qui existe entre la Répartition des Éléments Magnétiques et la Distribution Générale des Mers et de la Température Moyenne Annuelle à la Surface du Globe. Note de M. le Lieutenant Général Alexis de Tillo.

Volcanoes. **Grosser.**

Die Ergebnisse von Dr. Alphons Stübels Vulkanforschungen. Von Paul Grosser. Schöneberg: Berlin, 1900. Size 10½ × 7½, pp. 14. *Presented by the Author.*

A discussion of the results of Dr. Stübel's study of the volcanoes of Ecuador in their bearing on the theory of volcanic action, and especially as regards the doubt they throw on the wide applicability of Suess's rift theory of volcanoes.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Colonization. **Haulleville.**

Alphonse de Haulleville. La Morale de la Colonisation. Deuxième édition. Paris: A. Challamel, 1900. Size 10 × 6½, pp. 44.

Colonization. **Ireland.**

Tropical Colonization. An introduction to the Study of the Subject. By Alleyne Ireland. New York: the Macmillan Company. London: Macmillan & Co., 1899. Size 9 × 6, pp. xii. and 282. *Diagrams.*

The author has had experience for several years in British tropical possessions in Asia and America, and now puts together the results for the benefit of the United States public, to enable them to form opinions as to the best way of governing a tropical colony, how to obtain a trustworthy labour supply, and to understand what the possession of tropical colonies amounts to from the standpoint of the sovereign state.

BIOGRAPHY.

Dawson. *J. Geology* 7 (1899): 727–736. **Adams.**

Sir William Dawson. By Frank D. Adams.

General. **Viterbo.**

Trabalhos Nauticos dos Portuguezes nos seculos xvi. e xvii. Parte ii. Constructores Navaes. Memoria apresentada á Academia Real das Sciencias por occasião da celebração do 4° Centenario do Descobrimento do caminho maritimo da India. Por Sousa Viterbo. Lisboa, 1900. Size 12 × 9, pp. 300. *Frontispiece. Presented by the Author.*

A biographical dictionary of 124 Portuguese shipbuilders of the sixteenth and seventeenth centuries.

Münster. **Hantzsch.**

Sebastian Münster, Leben, Werk, Wissenschaftliche Bedeutung. Von Viktor Hantzsch. (Des XVIII. Bandes der Abhandlungen der philologisch-historischen Classe der Königl. Sächsischen Gesellschaft der Wissenschaften. No. III.) Leipzig: B. G. Teubner, 1898. Size 11½ × 8, pp. 188.

Sebastian Münster was the compiler of one of the earliest geographical text-books published in the sixteenth century.

Smithson. *J. Tyneside G.S.* 4 (1900): 229–230. ——

The Late Mr. G. E. T. Smithson. *With Portrait.*

Wild. *Terrestrial Magnetism* 4 (1899): 273. ——

Professor Heinrich Wild.

GENERAL.

Geographical Congress. **Claparède.**
Souvenirs du VII^e Congrès International de Géographie, Berlin, 1899. Par Arthur de Claparède. Genève, 1899. Size $7\frac{1}{2} \times 5$, pp. 52. *Presented by the Author.*

A very animated description of the proceedings of the Seventh International Geographical Congress.

Geographical Congress. *B.S.G. Madrid* **41** (1899): 249–282. **Lluesma.**
El Congreso internacional de Geografia de Berlin. Reseña de sus tareas, por el Secretario de la Sociedad Geográfica de Madrid. Don Eusebio Jiménez Lluesma.

Geographical Congress. *B.S.G. Italiana* 1 (1900): 9–52. **Vedova, Agostini, Viezzoli.**
Il settimo Congresso Internazionale a Berlino, relazione dei Soci Delegati della Società Geografica Italiana Prof. G. Dalla Vedova, dott. G. De Agostini, Prof. F. Viezzoli.

Geography. *B. Union G. Nord de la France* **20** (1899): 32–45. **Conrad.**
La Géographie et la Science. Par H. Conrad.

Geography. *G.Z.* **6** (1900): 65–89. **Günther.**
Der Humanisms in seinem Einflusse auf die Entwicklung der Erdkunde. Von Prof. Dr. S. Günther.

Geography. **Wagner**
Lehrbuch der Geographie, von Hermann Wagner. Sechste . . . Auflage von Guthe-Wagner's Lehrbuch der Geographie. Erster Band. Einleitung. Allgemeine Erdkunde. Hannover und Leipzig: Hahn'sche Buchhandlung, 1900. Size $9\frac{1}{2} \times 6\frac{1}{2}$, pp. xvi. and 882. *Presented by the Author.*

A monumental work passing in review every department of the science of geography.

Health in Tropics. *G.Z.* **5** (1899): 671–678. **Däubler.**
Ueber die Berechtigung der Anlage von Höhensanatorien in den Tropen, auch mit Rücksicht auf die neuesten Ergebnisse der Malariaforschung. Von Dr. C. Däubler.

On the question of the best situation for sanatoria on the mountains of tropical countries, with special reference to the avoidance of malaria.

Mountains. **Lendenfeld.**
Die Hochgebirge der Erde. Von Robert von Lendenfeld. Freiburg im Breisgau. Herdersche Verlagshandlung, 1899. Size $9\frac{1}{2} \times 6\frac{1}{2}$, pp. xiv. and 532. *Maps and Illustrations.*

Chapters on the origin, structure, and arrangement of mountains and mountain chains and on mountain floras lead to a general account of each of the great mountain chains of the world, with numerous illustrations and maps.

Paradox. **Andrews.**
The Diurnal Theory of the Earth; or, Nature's System of Constructing a Stratified Physical World. By William Andrews. New York: M. Andrews & E. G. Stevens; London: Low & Co. 1899. Size 8×6, pp. xxiv. and 552. *Portrait and Maps. Price 12s. 6d. Presented by Messrs. Low & Co.*

The author of this curious speculation was a man of considerable ability. Born in Philadelphia in 1798, he was a drummer in the war of 1812, and became in turn a bookbinder, journalist, and stationer; but he found time to collect an immense number of geological specimens, and to elaborate the theory described in this volume. He had the self-control to publish nothing, and died in 1887. His executors claim that he takes his place "beside Copernicus, Galileo, Newton, and Darwin." Diurnal revolution is described as a sort of spiral revolution of the Earth, in the course of which "the north terrestrial polar point is taken within 30° of the south sidereal polar point, and returned to within 60° of the point under the North Star, from whence it started."

Place-names—America. *Deutsche Rundschau G.* **22** (1900): 193–202. **Schiller-Tietz.**
Woher stammt der Name "Amerika?" Von Schiller-Tietz.

A summary of the controversy as to the origin of the name "America," now set at rest by the definite proof that Waldseemüller introduced the word as derived from the name of Amerigo Vespucci.

Regional Geography. *B. Union G. Nord de la France* **20** (1899): 27–31. **Ardaillon.**
Programme d'études de géographie régionale. Par M. E. Ardaillon.

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(E. Stanford, Agent.)

England and Wales. **Bartholomew.**

Bartholomew's Reduced Ordnance Survey of England and Wales. Scale 1 : 126,720 or 2 stat. miles to an inch. Sheet 3, Cumberland. J. Bartholomew & Co., Edinburgh. *Price 2s. mounted on cloth. Presented by the Publishers.*

ASIA.

Indian Government Surveys. **Surveyor-General of India.**

Indian Atlas, Quarter-sheets, 4 miles to an inch. No. 66 S.W., parts of districts Bijnor, Almora, Naini Tal and Garhwál, and Native State of Tehri Garhwál (N.W.

Provinces), additions to 1899; 76 N.E., parts of districts Karnal, Nellore, and Kistna (Madras Presidency), 1898; 77 N.W., parts of districts Karnal, Anantapur, Cuddapah, and Nellore (Madras Presidency), 1899.—Skeleton Map of India, 64 miles to an inch. 1899. 2 sheets.—Assam, 48 miles to an inch. 2nd edition, 1899.—Punjab and surrounding countries, skeleton map, 32 miles to an inch. Additions and corrections to 1899.—Sind Survey, 1 mile to an inch. No. 33, district Karachi, Season 1894–97; 77A, part of Kalát (Baluchistán) and district Dera Gházi Khán (Punjab), Season 1897–98; 87 (Preliminary issue), districts Hyderabad and Thar and Párkar, Season 1896–97.—Central India and Rajputána Survey, 1 mile to an inch. No. 474, parts of district Mirzapur (N.W. Provinces), and Native State of Rewah (C.I. Agency), Seasons 1864–65, 1881–82, and 1883.—South Eastern Frontier, 4 miles to an inch. No. 5 S.W. (6th edit.), Seasons 1886–92.—Upper Burma, 16 miles to an inch. 2 sheets (2nd edit.).—District Darbhanga, Seasons 1846–49, 4 miles to an inch. Corrections to 1899.—His Highness the Nizam's Dominions, including the Assigned Districts of Berar, 16 miles to an inch. 2 sheets. Additions and corrections to 1898.—Hill Tippera, Bengal, 8 miles to an inch. Corrections to 1899.—District Rohtak, Punjab, 8 miles to an inch. 1899.—Chart of Triangulation and Traverse. No. 12, Party (Sind), 2 miles to an inch. Sheets 77 and 77A, parts of Kalát (Baluchistán); Nos. 86, 87, 88, 106 (Sind), Seasons 1896–98.—Assam, Index Map showing scales of publication. 1899.—Conventional signs for Cadastral Maps.—*Presented by H.M. Secretary of State for India, through the India Office.*

AFRICA.

South Africa. **Wood and Ortlepp.**

Map of the Orange Free State, southern part of the Transvaal, Natal, Basutoland, and the adjacent parts of Cape Colony. Scale 1 : 1,267,200 or 20 stat. miles to an inch. Wood and Ortlepp, Cape Town and Johannesburg. London: E. Stanford.

This map will be useful for reference in following the movements of troops in South Africa. It embraces the whole of the Orange Free State, Natal, the southern part of the Transvaal, Basutoland, and the adjacent parts of the Cape Colony. Inset plans are given on enlarged scales of Pretoria, Johannesburg, Bloemfontein, Kimberley, Mafeking, Ladysmith, Dundee, and a small general map of South Africa. Although more names of places are given than is usual on maps of this scale, they are clearly written, and do not give the map the appearance of being overcrowded. Railways are printed in black, roads in red, and hills in brown.

GENERAL.

World. **Dickinson and Andrews.**

The "Diagram" Series of Coloured Hand Maps. Designed by B. B. Dickinson, M.A., F.R.G.S., and A. W. Andrews, M.A., F.R.G.S. London: George Philip & Son. *Price* 1*d. each. Presented by Messrs. Dickinson and Andrews.*

This series of orographically coloured maps, of which the following is a list, should prove useful in schools. Names of places are purposely omitted, but spots indicating the positions of the principal places are shown. As the maps have been carefully compiled, and can be purchased for one penny each, they will no doubt soon come into general use for the purposes of geographical instruction. The following is a list of the maps:—

Europe, Germany, Italy, Austrian Empire, the Netherlands, Balkan Peninsula, British Isles, England and Wales, Scotland, Ireland, London District, France, Wales, Asia, S.E. Asia, Indian Empire, Palestine, Africa, South Africa, North America, British North America, South America, Australia.

World. **Ilyin.**

Two charts of the world showing Isobars and Wind for January and February, and June and July. A. Ilyin, St. Petersburg. (In Russian characters.) *Presented by the Publisher.*

World. **Vivien de Saint Martin and Schrader.**

Atlas Universel de Géographie. Ouvrage commencé par M. Vivien de Saint Martin et continué par Fr. Schrader. Paris: Librairie Hachette et Cie. Sheets: Europe Centrale, Inde Méridionale. *Price* 2 *fr.* each. *Presented by the Publishers.*

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, January and February, 1900. *Presented by the Hydrographic Department, Admiralty.*

No.	Inches.	
3110 m	= 3·9	Scotland, east coast :—Cromarty Firth. 2*s*. 6*d*.
3129 m	= 0·92	Arctic Ocean :—Yugorski strait. 1*s*. 6*d*.
703 m	= 7·9	Plans on the north coast of South America :—La Guaira harbour. 1*s*.
3111 m	= 3·9	Isthmus of Panama :—Colon or Navy bay. 1*s*. 6*d*.
3108 m	= 0·25	Brazil :—Rio Doce to cape St. Thomé. 2*s*. 6*d*.
3120 m	= 0·36	United States, west coast :—Bodega head to Abalone point. 2*s*. 6*d*.
3121 m	= 0·36	United States, west coast :—Abalone point to Redding rock. 2*s*. 6*d*.
3103 m	= 0·75	Bay of Bengal :—North part of North Andaman island, with adjacent channels. 2*s*. 6*d*.
3128 m	= {1·4, 0·7}	Anchorages on the south and west coasts of Celebes :—Pare Pare bay. Laikang and Malasoro bays. 1*s*. 6*d*.
1339 m	= 1·42	Samoa or Navigator islands :—North coast of Upolu. 1*s*. 6*d*.
580		Strait of Georgia, sheet 2. New plan :—Tribune bay.
1457		Anchorages in Alaska. New plan :—Doris and Anchorage bays.
2975		Anchorages on the west coast of Yezo island. Plan added :—Mashike Hakuchi.
979		Islands between 160° east and 150° west longitude. Plan added :—Manahiki island anchorage.

(*J. D. Potter, Agent.*)

Charts Cancelled.

No.	Cancelled by	No.
2962 Plan of Yugorski strait on this chart.	New plan. Yugorski strait	3129
2632 Plan of Latakiya on this chart.		
513 Plan of La Guaira harbour on this chart.	New plan. La Guaira	703
1493 Plans of Colon or Navy bay and port Colon on this chart.	New plan. Colon or Navy bay	3111
1457 Plan of Chignik bay, anchorage on this sheet.	New plan. Doris and Anchorage bays	1457
2662 Plans of Pareh Pareh bay and Malasoro bay on this sheet.	New sheet. Plans on south and west coasts of Celebes	3128
1339 North coast of Upolo.	New chart. North coast of Upolo	1339

Charts that have received Important Corrections.

No. 2929, Atlantic ocean :—Currents. 1188, The World :—Coal and Telegraph chart. 240, England, south coast :—Hamoaze. 62B, Channel islands :—Jersey. 2273, White sea, Sheet v. 2274, White sea, Sheet vi. 2353, France, west coast :—Rade de Croisic to Presqu'île de Quiberon. 1131, Island of Corsica. 2802, Greece, east coast :—Euripo town and strait. 2232, Black sea :—Odessa to Sevastopol. 1774, Falkland islands :—Stanley harbour. 2818, United States, east coast :—Hampton roads and Elizabeth river. 2044, Brazil :—Ilha Grande and Sapetiba bays. 2531, United States, west coast :—Cape Mendocino to Vancouver island. 1917, Vancouver island. 2689, British Columbia :—Haro and Rosario straits. 643, Africa, south coast :—Port Natal. 685, Africa, east coast :—Bazaruto bay. Limpopo river. 253, Gulf of Aden :—Jebel Jau to Shab Kulangarit. 2403, Singapore strait. 934, Eastern archipelago :—Surabaya, Bali, and Sapudi straits. 947, Borneo :—Victoria harbour. 214, Solomon islands. 2637, Strait of Makassar, south part. 2662, Eastern archipelago :—Ports in Makassar strait. 2562, China :—Canton river. 166, China :—Pagoda anchorage and approaches. 452, Japan :—Yezo island. 996, Japan :—Kii channel to Yedo. 1016, Australia, south coast :—Corner inlet to Gabo island. 2054, New Zealand :—Cook strait and coast to Cape Egmont. 2535, New Zealand :—Manukau harbour to Cape Egmont. 1469, Solomon islands :—Guadalcanar and Florida islands. 2658, Solomon islands :—Gavutu and Tulagi harbours. 1378, Sandwich islands :—Honolulu harbour.

(*J. D. Potter, Agent.*)

(22) Valle Nuevo; (23) River Chubut; (24) Maniu forest, on both sides of river Mañiuales; (25) Lake Todos los Santos; (26) Lower Corcovado river; (27) River Chubut in the Maiten valley; (28) Valley of river Lenca; (29) Upper Manso valley; (30) Burned wood and "Magui" shrubbery in the narrows of the Puelo valley; (31) Settler's house, Valle Nuevo; (32) Narrows of river Puelo; (33) First big rapid of the Aisen river; (34) Mount Tronador and the Puelo glaciers; (35) Valley of the upper river Futaleufu; (36) Port Tangbac in the Chonos archipelago; (37) Destroyed mani wood in the Mañiuales valley; (38) Rocky narrows in the Mañiuales valley; (39) River Cisnes and Mount Pyramide; (40) River Aisen near its mouth and Mount Maca; (41) The "Boquete" parting the waters between the Puelo and Chubut basins; (42) Rapid, river Aisen; (43) The "Boquete" parting the waters between the Puelo and Chubut basins; (44) Snowy range, bordering Valle Nuevo; (45) Forest in the Central Cisnes valley; (46) Remains of an ancient settlement in Port Tangbac; (47) Rapid and narrows, river Manso; (48) Upper Mañiuales valley; (49) Water-parting region between rivers Cisnes and Apulen; (50) River Puelo in its lower course, and Mount Yate; (51) River Correntoso; (52) Torrentes valley; (53) Junction of rivers Simpson and Mañiuales, and Flores island; (54) Lake Totoral and Puelo valley; (55) Rapid in river Cisnes; (56) Lake Jorje; (57) Glacier-covered range dividing the waters between Lake Fontana and river Mañiuales; (58) Lower valley of the river Manso; (59) The "Porton," upper Mañiuales valley; (60) Lower valley of river Cisnes; (61) Western entrance to the narrows of river Cisnes; (62) River terraces, upper Cisnes valley; (63) Cedro wood, Puelo valley; (64) River Tictoc; (65) Water-dividing region between rivers Pico and Chergue; (66) Outlet of Lake Puelo; (67) Lower valley of river Aisen; (68) River terraces, Cisnes valley; (69) Scenery of a Sub-Andine valley; (70) Destroyed maniu wood, covering the bed of the Mañiuales river; (71) The Estancia Maiten; (72) Maiten valley and the Cordillera ranges; (73) Cedro wood in the Puelo valley; (74) Water-parting range between rivers Pulena and Ninehuan; (75) River Fenix flowing into Lake Buenos Aires; (76) Scenery bordering river Manso; (77) Marching in the Nuevo valley; (78) Valley of river Futaleufu; (79) Largo Maiten tree, Valley Nuevo; (80) Water-dividing region between rivers Pico and Chergue; (81) The "Morro," Cisnes valley; (82) Volcano Osorno; (83) Lower valley of river Cisnes; (84) Corral of Puelo valley, with terraces of former river-levels; (85) Mount Cáceres; (86) Port Carter, mouth of the river Cisnes; (87) Puelo valley and Cordilleras, from Mount Observacion; (88) Crossing river Cisnes on a raft; (89) Water-parting gap in the Caquel range between the rivers Teka and Corintos; (90) Water-dividing region between rivers Pico and Chergue; (91) Western entrance to the river Puelo narrows; (92) Lana Cáceres; (93) Rapid, lower Cisnes river; (94) A lagoon in the Mañiuales valley; (95) River terraces in Cisnes valley; (96) Water-parting region between rivers Cisnes and Shamon; (97) River Belgrano; (98) Cañon-like formation of the Mañiuales valley; (99) Corcorado river; (100) Affluent of river Cisnes; (101) Upper Mañiuales valley; (102) South border of the great basaltic tableland, seen from Sillo valley; (103) Western extremity of the upper Puelo lakes.

Upper Nile. **Stanton**

Nine photographs of the Upper Nile above Fashoda, showing "Sudd," and three of natives, by Major E. A. Stanton. *Presented by Major E. A. Stanton.*

This interesting set of photographs shows, principally, the sudd on the upper Nile and its tributaries; in addition to which there are photographs of natives and their dwellings. The following is a list of their titles:—

(1) Sudd coming down the White Nile near Lake No; (2) Sudd islands drifting down stream; (3) White Nile near Sobat: drifting sudd; (4) Wind breaking pieces of sudd; (5) Composition of the sudd on the Bahr ez Zeraf; (6) Denka war-dance; (7) Camp on White Nile, 25 miles north of Fashoda; (8) On the banks of the Bahr ez Zeraf; (9) Lake No and sudd coming out of Bahr el Ghazal; (10) Piece of sudd being broken up; (11) A Denka man; (12) Shieluks at Fashoda.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

SUMMIT OF

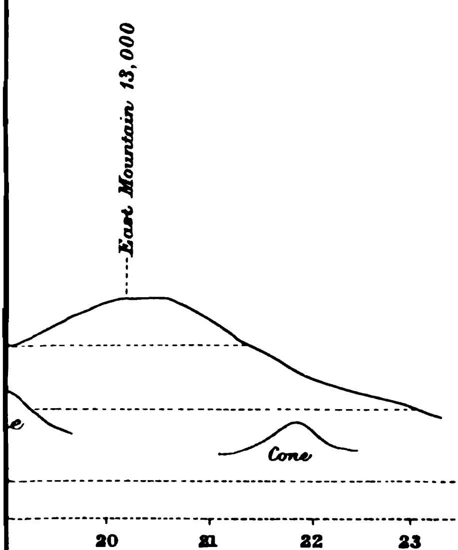
MOUNT KENYA

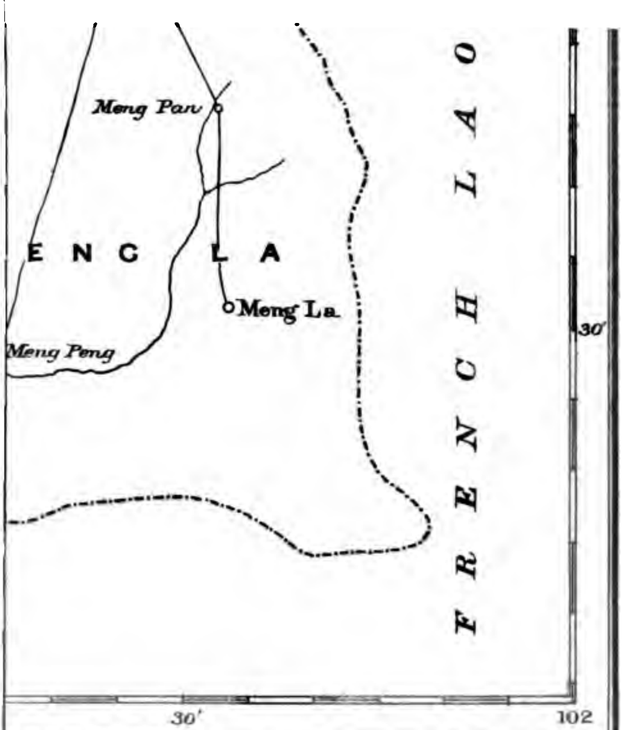
from a survey by

Mr. H. J. MACKINDER

1899

Heights in feet. Route

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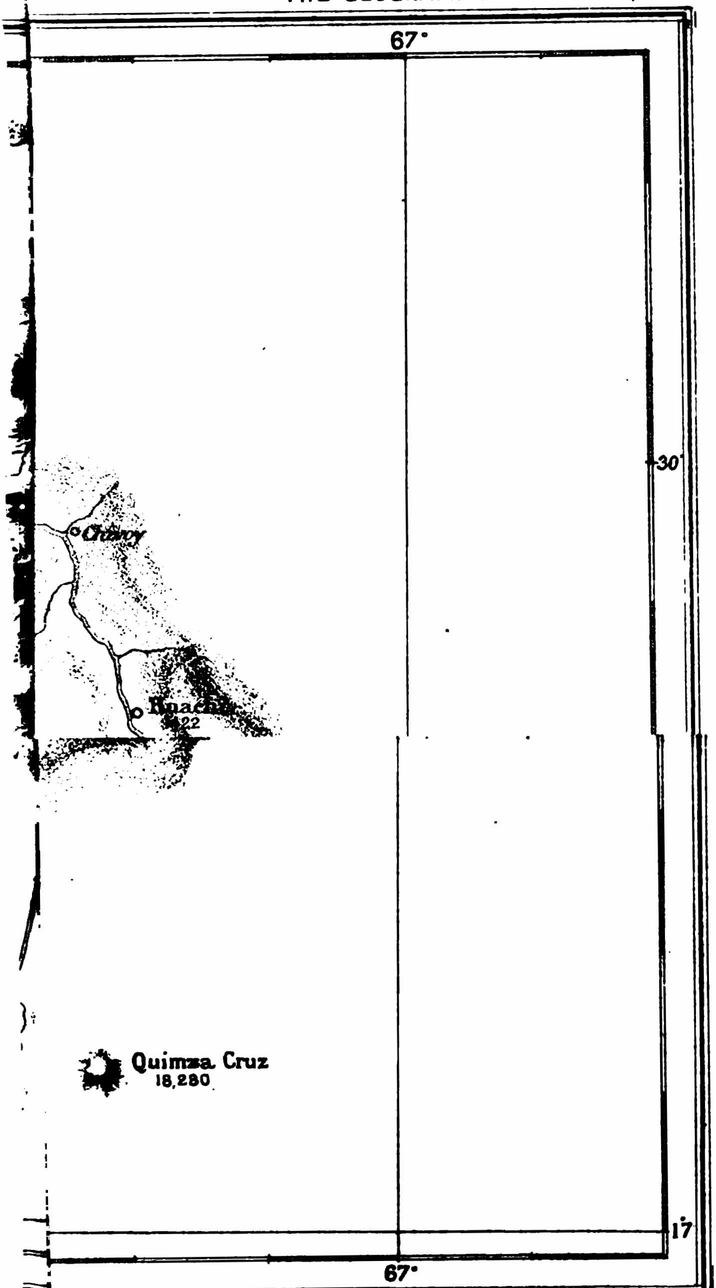
THE GEOGRAPHICAL JOURNAL, 1900.



F.S.Weller, lith.

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The

Geographical Journal.

No. 6. JUNE, 1900. Vol. XV.

TWELVE YEARS' WORK OF THE ORDNANCE SURVEY, 1887 TO 1899.*

By Colonel Sir JOHN FARQUHARSON, K.C.B., R.E.

Preliminary.

I am afraid I am about to deal with a very dry subject. The record of the work of a public department, however interesting to specialists or to those who have taken part in it, can hardly be made interesting to a general audience. For it must necessarily in a large measure consist of dull figures and uninteresting dates. As, however, it is now twelve years since any Survey officer has written or spoken on the subject (the last occasion having been when Sir Charles Wilson read a paper at Manchester on September 6, 1887), I could hardly see my way to refuse when I was asked to write a short account of the recent work of the Ordnance Survey. I can only hope that you will receive what I have to say with as much patience and indulgence as you can.

There is nothing new or original in the paper. Its main subject is the work of the Survey from 1887 to March, 1899, when I left Southampton, but it is necessary to make a few preliminary observations on the previous work of the department.

I have endeavoured to shorten the paper, and to avoid stating to you a number of figures as to areas, which would convey little information to your minds, by preparing shading diagrams to show the progress made by the Survey during the above period upon the various branches of its work. The extent of the shading shown upon each diagram represents the extent of the work done during the twelve years; and

* Read at the Royal Geographical Society, March 20, 1900.

the shading will enable you to see at a glance both the amount of the work done and the localities in which that work has been proceeding.

Another point which I have desired that you should have an opportunity of criticizing is the variety and the quality of the Ordnance Survey maps. Criticisms have been at various times made as to the quality of the latter as compared with the quality of the maps of other countries. The Survey has no desire to avoid such comparisons. I have made a collection both of the English Survey maps and also of the maps of foreign countries, on all the scales available. These collections are open to the inspection of such of you as take an interest in map-making, and I think that they will not only enable you to compare the relative quality of the maps, but that they will, incidentally, also indicate to you the differences between the nature of the work carried out by the National Survey of England and the nature of the work done by the Government map-making departments of other countries.

I. The Work of the Survey from 1784 to 1887.

1. *One-inch Scale Surveys.* 1784 to 1824.

The first operation of the Ordnance Survey of the United Kingdom, namely, the measurement of a base-line in 1784, was undertaken as a consequence of the action of the Government of France. In 1783 the French Government invited the British Government to connect the Paris and Greenwich observatories by a series of triangles. This proposal was supported by the Royal Society, who recommended that General Roy, one of its members, should carry out the work. In 1784 the first base-line was measured on Hounslow Heath, and on September 23, 1787, the triangulation having been carried eastward to the coast of Kent, three French scientific men met General Roy and others at Dover, and arrangements were made for carrying reciprocal observations across the Straits of Dover. Soon afterwards two stations on the French coast (Blanc Nez and Montlambert) were intersected by observations from the two English stations at Dover and Fairlight Down. The result was that the distance from Dover across the Channel as computed from the Hounslow Heath base was found to be 7 feet longer than the distance as computed from the French triangulation.

From the triangulation of Kent thus established, a survey, on the scale of 1 inch to a mile, of that county was undertaken in 1797, and the resulting map in four sheets was published on January 1, 1801. It was a wonderfully good and accurate map for the period at which it was produced.

A second edition of the same survey was published by Colonel Mudge in 1819 as Sheet III. of the old series 1-inch map of England and Wales. This Sheet III. shows that there was by 1819 a considerable improvement in the English style of map-engraving. These old series

1-inch maps of England and Wales were the only maps prepared and published by the Ordnance Survey down to 1824, but they continued to be produced, simultaneously with other surveys, down to 1844, when they had reached as far north as South Lancashire and Yorkshire. They were, especially the later sheets, excellent topographical maps. There are two specimens of them, the sheet containing Birmingham, and the sheet containing Snowdon, in the portfolio of English maps.

2. *Six-inch and 5-feet Surveys.* 1824–1855.

The first advance as to the scales of the Survey was made in 1824, when surveys on the scale of 6 inches to a mile began. In 1824 there was an Irish land question, as there is now; and for valuation purposes the Government gave Ireland 6-inch maps, the 1-inch survey of England being meantime largely suspended. This 6-inch survey of Ireland proceeded from 1824 until its completion in 1840. By that time it had been found so useful for purposes other than those connected with land that the 6-inch scale was adopted by the Government for the survey of the counties of York and Lancaster in England, and of several counties of Scotland, the 1-inch maps to be obtained from the 6-inch by reduction. These 6-inch maps were engraved on copper; there is a specimen in the portfolio of English maps. They were well engraved, and had more numerous contours than the later maps. These 6-inch surveys proceeded from 1824 to 1855.

The towns in the above counties were at the same time—that is, in 1840, ordered to be surveyed and published on the scale of 5 feet to a mile. These town maps were also engraved on copper, and there is a specimen of them in the portfolio of English maps.

3. *Six-inch,* 25-*inch, and* 10-*feet Surveys from* 1855 *to* 1880.

The next advance as to the scales of the Survey was made in 1855.

In the early fifties Parliament had taken up the subject of the best scale for the National Surveys, had held various discussions, and, as might be expected from the constitution of that body, had come to various conflicting decisions regarding it. About this time Sir Henry James had become Director-General of the Survey. He held very strong views on the subject of scales, lost no opportunity of pressing them upon the Government and the country, and in 1855 he gained his point. In that year the Treasury, in accordance with the recommendations of a scientific committee, ordered that for Great Britain the agricultural districts should be surveyed for the scale of 1 : 2500, or about 25 inches to a mile; the towns for the scale of 1 : 500, or about 10 feet to a mile; and uncultivated or mountainous districts for the scale of 6 inches to a mile. The 1-inch maps were to be obtained by reduction from those larger scales; and, later, it was decided that the "Old Series" 1-inch maps, so far as already completed, that is for the whole of England and

Wales south of Lancashire and Yorkshire, should be superseded by a "New Series" 1-inch map based on the new large-scale surveys.

This year, 1855, therefore, marks an entirely new departure in the work of the Survey. Nearly the whole of the survey maps of Great Britain which are now in use are based on the new surveys and scales decided upon in that year, and nearly the whole of the survey work done in Great Britain before that year has been put on one side.

From 1855 until 1880 the Survey had a comparatively quiet time. By 1880 the four northern counties of England and nearly the whole of Scotland were completed on the new scales. Some progress had also been made in England in the south-eastern counties and in the mining districts. At first an endeavour was made to engrave the new 25-inch and 10-feet plans on copper, but the attempt was found to be hopeless; Sir Henry James found that the time taken would be too great, and that the necessary engravers could not be got. The plans on the two largest scales were therefore published by zincography, the buildings being coloured by hand. For these large scales the zincographic method of production has been found for all practical purposes sufficient, while it is much more rapid and much less expensive than copper-plate engraving.

Specimens of the earlier and later 25-inch and 10-feet maps can be seen in the portfolio of English maps. The latest of the changes made in the style of these maps are in accordance with the recommendations of the Departmental Committee of 1892, alluded to later on.

4. *Acceleration of the Cadastral Surveys,* 1880 *to* 1890, *and Completion from* 1887 *to* 1890 *of the Publication of the Cadastral Plans of Great Britain.*

By 1880 a new political question had arisen—that of the cheap transfer of English land. A select committee had reported to the Government that the Ordnance Cadastral Survey was suitable for carrying out this object, and had recommended that that survey should be immediately completed for England and Wales. At the then annual rate of expenditure and the then established strength employed on the survey, it was estimated that it would not be completed until the twentieth century—that is, it would not have been completed now. The Government in 1880 asked Colonel Cooke, the then Director-General, whether, if they doubled his Survey vote, he would undertake to complete the Cadastral Survey of England and Wales within half the estimated time—that is, if he would undertake its completion by 1890 instead of 1900. The question was a difficult one. To double within a limited time the strength of a large number of surveyors involved manifest risk to the accuracy of the work, and accuracy has always been one of the paramount objects of the Ordnance Survey. But Colonel Cooke faced this risk. He drew up a scheme, with estimates, for completing the work, and organized the large additional force which had to be employed.

His confidence was justified by the result. The total estimated cost of the work for the ten years was about £1,600,000. It was completed within the time and cost estimated, and it has stood the test of accuracy as well as the work done before the acceleration, while the cost per acre was not increased. I do not think that Colonel (now General) Cooke has ever received the credit due to him for this service. If, as he might very easily have done, he had declined the responsibility of undertaking it, not merely the Cadastral Survey, but all the smaller scales would have been greatly delayed; Devonshire and the Midlands would still have been without a one-inch map of later date than the earlier part of this century, while any revision of the older maps on all scales could not even now have been begun, much less have made the considerable progress which has been made. It is true that the main object of the acceleration, namely, the cheap transfer of agricultural land, has not even now been attained; but that is not the fault of the Ordnance Survey or of General Cooke; rather, I suppose, it is the fault of our system of government by party. It is true that in 1897, by some happy accident, the present Government at last succeeded in passing a Land Transfer Act; but, hitherto at least, it applies only to the county of London, which had already, long before 1880, had large-scale surveys. The application of the Act to the country in general and to agricultural land remains still a question for the future.

But the acceleration of the survey had caused another change to be made in the method of production of the maps. This time it was the 6-inch maps for which copper-plate engraving had to be abandoned. After 1880 the output of 6-inch maps under the acceleration became so large that the time and cost of copper-plate engraving became prohibitive, and Colonel Cooke decided that those maps should be produced by photo-zincography. Under this method it was possible to publish the 6-inch maps not only as soon as, but earlier than, the maps on the 25-inch scale, while if engraved their publication would have had to be postponed for years. But the exigencies of photography required that they should be published by quarter-sheets instead of full sheets. Recently this difficulty has been got over, and the 6-inch maps of part of Scotland and Ireland are now being published by photo-zincography in full sheets. Although, from the nature of the case, zinc maps can never rival copper-plate maps, the object has been to bring the former as near the latter as possible in quality. Specimens of the various forms of the English 6-inch map are in the portfolio for English maps.

5. *The Departmental Committee of* 1892.

Some of the advantages of the service done by Colonel Cooke in 1880 have been already mentioned, but there is another, which, although not strictly in chronological order, may be mentioned here. In 1892 the Board of Agriculture appointed a Departmental

Committee, of which Sir John Dorington, M.P., was the chairman, and Colonel Johnston, the present Director-General of the Survey, was the secretary, to report upon the work generally of the Ordnance Survey. The committee was a very strong one. It received a large amount of evidence, and made a most valuable report, which has in every way greatly strengthened the position of the Survey. But many of their recommendations, the most important of which have been given effect to by the Board of Agriculture, and which have either been already alluded to or will be alluded to later on, could not have been carried out unless the acceleration of the Cadastral Survey of Great Britain had been completed, as it had been, before the committee was appointed.

II. The Work of the Survey on Large-Scale Maps from 1887 to 1899.

1. *Completing the publication of the Cadastral Survey of Great Britain.* 1887–1890.

We have now reached the period in the history of the Survey—1887 to 1899—with which this paper has mainly to deal, and it will be convenient to divide the account of the work done during that period into two heads, namely, first, maps on the larger scales—that is, maps on scales of 6 inches to a mile and upwards; and, secondly, maps on the smaller scales, namely, maps on scales of 1 inch to a mile and less, usually called topographical maps.

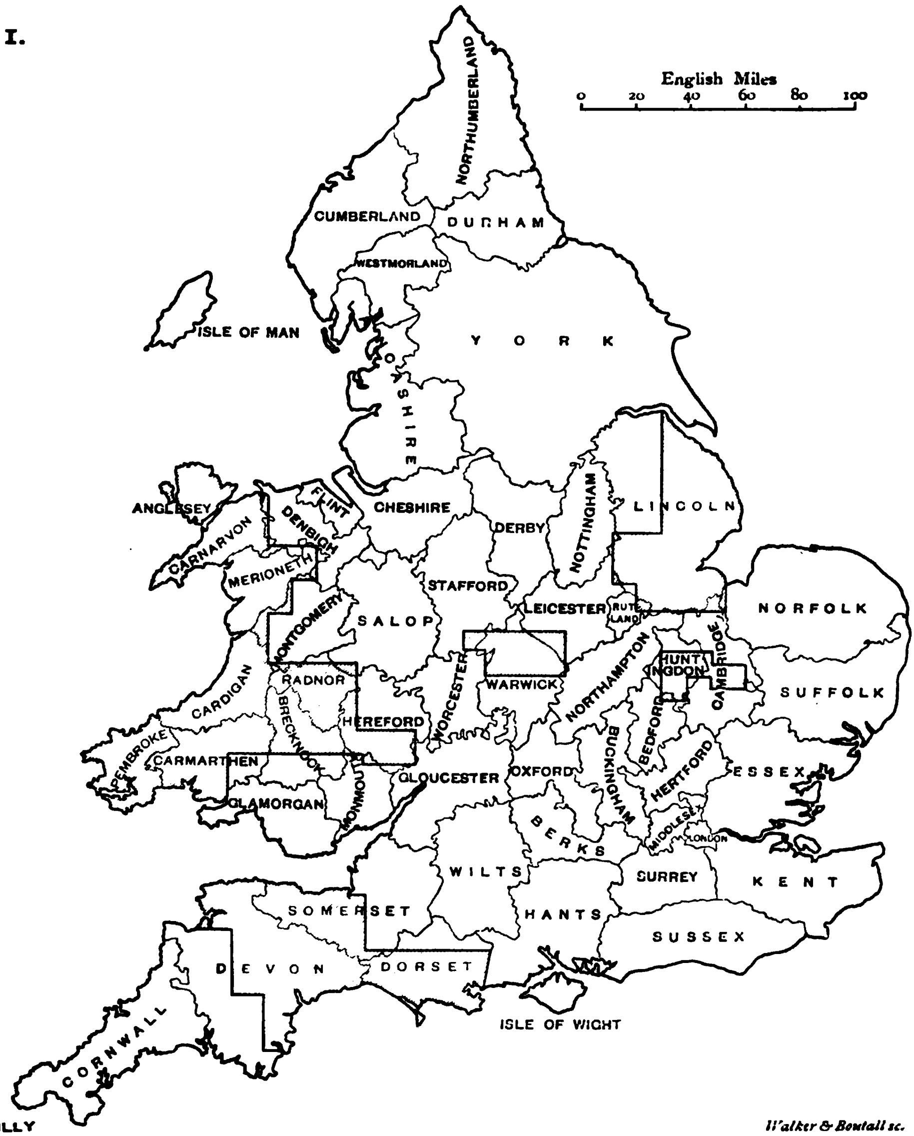
It has been stated above that Colonel Cooke in 1880 had undertaken that the survey would complete and publish the large-scale or cadastral survey of England and Wales by 1890. By 1887 the field work and most of the manuscript plans for the accelerated survey had been practically completed, and little remained to be done except to finish the publication of the maps. From 1887 to 1890 this work was pushed on as rapidly as possible by Colonel Bolland, who was then in charge of the Publication Branch of the Survey, and by 1890 it was complete, as had been in 1880 promised by Colonel Cooke.

Diagram No. 1 shows the area published after 1887. It amounts to about 10,000 square miles.

2. *Large-scale Revision Surveys, ordered* 1886.

Apart from the completion of the publication of the Cadastral Survey just mentioned (1887 to 1890), the principal work of the Survey in Great Britain from 1887 onwards assumed the character of revision surveys as distinguished from original surveys. In November, 1886, Colonel Sir Charles Wilson was appointed Director-General. It was fortunate for the Survey that an officer so able and distinguished, and

No. I.



COMPLETION OF PUBLICATION OF CADASTRAL SURVEY OF ENGLAND AND WALES.

Published 1887-93,

of so large a survey experience both at home and abroad, took charge of the work at so important a time. He had practically to organize not only most of the work which filled up the period from 1887 to 1899, but much of the work which will go on for the next ten years. Just as the name of General Roy is associated with the commencement of the Survey, of General Colby with the great triangulation and the introduction of 6-inch maps, of Sir Henry James with the introduction of the 25-inch and 10-feet maps, and of General Cooke with the acceleration of the Cadastral Survey, so will Sir Charles Wilson's name be associated with the commencement and organization of the work of Revision Surveys for Great Britain, the necessity for which had long been pressed upon the Treasury by successive Directors, but which it fell to him to begin.

3. *Preliminary Re-surveys and Revisions, and Completion of the Original or First Edition 25-inch Maps of Great Britain.* 1887 *to* 1894–95.

On December 22, 1886, about a month after Sir Charles Wilson had been appointed Director-General, the Treasury authorized a revision of the original 10-feet, 25-inch, and 6-inch maps of the Survey to be carried out. Later it was decided that maps on those scales should be revised at intervals of twenty years, and the 1-inch maps at intervals of fifteen years. But before the revision proper, that is, on the same scale, of the original 25-inch maps could be taken up, there was a good deal of preliminary work to be done, and the first work to be undertaken was a re-survey on the 25-inch and 10-feet scales of Lancashire and Yorkshire. Those counties had, as has been above stated, been surveyed for the 6-inch and 5-feet scales about forty-years before, and that survey had been reckoned as part of the Cadastral Survey of England. But it was plain that they were now at a disadvantage as compared with the rest of Great Britain, which had been provided with 25-inch and 10-feet maps. Their re-survey was begun in 1887 and completed in 1892.

There followed a re-survey on the 25-inch and 10-feet scales of the counties of Scotland and of the island of Lewis, which had been surveyed for the 6-inch and 5-feet scales over thirty or forty years before, and which were therefore on the same footing as Lancashire and Yorkshire. Their re-survey began in 1892, and was completed in 1895. By the publication in 1895 of the last 25-inch map of the island of Lewis, there was completed the original or first edition of the 25-inch survey of Great Britain, which had been begun under Sir Henry James in 1855, just forty years earlier.

The most prominent feature in the re-survey of Yorkshire and Lancashire was the immense development of towns and urban districts since the last survey. Practically the whole of South-west Yorkshire and South Lancashire had to be entirely re-surveyed, the original survey being quite lost in the universal additions to, and changes in, the buildings and streets which had been first surveyed. Although the town or 10-feet surveys were curtailed as much as possible, yet for the two counties they extended over 124,745 acres, requiring about 3250 plans. The same feature occurred in the revision of London on the 5-feet scale, which followed on the re-survey of Lancashire and Yorkshire. It included the town survey of 116,582 acres, requiring about 760 5-feet plans. An entirely new survey had to be made of the whole of the outer ring of London. It was begun in 1890 and completed in 1894.

Re-surveys or revisions of the 10-feet plans of Edinburgh, Glasgow, the Tyneside towns, and Plymouth were taken up and completed about the same time. Their original large-scale plans were very old.

The total number of plans of the above towns, which were completed from 1887 to 1894, amounted to nearly 5000, covering an area of 275,000 acres, or about 410 square miles. When it is remembered that the scale of most of these plans is about 40 feet to an inch, that is, large enough to show door-steps, which are in fact shown on them, the laborious and costly nature of this town work will be understood.

Complaints have been made, and down to quite recently, of the slow production of its topographical maps by the Ordnance Survey as compared with the rapid production of their topographical maps by other countries. The systems in this country and abroad are so different that there are no grounds for such comparisons. Foreign countries do not publish at all such maps as our plans on the 10-feet or even the 25-inch and 6-inch scales; they only publish topographical maps analogous to our 1-inch maps. France, for instance, with the exception of a few towns on a scale of about 3 inches to a mile, publishes no maps on a scale larger than 1 : 50,000, which is a little larger than our 1-inch map on the 1 : 63,360 scale. The result is that the whole of France, about 206,000 square miles, is covered by 1100 of these 1 : 50,000 sheets. I have had two diagrams prepared, both on the same scale. One (Diagram 1A) is of Great Britain, of which the total area is about 91,000 square miles, showing by shading the areas—amounting to a few hundred square miles—for which, from 1887 to 1894, as above stated, the Ordnance Survey had to prepare nearly 5000 maps. The other shows the area—about 206,000 square miles, namely, the whole of France *—for which the French General Staff would have to prepare only about 1100 maps. A comparison of these two diagrams, and of the relative number of maps, shows the entirely different nature of the work done by the respective Government map establishments of the two countries.

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* It is not thought necessary to print this diagram of France; any map of France will show the area.

No. 1a.

CH THE SURVEY PREPARED 4913 TOWN-SCALE PLANS, 1887–1894.

Lancas' ... lon, Tyneside Towns, Edinburgh, Glasgow, Plymouth—Area published 1837-94.

4. *Abandonment of the Town Scales.* 1894.

But the large amount of work thrown upon the Survey by the town scales from 1887 to 1894 had drawn attention to the great, and rapidly increasing, cost and delay which they involved. The Departmental Committee of 1892 recommended, after hearing Sir Charles Wilson's evidence, that in future all towns should bear the cost of keeping up their own maps on any scale larger than 25 inches to a mile; and in 1893 the Board of Agriculture asked the Survey what would be the relative cost of revising the whole of Great Britain, firstly, if the town scales were retained, and, secondly, if they were abandoned. The answer was to the effect that if the towns were to be revised on the 10-feet scale the cost of revision would be about 50 per cent. more than if the whole country were revised only on the 25-inch and 6-inch scales. The Treasury then, in January, 1894, ordered that in future these town surveys should not in Great Britain be carried out except at the cost of the towns themselves. This decision was amply justifiable, and has given great relief to the work of the Ordnance Survey. Town surveys had gone on from 1855 to 1894, or nearly forty years. During that time every town of any importance in Great Britain has been provided with either 5-feet or 10-feet plans, which it can if it pleases keep continuously up to date at no great difficulty or expense.

Specimens of these town maps at various periods are in the portfolio of English maps.

5. *General Revision of the* 25-*inch and* 6-*inch Maps of Great Britain.* 1894–1899.

By 1894 the preliminary re-surveys or revisions of Lancashire and Yorkshire, the six Scottish counties, and the towns above mentioned, had been completed, and it was possible to begin, for the first time, that regular and general revision of the original 25-inch and 6-inch maps of Great Britain, which it is intended in future to carry out every twenty years. The districts which had the oldest surveys were taken up first; they were mainly in the north of England and south of Scotland. The work was of a kind new to the Survey. Chain surveyors had to be trained to take the original maps to the ground, and plot on them to scale the alterations which had taken place, and the draughtsmen in the field divisions had to be trained to trace the revised maps for zincography. The work has, however, proceeded rapidly. The rate of progress is two or three times that of the original survey. But there is a danger for which the Director-General may have to provide. One of the survey divisions has already been seriously retarded by having to revise a large town at the town's expense on the 10-feet scale. If many such cases occur either additions should be made to the survey strength, or the work will not be completed by 1910, the estimated time.

In 1896 a scheme, based partly upon extent of country, partly upon population, was drawn up under which each of the eight survey divisions in Great Britain is the centre of a district of which it will in future carry out revision surveys. It is, however, liable to modification according to the results of experience.

There have had to be changes in the method of producing the revised 25-inch maps, which are produced partly by zincography and partly by photo-zincography. The buildings on these maps are now printed cross-ruled instead of being coloured by hand, a change recommended by the committee of 1892, but which would in any case have had to be adopted after 1894; it would be impossible without adding largely to the buildings and staff at Southampton to colour by hand the largely increased number of maps now printed.

The progress on all the 25-inch and 6-inch re-surveys and revisions from 1887 to 1899 for Great Britain is shown on diagram No. 2. It will be seen that by far the most difficult areas of the country, and most of the oldest maps, have been re-surveyed or revised since 1887, but part of this area will come within the twenty-year limit, and will have to be again revised before 1910. I have, however, for the sake of simplicity, included in one diagram all the large-scale re-surveys and revisions carried out from 1887 to 1899.

6. *25-inch Re-survey of Ireland.* 1887–1899.

Meanwhile, while the work of the Survey in Great Britain had changed from surveys to revisions, the work in Ireland had changed from revisions to re-surveys. I have already stated that in 1840 Ireland had 6-inch maps for the whole of the island, and was then as to its maps far ahead either of England or of Scotland. By 1887 it was as much in arrear as it had been ahead in 1840. With the exception of County Dublin, which had been surveyed and published on the 25-inch scale, Ireland had still in 1887 only its 6-inch maps. In the end of the latter year the Treasury sanctioned the re-survey of Ireland for the 25-inch scale; but it was not until 1891 that two additional survey divisions, one at Ennis and the other at Cork, could be organized for the work. Since 1891 the progress of the work has been slow. It has been all in what are usually called the congested districts in the west of Ireland. I have obtained one of the maps of these districts on the 25-inch scale, as an example of the kind of work that has had to be done. This map has more than fifteen hundred enclosures, or parcels, as we call them on the survey; the area of the whole map is 960 acres, so that the average area of each enclosure is about two-thirds of an acre. The Survey had previously not met with work so laborious in any agricultural or country

No. 2.

Walker & Boutall sc.

PROGRESS ON LARGE-SCALE RESURVEYS AND REVISIONS OF GREAT BRITAIN.

Resurveyed or revised 1887 to March, 1893, ■

district, and I am glad to hear from the present Director-General that he has been authorized to organize a fourth division for pushing on the re-survey of Ireland.

The diagram No. 3 shows the progress which has been made in the field on the re-survey of Ireland on the 25-inch scale up to March, 1899; and the specimen 25-inch map of County Mayo above mentioned, as well as, for comparison, an ordinary English 25-inch sheet near Canterbury, and a Scotch sheet, are in the portfolio of English maps.

III. The Work of the Survey on Small-Scale Maps from 1887 to 1899.

1. *Completion of Original* 1-*inch New-series Map of England and Wales in Outline.* 1887–1896.

Having now completed the record from 1887 to 1899 of the large-scale maps, I will turn to the record for the same period of the topographical maps on the 1-inch and smaller scales; and the first of these is the first edition of the new-series outline map of the United Kingdom on the 1-inch scale.

On December 31, 1887, the outline 1-inch maps of Scotland and Ireland were complete, but 220 sheets of England and Wales remained unfinished. They were completed in 1896. All these 1-inch maps have been obtained by reductions from the Cadastral or large-scale maps of Great Britain and Ireland. It has been contended that it would have been better to have made an entirely independent 1-inch survey of the whole country. I doubt this. At any rate, I believe one thing is certain, namely, that we are much better off now with the 1-inch maps based on the larger scales than we should have been if a separate 1-inch map had been made.

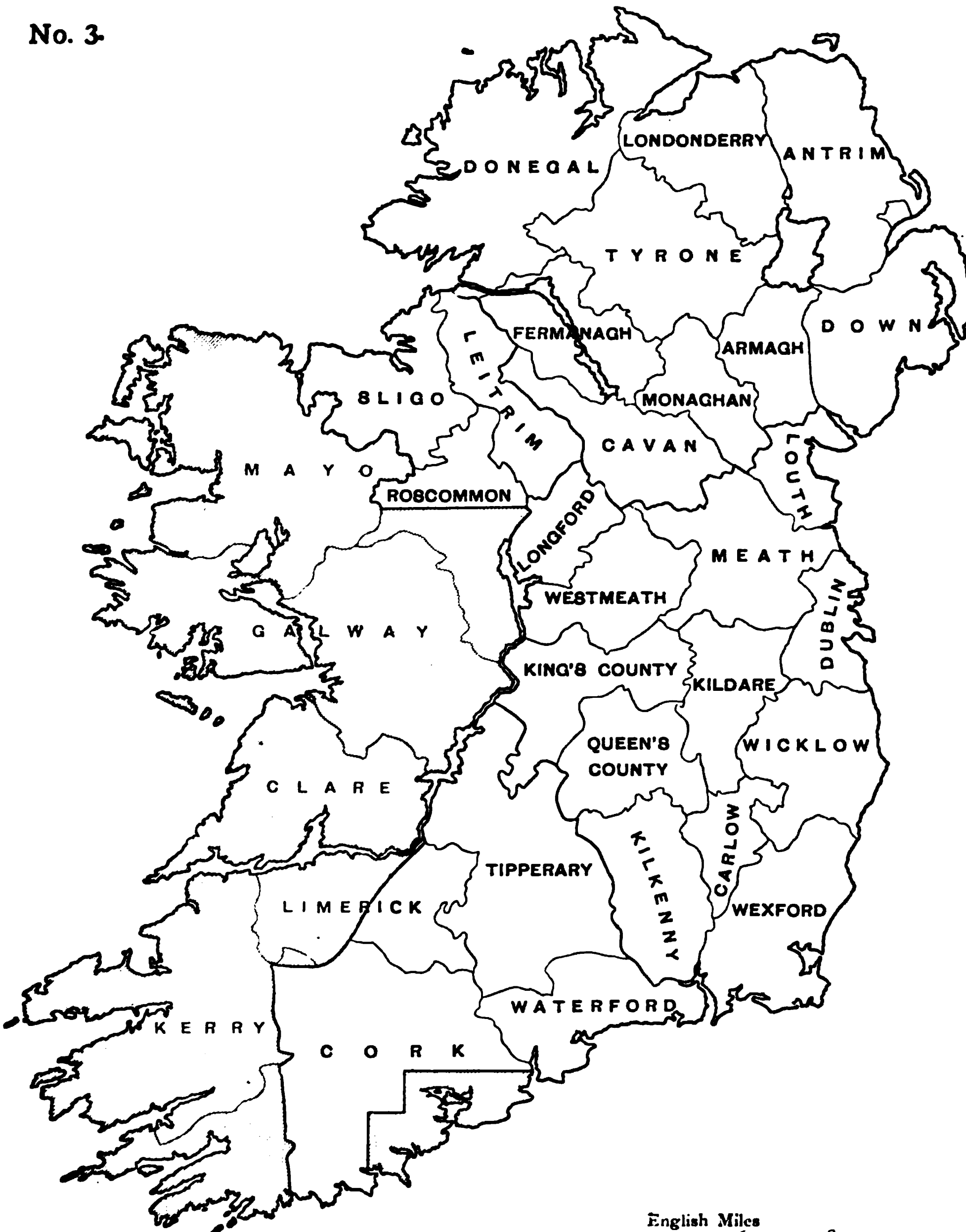
Specimens of the various kinds of the 1-inch maps of Great Britain, from the earliest to the latest, are in the portfolio for English maps.

Diagram No. 4 shows the progress made on engraving the 1-inch outline map of England and Wales from 1887 to its completion as above-mentioned in 1896.

2. *Progress of the* 1-*inch Hill Map of the United Kingdom, New Series, from* 1887 *to* 1899.

As to the 1-inch map of the United Kingdom with engraved hill features, about 40 sheets of Scotland out of 131, most of them containing only islands, about 30 out of 205 sheets of Ireland, and about 280 out of 360 sheets of England and Wales, remained to be completed on December 31, 1887. Scotland and Ireland were completed in 1895. On March 31, 1899, about 100 full sheets of England and Wales still remained to be engraved with hills, so that about 180 sheets of England,

No. 3.

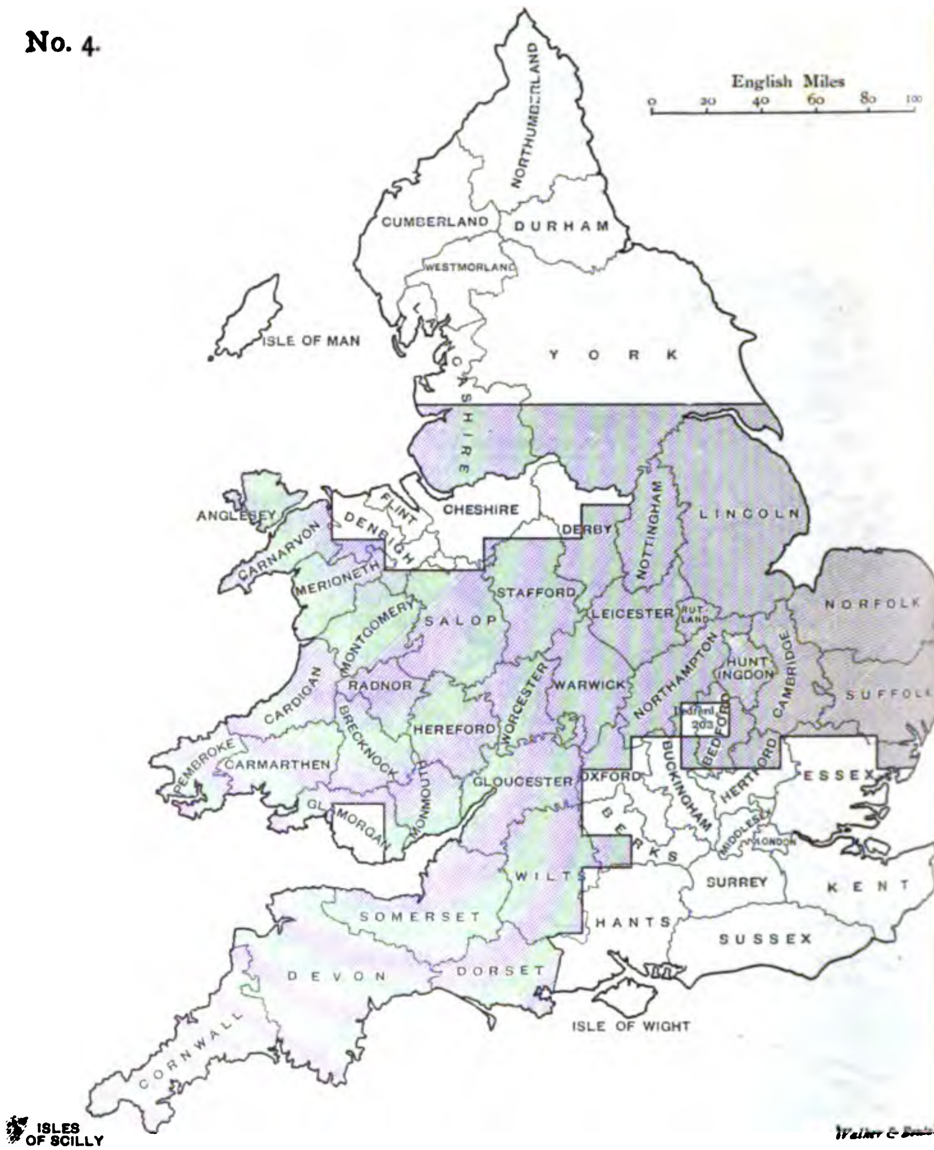


Walker & Boutall sc.

IRELAND: PROGRESS ON 25-INCH RESURVEY.

Resurveyed 1891 to March, 1899.

No. 4.



COMPLETION OF ENGRAVED 1 INCH OUTLINE MAP OF ENGLAND AND WALES.

Engraved and published 1837-96,

40 of Scotland, and 30 of Ireland were completed from 1887 to 1899. The estimated date for completion of the entire work in the United Kingdom was at one time 1925, later it was 1910, now it is 1902. I do not now think the work can be satisfactorily completed by 1902, and I think the Director-General should apply for authority to extend the time for either two or three years. Competent hill engravers are most difficult either to get from outside or to train in the department. It must be remembered that this work once done remains always good, that great part of that already done has been extremely well done, that the most important part of the country from a military point of view is already completed, and that, judging by the sales, the general public prefers using the outline map to using the hill map. I have no doubt that undue pressure for completion will injure the quality of the sheets remaining to be done. Owing to this pressure, I had recourse some time ago, but only as an experiment, to a firm in London to push on the work. Some of the work done by them had not in 1899 turned out as satisfactory as had been expected. Unless their work has since considerably improved, I think that this mode of accelerating the hill engraving should be abandoned, and that more young engravers should, if possible, be trained to this duty by the Survey itself.

Specimens of the English hill-maps are in the portfolio. For the South of England the hills can be printed either in black or brown from the copper plates. For that district the hill features have since 1889 been engraved on separate plates, and this system will be continued as far north as South Lancashire and Yorkshire.

Diagrams Nos. 5 and 5A show the progress made with the engraving of the hill-maps of the United Kingdom since 1887.

3. *Revisions of the Small-scale Maps. Completion of Revision of the Outline New Series, One-inch Map, Great Britain.* 1893–1899.

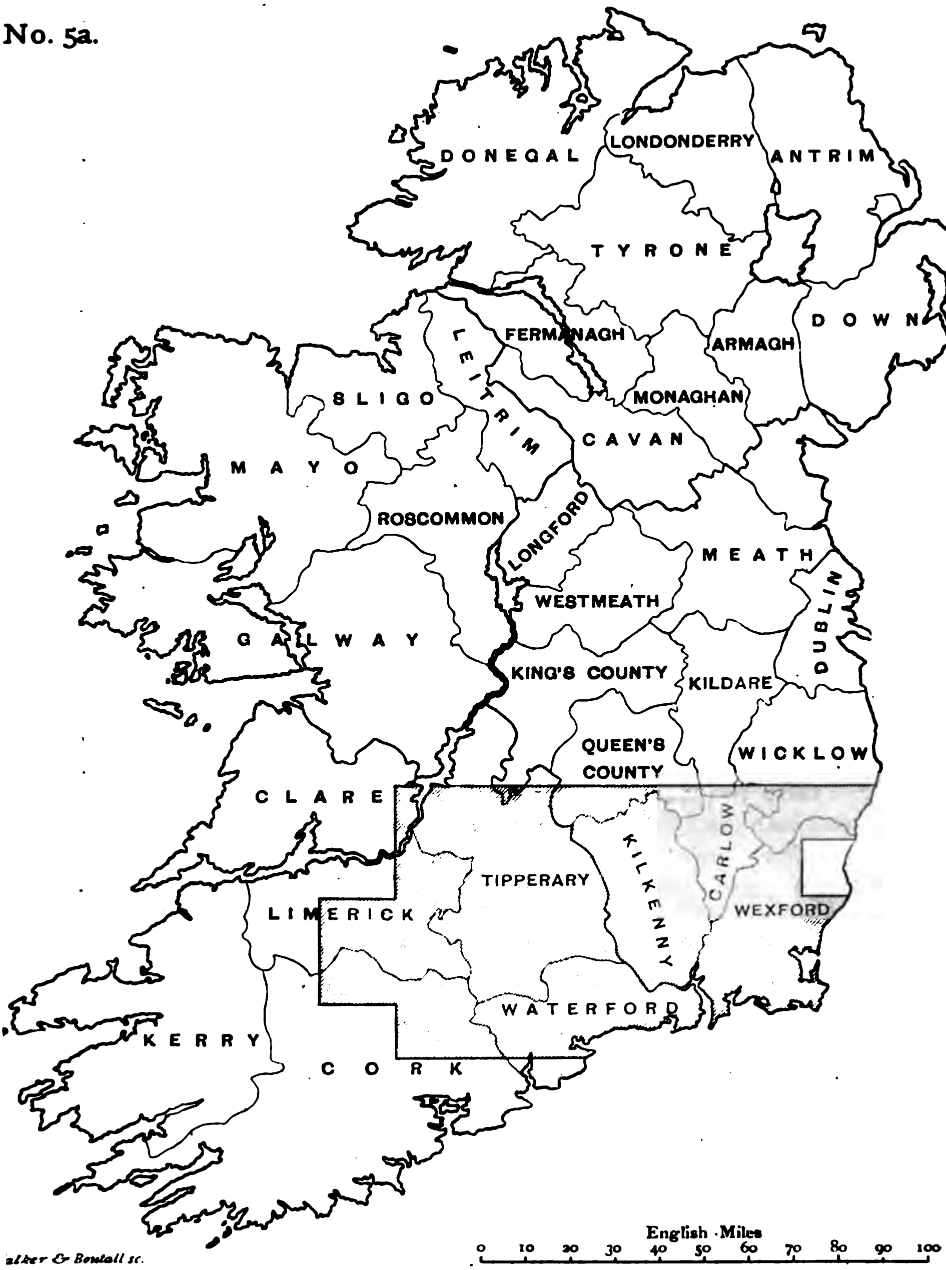
The Departmental Committee of 1892 recommended that the revision of the 1-inch map of the United Kingdom should be carried out independently of the revision of the maps on the larger scales, and this recommendation has been given effect to by the Board of Agriculture and the Treasury.

The revision in the field of the 1-inch maps of Great Britain was begun in 1893, but all the engravers were not free to go on with the engraving of this work until the original outline 1-inch map was completed in 1896. Thereafter the work proceeded very rapidly, and last March it was practically completed for Great Britain. A large area of Ireland had also been revised, and part of the revisions had been engraved by March, 1899; the same methods of representing detail being as far as possible followed as in the case of the revised 1-inch maps of Great Britain.

No. 5.

PROGRESS ON ENGRAVED 1-INCH HILL MAP OF GREAT BRITAIN.

Engraved and published 1887 to March, 1899, No. 5a.



COMPLETION OF ENGRAVED HILL-MAP OF IRELAND.

Engraved and published 1887-95, ■

Sir Charles Wilson's original estimate for this work was only for a revision of the 1-inch maps of Scotland and of about two-thirds of England and Wales, the rest of England and Wales to be completed more gradually. But it seemed to me that an excellent opportunity now presented itself for obtaining a 1-inch map on the same uniform lines, and nearly up to date, for the whole of the United Kingdom. The Board of Agriculture readily concurred, and obtained the sanction of the Treasury to this work being carried out at once to completion, not only for Great Britain, but also for Ireland.

Diagram No. 6 shows the area of 1-inch revision of Great Britain completed from 1893 to 1899. It amounts, as above stated, to practically the whole of the area of Great Britain, only some five or six sheets in the Midlands remaining to have the engraving completed on March 31, 1899.

4. *Revised 1-inch Maps of Scotland, Ireland, and the North of England, with Hills in Brown.* 1898–1899.

The revision of the 1-inch maps of Scotland and the north of England was only carried out on the outline copper plates, and not on the hill copper plates, which contained both names and detail. To have carried out the revision on these hill plates would not only have doubled the cost of the engraving but would have damaged the hill features. On the other hand, if these hill-sheets are unrevised, they will go out of use, and their original cost will be thrown away. The difficulty has been got over by preparing one zinc plate with the hills only, and another zinc plate with only the revised detail and the names. From these two zinc plates, by double printing, a map is obtained containing both the hill features and the revised details. As the hills on this revised map are printed in brown, it is in many respects clearer than the original engraved hill-map, especially in the more mountainous districts, where the engraved hills, printed in black, although very artistically executed, are extremely dark, and obscure the names and detail. The revised map also has the contours, which the original hill-map has not.

Two specimens of Sheet 54 Scotland ("Loch Rannoch"), one being the original unrevised sheet with the hills in black, the other being the revised sheet with the hills in brown, can be compared in the portfolio of English maps. This map should be pushed on rapidly for Scotland, the North of England, and Ireland, as the revision of the 1-inch maps in the case of those countries or districts cannot be considered complete until it is done. Only a few sheets of Scotland had been published on March 31, 1899 (see Diagram No. 7).

5. *Progress of One-inch Coloured Map. England and Wales.* 1893–1899.

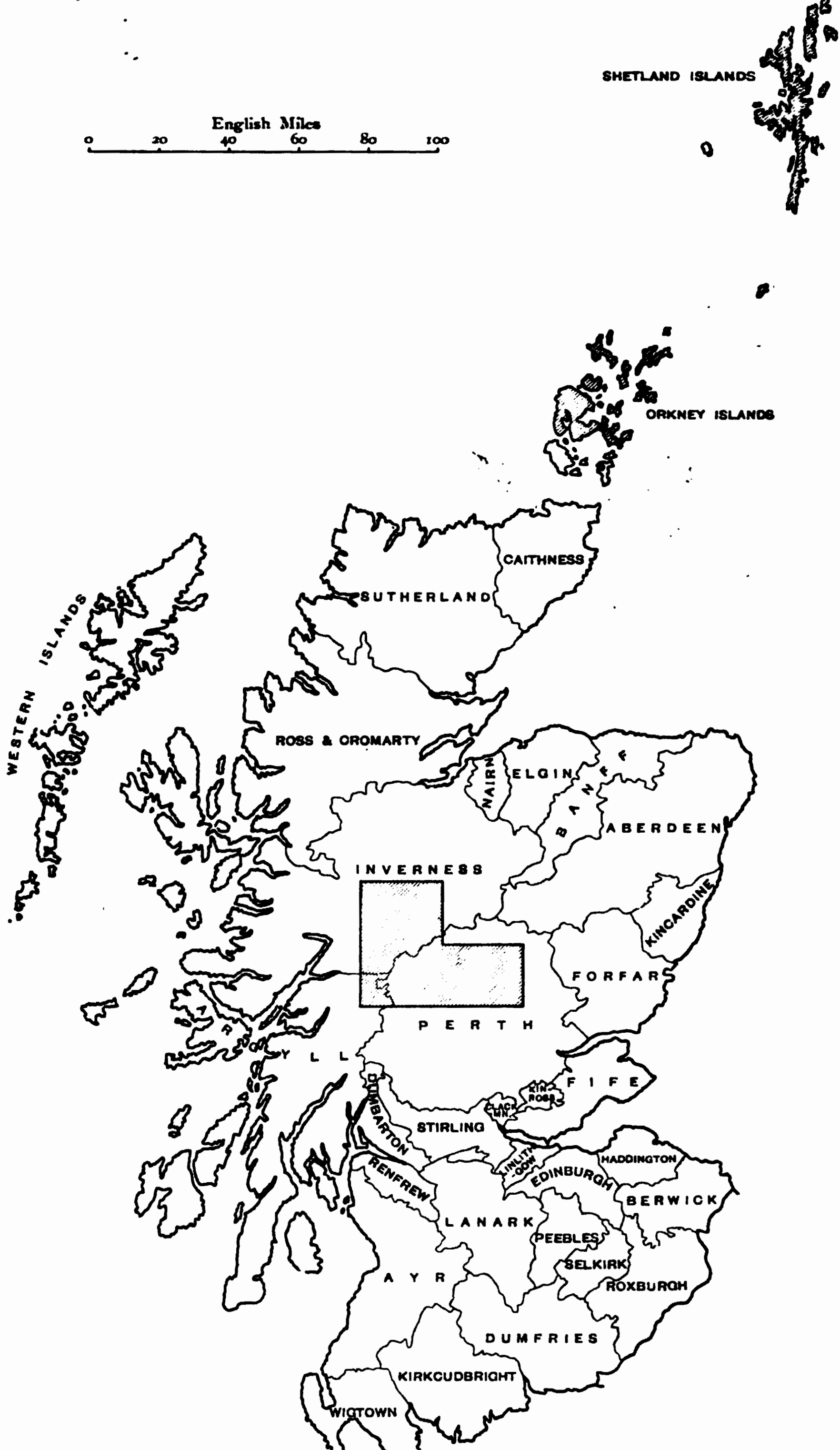
In March, 1892, the War Office appointed a Committee, of which Sir Charles Wilson was a member, to report upon the best means for

No. 6.

REVISION OF ENGRAVED 1-INCH OUTLINE MAP OF GREAT BRITAIN.

Revised and published 1893 to March, 1899

No. 7.



: PUBLICATION OF REVISED 1-INCH MAPS, WITH HILLS IN BROWN.

Published 1898 to March, 1899, ■

obtaining a military map of the United Kingdom, and in April, 1892, the Board of Agriculture appointed, as has been stated above, a Departmental Committee to report upon the work of the Ordnance Survey generally. Both committees agreed that the military map should be based upon the 1-inch map of the Ordnance Survey, which should be printed in five or six colours, and that it should be on sale to the public. They also agreed, with some minor exceptions, as to the details which should appear on the map. The Treasury at first refused to appropriate any money for this coloured map, but General Sir Redvers Buller, who was then Adjutant-General, and who is a strong advocate of maps in colour, brought pressure to bear on the Treasury, and obtained permission for me to divert £500 of the Survey Vote to making an experiment in the preparation of 1-inch coloured maps. Later on, the Treasury, on the recommendation of the Board of Agriculture, sanctioned the preparation of these coloured maps as part of the regular work of the Survey; the map was not, however, intended to extend beyond the southern counties of England, until it should be seen whether it would be taken up by the public.

But colour printing from zinc or stone was till recently comparatively unknown on the Ordnance Survey, and practical difficulties arose in organizing a staff for carrying it out. The earlier maps produced were not satisfactory, but a considerable improvement has since been effected. Two specimens of these maps, one being an early sheet containing Margate, and the other being the Shaftesbury sheet, which was one of the last done before I left Southampton in March, 1899, are in the portfolio of English maps. The latter is a great improvement on the former, and is a good clear map. Diagram No. 8 shows the progress which had been made in the preparation of these 1-inch coloured maps up to March 31, 1899.

6. *One-inch Civil Parish Map in Colours for Great Britain.* 1898–1899.

Another experiment in colour printing has been the production of 1-inch maps for civil purposes with the parishes shown in colour. They are also used as indexes for the 6-inch and 25-inch maps, and are on sale to the public, but enough time has hardly yet elapsed to show whether they will have any sale as maps. Two specimens, one for England and one for Scotland, are in the portfolio of English maps.

When the next census comes, these 1-inch maps, and a general map in colour on the scale of 2 miles to an inch for each county of England and Wales, a specimen of which was prepared in 1898, may be found to be not only useful but necessary. The latter map was prepared at the instance of the Board of Agriculture. Both maps ought to be of great service for all purposes connected with local government, although, as is mentioned elsewhere, the Local Government Board, the department principally concerned, appears rather to dread than to

No. 8.

PROGRESS ON 1-INCH MAPS OF ENGLAND AND WALES IN COLOUR.

Published in colour 1894 to March, 1899, ■

welcome the use of any kind of maps for either its local government or its boundary purposes.

Diagram No. 9 shows the progress which had been made up to March 31, 1899, on the publication of this civil parish map.

7. *Maps on Scales smaller than 1-inch to a Mile.*

As to these, the present instructions of the Survey include only engraved 4-mile and 10-mile maps. Both of these already exist for England and Wales and for Ireland, principally based on the old 1-inch maps, and consequently not up to date, while the 10-mile maps were only published as indexes to the 1-inch map. Neither could be revised until the revision of the 1-inch map should be completed. That is now done for England and Wales, and in 1898 the revision of the 4-mile map of England and Wales was approved, and the drawing begun. The execution of the original map on that scale was excellent and up to the highest standard of engraving, and, as it would have been hopeless to get a better executed map at the present day, while the most important detail on the original map still remained good, it was decided to revise the old map instead of making an entirely new map. In view of future colour-printing, the size of the old sheets had to be reduced, and the new sheet lines were made to coincide with the sheet lines of the new series 1-inch map; it was also decided that third-class roads should be shown in addition to the first and second class roads, and that the hill features should be represented by hill-shading, and not by contours. These decisions were arrived at after consultation with the War Office, which places considerable importance upon this 4-mile map. As the outline edition must precede the hills edition, no decision was come to, or was in 1898 necessary, as to the method of hill-shading to be adopted for this map; nor am I aware that any decision has yet been arrived at; but I very strongly hope that the hill-shading will be by engraved vertical hachures. This course, in addition to being, I believe, the best method of representation, would have the additional advantage of continuing for a time the employment of hill-engravers, who are, as already stated, so much required for the completion of the hill-engraving of the 1-inch map. I hope, also, that this revised 4-mile map in outline will be pushed on as rapidly as possible; the original map in outline, even when published unrevised some years ago, has been one of the most popular maps ever published by the Survey, and in its revised state there is every probability, for various reasons, of its becoming even more popular.

As to the revised and engraved 4-mile maps of Scotland and Ireland, and as to the maps of the three kingdoms on the scale of 10 miles to an inch, they are still entirely for future execution, and do not come within the scope of this paper.

No. 9.

PROGRESS ON 1-INCH COLOURED PARISH MAP OF GREAT BRITAIN.

Published 1898 to March, 1899,

A good deal of the revised 4-mile map of England and Wales had been drawn under the above decisions, and some of it had been engraved, before March 31, 1899, as shown on the accompanying diagram, No. 10.

Specimens of the old and of the revised 4-mile map are in the portfolio of English maps. The engraving in both cases is above the average in quality. The old sheets contained an area of about 120 miles by 90 miles. The new sheets contain an area of about 90 miles by 60—that is, they each include 25 sheets of the new series 1-inch map.

There are also specimens in the portfolio of the unrevised engraved 4-mile maps of Ireland, of a photozincographed (temporary) 4-mile map of Scotland, and of the 10-mile maps of the United Kingdom which were engraved as indexes to the 1-inch maps.

IV. General Observations.

1. *The Use of Ordnance Maps by Public Departments and the General Public.*

The Public Departments which mainly use the Ordnance maps are the War Office and the Admiralty. The Foreign and Colonial offices have also of late years shown a greatly increasing appreciation of maps specially produced for them by the Ordnance Survey. The curious circumstance is that the department, the Local Government Board, which is most concerned with local areas and their boundaries in England and Wales, and to which for good administration good maps are absolutely essential, appears to have the greatest dislike of all kinds of maps in connection with both Local Government areas and their boundaries. It is probably not too much to say that the chaos of different local areas and authorities under which England has been labouring for many years, and from which it is only now beginning to emerge, is due to the timidity of this public department, and to its reluctance or incapacity to make any intelligent use of maps. Scotland is not much better off. Ireland is, in fact, hitherto the only one of the three countries in which the public gets full practical benefit from its Ordnance maps. There the whole of the valuation of the country, and all decisions as to the boundaries of the Local Government areas, are by legal enactment based on the Ordnance Survey maps; while under a system organized some forty years ago by Colonel, now Sir George, Leach, upwards of five thousand estates have been mapped by the Ordnance Survey for the Land Judges Court. A similar Ordnance Survey organization should undoubtedly have been adopted for the system of Land Transfer by maps, which has been recently introduced in London, but other influences were too strong. A new Government map-making organization has thus been established for carrying out work identical with that of the Ordnance Survey, with the certain result that the cost of both organizations will be largely increased, accompanied by an unnecessary addition to the cost of land transfer.

No. 10.

PROGRESS ON NEW 4-MILE MAP OF ENGLAND AND WALES.

Revised and engraved 1898 to March, 1899, ■

As to the published maps of the Survey on sale to the public, I hope they will always be limited to the scales and forms at present authorized, and that maps on all other scales and in all other forms will continue to be left to private enterprise. The publication branch of the survey at Southampton is becoming over-weighted with the work already allotted to it, while efficient firms of map publishers like Messrs. Bartholomew and Stanford are well able to supply the public with maps on other scales based on those of the Ordnance Survey. It seems to me to be in accordance with public policy that they should be encouraged to continue the production of all such maps, if not even, in case of necessity, to assist the Survey in the publication of its own maps. Inferior productions on the other hand, which are, unfortunately, numerous, should be discouraged as much as possible.

2. *Style and Quality of the Ordnance Maps.*

Time only allows a very brief allusion to this point. The general principles followed hitherto by the Ordnance Survey Department have been the following :—

1. That the accuracy of its maps is the first consideration.

2. That for scales larger than 1 inch to a mile, the more rapid and cheaper processes of printing from zinc or stone are, in nearly all cases, sufficiently good for all practical purposes, and are practically enforced on the Survey by considerations not only of time and cost, but also by the limits imposed by the number of available copper-plate engravers, and by the extent of the publication establishments at Southampton and Dublin.

3. But, on the other hand, for maps on the 1-inch or smaller scales, copper-plate engraving is in the first instance essential both for clear outline and for the hill features, whether the printing is done from the copper direct, or by transfer to stone or zinc; and the engraving for these scales should be maintained at the original survey standard.

4. It follows that the engraving of these small-scale maps should not be unduly hurried; and this applies more particularly to the hill engraving, which is a permanent work, and which should be completed with as great perfection as possible, the estimated time of completion (1902) being extended if necessary.

As to this point of hill engraving, the system introduced in 1889 by Sir C. Wilson of engraving the hills on separate plates is no doubt open to minor objections, but it has been rendered indispensable by the recent demands for coloured 1-inch maps with the hill features.

As to the principles above stated, they will, I think, be found to be supported and corroborated by an examination of the maps of foreign countries. The best of these foreign topographical maps are in every case first produced by copper-plate engraving, both of the detail and of the hill features.

3. *Sale of Maps.*

On January 1, 1897, the charge of the sales of the ordnance maps was, in accordance with the recommendations of a Departmental Committee, appointed by the Board of Agriculture, and of which Mr. Hayes Fisher, M.P., was chairman, transferred from the Stationery Office to the Ordnance Survey Department. This change was mainly owing to the general complaints from the bookselling trade in England, and from professional men all over the country, that they could only get maps by sending to London for them. The results have hitherto been distinctly successful. The net value of the sales increased from about £17,700 in 1896–97 to about £23,750 in 1898–99, an increase of about 33 per cent. in two years. But another branch of the new system, that of sales through post-offices, has distinctly failed. I believe the reason to be that the Postmaster-General offers entirely inadequate remuneration to the postmasters for the rather complicated work they have to do under the rules laid down.

4. *Organization of the Department.*

This has now stood the test of the experience of a hundred years, and although the Ordnance Survey has been successively attached to four different public departments, viz. the Board of Ordnance, the War Office, the Office of Works, and now to the Board of Agriculture, its organization throughout has remained practically unchanged. The Board of Agriculture has taken, and takes, a keen interest in the work of the survey, and this interest has in various ways benefited and advanced the work of the department. But in the future this very interest may easily entail not only that advantage, but the disadvantage of undue interference as to the details of administration. So long, however, as an administrator of the strong practical common sense of the present (1899) President of the Board of Agriculture remains at the head of affairs, this danger is unlikely to arise. Nor, under the same condition, is it likely that the present organization of the survey, or its system of pay and discipline, will be seriously interfered with.

That organization is, so far as I know, absolutely peculiar to the Ordnance Survey as a branch of the public service. Its basis is a military establishment of some 20 officers and some 400 or 500 non-commissioned officers and men of the Royal Engineers. To this military establishment are attached at the present time about 2000 civilians. The civilians vary as to class from unskilled labourers, at the bottom of the tree, to a few able and superior public servants at the top. Nearly all the men employed, military and civilian, are trained to their survey duties by the Survey itself. For the field work, which is the basis of the Survey, with its frequent moves from district to district or from country to country, the military element is manifestly invaluable, if not indispensable. On general grounds also its value is steadily increasing, in view of the principle which appears now, with the sanction and encouragement of most of our modern members of the House of Commons, to be in course of rapid application to those branches of the Civil Service which have most Parliamentary votes—the principle, namely, that the general tax-payer ought to pay to his civil servants of those branches the maximum of pay and pension without much regard to the value of the work rendered in return.

5. *Future Work of the Survey.*

There is still very important survey work remaining to be completed. I should myself place first in importance the completion of the edition of the revised maps of Great Britain, with the hills in brown, followed by similar work in Ireland; until this is done, as has been already mentioned, the 1-inch revisions cannot be considered complete. Next in importance, I should place the completion of the revised 4-mile and 10-mile maps in outline of the United Kingdom. As to the 1-inch coloured maps of England and Wales, they are mainly required only as military maps of the district south of a line running east and west through Cardigan, and it still remains to be seen whether they will be popular with the public, while as to the hill-engraving of the 1-inch map of England and Wales, its rate of progress and date of completion should, as has been stated above, be made entirely dependent on good quality being ensured. As to the large-scale revisions, the heavy expenditure on them will always require that close attention should be paid to the rate of progress.

But as to the completion not only of the work now in hand, but also of any new work which the Board of Agriculture and the Treasury may sanction for execution by the Ordnance Survey, I cannot be wrong in assuming that in the hands of my successor, Colonel Johnston, R.E., the reputation of the Survey for good work honestly carried out will be fully maintained.

Colonel JOHNSTON: I have only a very few remarks to make on the excellent paper we have heard. I must say, in the first instance, that I am very glad it has been read, as it could not have been in better hands, and the present is a very good opportunity for reading it. The Survey, until a few years ago, was concerned mainly with large-scale work; of late years, more especially during Sir John Farquharson's time, a very great deal of attention has been paid to the small or geographical work of the Survey, with which this Society is more especially interested. I may say I fully endorse the view of my predecessor as to the importance of this small-scale work. An advantage that I hope may arise out of this paper is, that we may get suggestions as to improvements in the survey maps, as the department has always shown itself willing to listen to suggestions or criticisms as to the maps produced. We shall be very glad to receive any to-day from members of this Society; especially I shall be glad to receive them as regards the coloured maps, to which Sir John Farquharson referred. The coloured map will very shortly be completed south of a line, speaking roughly, running from Ipswich to Cardigan. A considerable number of sheets are already published, but so far the sale has not been very great. It may be that the public do not know of them. I would like to remark on one or two points raised. Sir John Farquharson referred to the dead weight of the town surveys; in the past that has been a dead weight on the Survey, and I am bound to say, if the revision and resurvey of towns had continued, it would have prevented the Survey doing much other valuable work. At present we are not severely pressed in that way; Carlisle and Cardiff are nearly completed, and Aberdeen and Dundee are both in progress. As regards Ireland, the difficulty in the resurvey is very great. The fourth division, to which Sir John Farquharson referred, has not been formed owing to the calls on the Ordnance Survey due to the present war. As soon as it is over, and we get fully established again, I hope the fourth Irish division will be formed. On the other hand, the revision of Great Britain has so far progressed, that it has been possible to transfer one division from England to Ireland. As regards hill engraving, I may say that the measures taken by Sir John Farquharson have been extended, and I hope that, without any loss of quality, the 1-inch hill map will be completed by 1902, or very soon afterwards. As far as I am concerned, there is no intention of sacrificing quality in any way. It may be of interest to indicate what the Survey has done since Sir John Farquharson's time. As far as the large scale is concerned, practically the whole of England is within the twenty-years limit; that is, no appreciable number of counties have surveys over twenty years old. Scotland is not quite so satisfactory, but the few counties with older surveys are being taken up. The 1-inch revised map of Great Britain was completed last year. We are getting on with the 1-inch revised map of Ireland as fast as possible; the work has been extremely heavy. The present is based on an old survey, and the alterations are extremely heavy; the field work, drawing, and engraving have been very slow, but a quarter of the country has been done. The work is being pushed on as rapidly as possible. In England the 1-inch hills have been already alluded to; we have prepared revised hill sheets for a third of Scotland, and I hope in a year the whole of Scotland will be published. As the revision of the 1-inch map of Ireland is completed, so will the revised maps with hills be completed; it will go on *pari passu*. The revised 4-mile map is being engraved as fast as is consistent with good work. I hope within a year's time it will be practically completed. Engraving the 4-mile Scotland has been commenced, and that will go on as rapidly as possible. Ireland will follow. It has not been possible to do anything with the 10-mile map yet, as it has been thought better to concentrate our efforts on the 1-inch and 4-inch scales. There is one other work I should refer to; it has been heavy—that is, the work for the War Office. Ordnance Survey officers and men have been sent to South Africa for survey work, in addition to others for ordinary Corps work, and the result is we are extremely short. In other ways we have been drawn upon, by men of the reserves and volunteers being called out for army service, and we have had very heavy demands by the War Office for maps; so far we have been able to meet them. I don't think I have anything more to say, except that there is every intention on the part of the Ordnance Survey that its reputation for accuracy and good work shall be maintained.

Sir Charles Wilson: I wish to express my concurrence in Sir John Farquharson's excellent epitome of the work of the Survey to the present time, and to say how perfectly I concur in his estimate of the services rendered by General Cooke to the Survey, which have never been sufficiently appreciated. I should also wish to mention what Sir John has not been able to allude to himself, that he conducted the affairs of the Survey during his period of office in an admirable way. He had many difficulties to contend with, and I think he steered through all of them in a most successful manner. One difficulty the Survey has had to contend with in any new departure has been that of getting people in the different departments of the Government to understand what maps are and what their uses may be. As long ago as 1883, when I had charge of the Irish Survey, I was struck by the great expense to which landed proprietors in Ireland were put in selling their property. They often had to have 25-inch surveys made for the purposes of the court, and had to pay the whole of the cost themselves. I then advised the commencement of a 25-inch survey of Ireland, and was strongly supported by the boundary commissioner, Sir John Ball Green, and by the authorities of the law courts, but the Government would have nothing to do with a large-scale survey in Ireland. When I was appointed director-general I again took up the question, and with very great difficulty was able to persuade the Treasury that a 25-inch survey was absolutely necessary to enable the terms of the Land Acts for Ireland to be carried out. Exactly the same difficulty occurred afterwards with regard to the revision. It is impossible to get officials to recognize the absolute necessity of having accurate maps. At first only a small sum was allowed for revision; but gradually, when questions were asked in Parliament, the vote was increased, and at last continuous revision was authorized. I am glad that such excellent progress has been made in the revision. I am quite sure, from what I know of the present director-general, that the reputation of the Survey will not suffer in his hands, and that he will meet any new departure or any questions that may arise in the best possible way.

Lord Belhaven: Sir John Farquharson said the Local Government Board did not make much use of the Ordnance Survey maps, but certainly those who work under them use the Ordnance Survey maps on every possible occasion. For instance, the County Council to which I belong: we have to pay for them ourselves.

Mr. Hugh Leonard: I may be permitted to say that I think, if the Survey Department took a little more trouble in making known what maps they have for sale, there would be a much larger sale of their maps than there is now. I have been connected with maps for many years, and was not aware that there is a coloured 1-inch map published until to-day. We have had a great deal of information given to us with which I was not acquainted, and I think if any reasonable means were taken to let the public know what is going on, the sale would be increased, and the maps would thus be made more useful to the country, which has to pay for them in the end.

Mr. Douglas Freshfield: Having represented the Royal Geographical Society eight years ago, when the Council made representations regarding the Ordnance Survey maps, I think that we, who belong to the Society, may congratulate ourselves on the very great extent to which the recommendations I was authorized on behalf of the Society to make have been carried out. In the important matter of the use of colour in maps, it appears that great progress has been made. We have heard that there is a very small sale for coloured maps; this arises from want of knowledge by the public. I am convinced that the Ordnance Survey Department are now doing everything they can under the conditions in which they live; they have the same enemy that Lord Salisbury lately mentioned—the Treasury, and the Treasury is encouraged in its traditional policy by the extreme apathy and want of knowledge of the use of maps, which is not confined to the Government departments, as one of the speakers suggested, but extends through the whole nation.

Dr. A. J. Herbertson: In the first place, I would suggest that it should be compulsory for every head post-office to have an Ordnance map of the district framed and hung up on the walls. In the second place, it would be desirable if the Ordnance Survey could issue maps to schools at a cheap rate, in the way the American Government has arranged, where the maps are sold to teachers for school purposes at the cost of printing and paper; I think that would contribute to the popularization of maps, and would very much help all schoolmasters, who find the expense of buying maps very heavy.

Sir John Farquharson: I had something to say to you about the sales of Ordnance maps, but I began to think the paper was very long, and perhaps you would be getting tired of it. Roughly, it was that the Survey had had the sales in charge since 1897. Formerly it was in the hands of three agents, as you know—Stanford for England, Menzies for Scotland, and Hodges and Figgis for Ireland; but the Ordnance Survey took it up in 1897, and the results of that change have been distinctly successful. The value of the increase of sales was, after two years, about thirty-three per cent. But another branch, that of sales through the post-office, has distinctly failed. I believe the reason to be, as is stated in the paper, that the Postmaster-General offers inadequate remuneration for the complicated work the postmasters have to do. I think that you can get the Ordnance maps at a post-office in a fairly large town, if there is no local agent there for the sale of the maps; but the postmasters have to write such complicated forms that very often they make mistakes, and it is as troublesome to the Southampton people as it is to the postmasters themselves. Then, I think, the postmasters are only paid the fraction of a penny, in the same way as with money orders, and the result is that the postmasters don't care for the work. As to making the maps known, I think you will find that in places where visitors go, the local bookseller has a local map of his own that he wants to sell, and if you ask for a map of the district you will seldom be shown an Ordnance map, but a rough map that he has had compiled himself.

The President: The meeting will wish to pass a vote of thanks to Sir John Farquharson for reading his paper, and for his kindness in bringing these interesting foreign survey maps here, which he will allow to remain for a few days, so that a number of people who are interested in them can examine them in detail. The most interesting part of the paper to us, and all those who care for the spread of geographical knowledge, is the paragraph on the sale of maps. It is much to be deplored that the system of sale through the local post-offices has failed, owing to the obstruction and the want of interest in the matter at the General Post-office. Of course, if the postmasters were properly remunerated, the sales by that means, I cannot doubt, would be very large indeed. Since I was examined by the departmental committee of the Board of Agriculture, I have had a register kept of the number of people who come to examine the Ordnance Survey maps in this room. It is very large comparatively; it goes on increasing year by year, and I have very little doubt that most of those who come here afterwards buy the maps. It would not be of much avail, I think, to advertise very largely, as the advertisements would not be seen. I don't see any means of making the existence of coloured maps better known than those used by the different agents of the Survey Department. I now ask you to pass a vote of thanks to Sir John Farquharson for his very interesting paper, and for kindly showing us these foreign maps.

EXPLORATION OF THE BERMEJO RIVER AND ITS AFFLUENTS, ARGENTINE REPUBLIC.*

The expedition started in two boats, each 27 feet long by 7 feet beam by 3 feet deep. One was built at the Ingenio La Esperanza, having been designed and its construction superintended by Mr. Stephen Leach; the other at San Loreno, designed by Mr. R. Smythe, and built by his carpenter. Both boats were made of algarroba timber and cedar planking, being copper-fastened throughout. The first was launched for trial on the represser at La Esperanza, and on March 1 she was duly christened *La Esperanza*, and again on March 5, on the river San Pedro, about two miles from the junction with the Lavalyen. The other on March 3 was launched in the river San Francisco, about 2 miles below where the San Lorenzo flows into it, and was christened the *Bertha*. There were, besides, three chalanas, 22 feet long by 7 feet beam by 1 foot 9 inches deep, especially built in Buenos Aires for the expedition, from a design and by the order of his Excellency the Minister of Marine, Commodore Rivadavia, and sent overland by rail as far as the station Pampa Blanca F.C.C.N. (Central Northern Railway), and thence to the river in carts. One, the *Ledesma*, was launched on the river San Pedro at the same time as the *Esperanza*; the other two, the *Lavalyen* and *Sora*, were launched on the San Francisco at the same time as the *Bertha*.

On March 4, 1899, the two boats *Esperanza* and *Ledesma* left the Ingenio La Esperanza on carts to be launched at the Paso del Piquete, about a mile below the junction of the San Pedro and Lavalyen, which unite to form the San Francisco. As the road through the forest was found too narrow, trees had continually to be cut down to clear the way, making progress very slow, so that by sundown little more than half the distance had been covered, and a halt had to be called for the

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* Map, p. 680. The following letter, dated "Esperanza, San Pearo, Provincia Jujuy, Republica Argentina, October 28, 1893," from Mr. Walter Leach, accompanies this paper:—

"Thinking that they may be of some interest to you, I am forwarding with this report of an expedition made by myself and various others, whose names appear in the report, and plans of the rivers whose course we followed.

"The idea of the trip originated through a desire to see if these rivers were not navigable, and so facilitate the carriage of the products of these northern provinces.

"The report and plans have been drawn up by Captain H. Bolland, master mariner of the British Mercantile Marine, who accompanied the expedition, taking with him all instruments necessary for taking observations, which I think you may be satisfied are correct. A sketch of this river with its curves and length of reaches was kept all through.

"If you wish for any further particulars, kindly address me here or write my brother Thomas Leach, the Harridge, Rochdale, Lancashire.

"I am, yours faithfully,

"Walter Leach."

night. Some of the party remained with the boats; the others pushed on to Piquete, where the first camp of the expedition was formed, lat. 24° 17′ 55″ S., long. 64° 41′ 40″ west of Greenwich.

March 5.—At daybreak work was resumed, but progress was very slow. By about 4 p.m. a place was reached where the road passes close to the river San Pedro. It was resolved to launch the boats then and there, which was successfully accomplished. Mr. Walter Leach taking command of the *Esperanza*, and Mr. Stephen Leach the *Ledesma*, proceeded with a few men down the San Pedro into the Lavalyen and the San Francisco, and arrived at the Piqueto camp at dusk.

March 6.—At 6 a.m. the camp was broken up and the boats ready to start. The *Ledesma*, drawing about 10 inches, with Mr. S. Leach and Captain H. Bolland, led the way, followed closely by the *Esperanza*, drawing about 12 inches, with Mr. W. Leach and Captain L. Zorilla. After grounding several times, a stop was made for breakfast on the shore, and after another pull in the afternoon, Mr. R. Smythe's camp was reached at about 5 p.m. Here was the other contingent of the expedition, with the boats *Bertha*, *Sora*, and *Lavalyen*.

March 7–13 were spent in the Sora camp, a place actually about halfway between the rivers San Lorenzo and Sora on the left bank of the river San Francisco, in front of Bella Vista, lat. 23° 53′ 41″ S., long. 64° 36′ 0″ west of Greenwich. The delay here was made to organize the expedition, to fit out the boats with all necessary gear to protect their crews as much as possible from the sun and rain, to load the provisions required for three months, and sufficient ammunition for defending the expedition in case of an Indian raid. Each boat was furnished with a Winchester rifle, a machete, a mosquito net and veil, and plates, cups, etc., for each one of its crew. Also two spades, two axes, two pickaxes, mast and sail, sun and rain awnings, a small tent, oars, rudder, anchor, lamp, and everything requisite to make the trip as comfortable as possible. Distributed amongst the boats were also a set of carpenter's tools, cooking-utensils, canvas, oakum, pitch, nails, screws, tacks, and all necessaries for making repairs. The provisions consisted of salt meat, boiled beef, vegetables, rice, beans, tea, coffee, sugar, yerba, and oatmeal, all in watertight casks or tins. Bread and salt were the only articles in bags and liable to be spoilt. The instruments included a chronometer, sextant, velometer, barometer, thermometer, compass, and theodolite. A medicine-chest was supplied with instruments and medicines, and a very liberal quantity of medical comforts, such as Liebig's extract of meat, cornflour, condensed milk, cocoa, and oatmeal biscuits. Also one large duck-gun, two German Mausers, and several fowling-pieces. Each man carried a large knife and revolver. The boats were numbered in the order in which they had to proceed, as follows: No. 1, chalana *Ledesma*, draft 14 inches: in this were H. Bolland and L. Zorilla, nautical men, who together piloted the expedition; also W. Paterson, doctor. No. 2, *La Esperanza*, draft 20 inches, with W. Leach, chief of expedition. No. 3, chalana *Sora*, draft 13 inches. No. 4, *Bertha*, draft 22 inches, with R. Symythe, second chief of expedition. No. 5, chalana *Lavalyen*, draft 11 inches.

Boats were tried with their respective crews, and two small 6-foot punts sent up from Buenos Aires were annexed. While in this camp rain was experienced on various occasions, generally during the night.

March 13.—Cloudy, with light north-east wind. At 11 a.m., the boats being loaded and everything ready, a start was made, each boat following in order as numbered, the *Esperanza* towing one of the punts, the *Bertha* the other. No great progress had been made before one or other of the boats began to get into difficulties, either by grounding or running against a snag, and causing a general delay, as all the other boats had to wait or send assistance. The *Esperanza*, fouling a snag, capsized her punt, which got adrift, but was recovered by the *Ledesma*. Shortly afterwards the *Bertha* followed suit; her punt, when recovered, was so badly damaged that it had to be taken on board. Several articles were lost or damaged; amongst others, a box of signal rockets. At 4 p.m. camp was pitched for the night on the left bank of the river, a little above the arrayo Sancelito. Some of the members slept on board the boats; the others on shore, in tents.

March 14.—Cloudy morning. Thunderstorm with rain during night. Here the two punts were abandoned, being left on shore, made fast to trees. At 7 a.m. broke camp and proceeded, boats continually getting into difficulties as yesterday. During the afternoon, the *Bertha*, while following the *Ledesma* through one of the numerous false channels, got badly aground, and had to be partly discharged to lighten her. She was hauled over the bank by tackles, working until dark with crews of *Esperanza*, *Ledesma*, and *Lavalyen*. The *Sora* was the only boat that took the right channel, but in doing so, nearly capsized on a snag. The *Esperanza* got through by taking a very narrow branch, where a tree that obstructed the way had to be cut in two. At dark camp was formed, *Ledesma* and *Lavalyen* remaining where *Bertha* was aground, *Esperanza* about quarter of a mile further down the river, and *Sora* in the other channel.

March 15.—Cloudy morning. Little rain during night. By 8 a.m., *Bertha* having been floated and reloaded, a start was made. Picked up *Esperanza* and *Sora* a little lower down, where they were in readiness to proceed. After grounding several times, about 3 p.m. arrived at a very shallow branch, where all the boats, except *Ledesma*, returned upstream about half a mile to come down another channel. *Ledesma* was sent on to see if another channel was practicable. She grounded several times, but eventually got past, and later on was joined by *Bertha*, and camp was made for the night. The other boats remained above the pass.

March 16.—Light southerly wind, and fine. At 7.30 a.m. the

Esperanza, *Sora*, and *Lavalyen* arrived at the place where *Bertha* and *Ledesma* were camped, having taken the same channel as the *Bertha*, and passing without any difficulty. To-day boats kept better together and got into less difficulties. At 4 p.m. came to a shallow pass where all boats grounded. On getting afloat, camped all together.

March 17.—Cloudy morning, with rain. At 6 a.m. left camp, but grounded soon afterwards for a short while, boats getting together again almost immediately. On leaving the coast where they had stopped to get together, the *Lavalyen* fouled a snag and capsized, floating about half a mile down-stream bottom up. She was eventually righted, the sand that in such a short time had almost filled her, cleaned out, and reloaded with the recovered articles. She lost some Winchester rifles, about 2800 rounds of ammunition; some of the crew's effects and provisions. She also had a plank stove in on starboard bow, but was soon repaired, so that in the afternoon progress again was made until about 4 p.m., when, coming to a bad pass, *Esperanza* grounded badly and could not be floated before dark. *Sora* and *Lavalyen* remained by her, *Ledesma* and *Bertha* passed and camped together about 500 metres lower down.

March 18.—Cloudy, misty morning. Rain during night. *Esperanza* and other two boats floated off easily (the river had risen some 6 inches), and got to where *Bertha* and *Ledesma* were camped. Remained all day in camp to dry clothes and rest.

March 19.—Fine morning. Left camp at 7 a.m., but grounded soon afterwards. *Esperanza* had to go for about a mile up-stream to take another branch. She did so, passing without any difficulty; all boats arrived about 4 p.m. at La Peña, where it was thought fit to remain, in order to replenish provisions lost when *Lavalyen* capsized, at Señor Pedro Romero's almacen, distant about half a mile, and to clean out, refit, and stow boats ready for entering the Bermejo.

March 20.—Cloudy morning. Very heavy rain and thunderstorm during night. Hauled *Bertha* and *Esperanza* on shore to examine their hulls, and wash them out. All boats were thoroughly cleaned out and re-stowed, and provisions replenished, thinking that on leaving here all traces of civilization would be left behind.

March 21.—Overcast sky, with fresh easterly wind. At 2.30 p.m., boats being all re-stowed and everything ready, a start was made for Las Juntas, where the San Francisco joins the Bermejo. The distance was covered in about an hour without any difficulty. Here the first rips were encountered, and the boats were in danger of being swamped by the waves. Camp was made on the right bank of the river San Francisco, about half a mile from its junction with the Bermejo. Lat. 23° 19′ 0″ S., long. 64° 4′ 56″ W. of Greenwich. From Paso del Piquete to the mouth of the river Ledesma, the San Francisco flows in a north-by-east direction at an average speed of about 4½ miles an hour, over a bottom of loose sand and stones. Its course winds, and in places divides itself into numerous shallow channels, studded with a number of snags, which are continually being torn from its banks at this time of year, when the river is in a flooded state, and carried down by its current, to be arrested in their progress by the shallowness of the stream, and remain to form, in a very few days or perhaps hours, a bank of sand. By this means the river changes its course, and thus it is very easy to understand the obstacles this river puts in the way of navigation, and the reason of the continual groundings of the boats of the expedition. Likewise, it must be stated that the crews of the boats were not experienced men; some of them had never before pulled an oar or seen a boat.

The lower section of the river, from the mouth of the Ledesma to its junction with the Bermejo, flows in a north-easterly direction, at about the same rate, over a bottom of fine, loose sand. The water is of a reddish colour and thickly mixed with sand, which makes it unfit for drinking until allowed to settle. The river is very wide in places, sometimes as much as three-quarters of a mile between its natural banks, which are in most places low and marshy, covered in general with a stunted growth of timber. Heavier timber is seen in the background at no very great distance from its shores. It is in these wide places, divided also into several channels, shallow and full of snags, that navigation is so difficult, as the channels are ever shifting, from day to day, and it requires a quick and practised eye to choose the right branch. Frequently in this expedition the boats were carried down a wrong channel, having become unmanageable by their crews in the current, and they had to return several times to get into the right branch. In low river the navigation should be easier, as then the course would be better defined. Both banks are fairly populated. Every now and again animals were seen grazing and habitations passed; but cultivation seems scarce, owing probably to the difficulty of getting produce to a market.

UPPER BERMEJO.

March 22.—North-east wind, and fine clear morning. Left camp at 2.40 p.m., entering upper Bermejo a few minutes afterwards. At 4.15 p.m. camped for the night on the right bank of river. To-day several rapids and rips were passed, some of the boats shipping much water.

March 23.—Clear fresh morning. Soon after sunrise an earthquake was felt. It lasted several seconds, and was so severe as to disturb water in a bucket on shore, but no change was noticed in the river surface, although it was felt in the boats. After an early start, good way was made until about 2 p.m., when a place was reached where the river was about 2 miles broad, and cut up into numerous small channels, studded with snags, and interspersed with small islands and dry sandbanks. Took the left-side channel, in which very little water was found about 500 yards further down. So we had to return, hauling the boats back by means of ropes made fast to the snags which divided this branch from the channel that skirted the left shore.

Eventually a way was cut through this barrier, allowing the boats to pass one by one into deeper water. Camp was here formed on left bank.

March 24.—Light southerly wind and clear weather. Got an early start from camp, but stopped about a mile further down at the puesto of Señor José Leon Tegueno (Luna Muerta), where some sheep were procured, and from an almacen distant about a mile inland, other articles.

At 11.45 made another start, and in about an hour regained the main channel of the river, which had been left on the previous day, just above the spot where the barrier of snags had to be cut through. More tide-rips and rapids were encountered to-day, but there was less grounding. At about 4 p.m. camp was formed for the night on the right bank.

March 25.—Strong south-east wind and cloudy, cold day. Left camp at 6.30 a.m., but little progress was made, the wind being nearly always dead ahead, and the boats could not make headway against it. At about 2 p.m. the spot was reached where the Teuco and Bermejo Central separate, the old course of the Bermejo Central being found completely dry. About 3 p.m. camp was made on a dry sandbank, in front of the high cliff (15 feet) of Pozo de la Orega. Here the channel is only about 80 yards wide, but very deep, and with a strong current running at the foot of the cliffs. This camp is in lat. 23° 34′ 45″ S., long. 63° 18′ 34″ W. of Greenwich. The upper Bermejo, from the mouth of the San Francisco to El Pozo de la Orega (where to-day the river Teuco may be said to begin), is at this season of the year, when the floods are at their height, a red-yellowish coloured stream with a current of about 4 miles an hour, maximum 5½ miles. Its course, for the first 15 miles, is in an east-north-east direction; then it turns sharply to the south-east, running in this direction, more or less, over a soft sandy bottom through a flat country. Its natural shores are as much as 2 miles apart in places, and are thickly wooded to the water's edge with fair sized timber. Although the shores in general are low and marshy, cliffs are occasionally seen to rise some 10 to 15 feet high, covered with detached clumps of trees and fine grass. The course of this river is continually crossing from shore to shore, often spreading out and dividing itself into numerous branches, intercepted by snags, dry sandbanks, and small islands. These channels have every appearance of constant shifting at this season of the year probably, but when the river is at its normal height, or low, they most likely unite in one good navigable channel for steamers of light draft, and, if once cleaned out, could possibly remain so with the continual traffic of steamers up and down. The old course of the Central Bermejo, where twenty years ago most of the water found its way from the river, was quite dry. To-day the current strikes a cliff about 15 feet high, just above this spot, and cannons off to the left, striking the cliffs of Pozo de la Orega, of which it consumes large portions every year. During the nights of March 25 and 26, which the expedition spent in this locality, continual landslips occurred, and were heard falling down with a thundering noise and splash into the river below, and it is said that about a mile of these cliffs has been consumed by the river in the last ten years. The country through which it flows seems to be very fertile and fairly populated, as every now and again cattle, sheep, horses, and goats were seen grazing, while in the background the habitations of their owners were visible, some of them being of a very substantial kind, notably El Carmen, belonging to Señor M. Aparicio, situated on the right bank, about 7 miles from the mouth of the San Francisco. The water of this river is so thoroughly impregnated with a fine yellowish sand, as to render it unfit for drinking without filtering, and it cuts to pieces, in an incredibly short time, any machinery in motion with which it comes in contact. Rapids and tide-rips, forming big and dangerous waves, were not uncommon, endangering the boats several times by nearly swamping or capsizing them.

River Teuco.

March 26.—Fresh south-east gale, very cold, with rain. Moved camp to left bank of river, and a little further down, under the cliffs of Pozo de la Orega, where a landing-place was obtained. Some fresh meat was procured from the *puesto*. Several members are down with "chucho," fever and ague.

March 27.—Fresh south-east wind, very cold and cloudy, with rain. After breakfast weather moderated a little, so a start was made. Several tide-rips were passed. In one of these the *Bertha* lost one of her crew overboard, and in rescuing him was very nearly swamped. At 4 p.m. camp was formed on the left bank, the night-watches being doubled.

March 28.—Moderate south-east wind, and cloudy, with small rain. Left camp at 6.30 a.m. Half an hour afterwards encountered very bad tide-rips, and all the boats shipped quantities, greater or less, of water. The *Bertha*, getting broadside on, nearly capsized. About midday passed Paso del Milagro, where there are boats stationed for ferrying purposes; two hours later Paso del Siderio, where there is a ferry also. At 2.30 p.m. camped for the night at Señor E. Sarmiento's puesto, where fresh meat was procured. Here the Mataco Indian interpreter (Crguarez) and one of the members of the expedition left to go to the Colonia Rivadavia. Letters, too, were sent back by "chasque" (a messenger) to La Esperanza.

March 29.—Light south-east wind, and cloudy. At 9.30 a.m. left camp, passing the ferry Paso del Confite about twenty minutes afterwards, and later on a Rancho with *chalanas*, no boats being seen further down the river. To-day saw Palo santo for the first time. At 4 p.m. camped for night on right bank of river.

March 30.—Light south-east wind, and cloudy. Rain during night. At 6.45 a.m. left camp, but had to stop from 7.30 to 10.30 for a heavy thunderstorm. To-day saw a few Indians on banks of river, fishing, but could not get near enough to speak to them, as they invariably hide themselves. At 4 p.m. camped for night at Port Belgrano, where Señor Tomas Ruiz has his establishment.

March 31.—Light south-west wind, and cloudy. Left camp at 8.50 a.m., passing a rancho on right bank, about 5 miles further down. Saw some Indians to-day, but could not get into communication with them. At 4 p.m. camped on left bank of river.

April 1.—Light south-west wind, and fine, cool morning. Left camp at 6.15 a.m. Saw various signs of Indians and several abandoned "toldos" in the forenoon. During the afternoon saw an Indian fishing; stopped and spoke to him. He recognized the chief of the expedition, Mr. Walter Leach, having been at the Ingenio La Esperanza. Sent him for his cacique (chief), whom he said was called Manuel. About an hour later Manuel arrived, accompanied by another chief, and said Cacique Sumaye had his *tolderia* about 2 miles further down the river. He was embarked on the *Ledesma* to point out the place, which was reached about 3 p.m. and camp made for the night. Soon after some white people, men, women, and children, came into camp, and said the place was called Belle-Ville. Numerous Indians also, with their families, who received presents, exchanging their weapons and wares for clothes, tobacco, etc. The cacique Sumaye, although known to the chief of the expedition, did not put in an appearance.

April 2.—Light south-west wind, and fine, clear morning. Indians brought goats and sheep into the camp, which was visited by the cacique Mariano (well known at La Esperanza) on horseback, and dressed in Christian garments. He was accompanied by some white men. As Sumaye had not turned up by 12.30 p.m., a start was made; three Indians, volunteering to proceed with the expedition, were embarked, two in the *Esperanza* and one in the *Bertha*. At 4.15 p.m. camp was made for the night on left bank.

April 3.—Light south wind, and fine, cold morning. Left camp at 6.30 a.m., and had not gone far when a tiger of the country, or jaguar (*Felis onza*), was seen on the left bank, and several others were shot during the day. No Indians were observed, nor traces of them. At 5 p.m. camped for night on right bank, finding it very difficult to get a suitable place, as the coasts are very little out of the water, and firewood very scarce.

April 4.—Light north wind, and cloudy morning. Left camp at 5.30 a.m. Saw and shot several tigers. About 7.15 a.m. came to a big rapid (Salto de los Ingleses), and later in the day to a pass with only 3 feet of water in it, and which was named Paso Roca.

April 5.—Light south-west wind, and fine, fresh morning. Left camp at 6.30 a.m. Shot several jaguars, which seem to be plentiful hereabouts. Saw Palo mataco to-day for first time; also two Indians in the distance, but did not get near enough to them to converse. Camped at 4.30 p.m. on right bank.

April 6.—Light north wind, and fine, clear morning. Left camp at 6.10 a.m. Saw smoke rising in different places ahead, but some distance off; probably Indians setting fire to the long grass. While stopping for breakfast saw a number of Indians (Tobas) on opposite bank, but as they could not speak the national tongue, though four or five came into camp and received presents, little or no information could be obtained. About twenty minutes after a start had been made a small stream of clear water was passed, coming in from the south-west, which was taken to be the old course of the Bermejo Central in lat. 25° 36′ 20″ S., long. 60° 14′ 45″ W. of Greenwich. The shores are a little thicker wooded, but still very low. At 4 p.m. camped for night on left bank of river. The river Peuco, being simply a continuation of the upper Bermejo, is similar in many respects, the water being of the same yellowish-red colour, and thickly impregnated with fine sand. It runs in a south-east direction, more or less, at the rate of 4 or 5 miles an hour, through a somewhat flat country, over a bed of soft movable sand. From Pozo de la Orega as far as the Puesto of Senor Eugenio Sarmiento, in lat. 23° 47′ 20″ S., long. 63° 7′ 0″ W. of Greenwich, this river has all the characteristic resemblances of the upper Bermejo, at one time running in one stream between its natural banks, at another spreading out into numerous shallow branches intercepted by dry sandbanks and studded with large snags. The shores, too, have the same appearance, being low and wooded, with habitations here and there, having maize-fields attached, and domestic animals close by. Tide-rips, with their large waves, are too often met with, making it extremely dangerous for small boats. Several canoes and *chalanas* (flat-bottomed boats) are used for ferrying purposes, notably those at the Pasos del Milagro and Siderio. The channels here, too, have the appearance of shifting during the floods, but of being concentrated into one when the river is low, when they could be navigated by small light-drafted steamers.

From the puesto of Señor E. Sarmiento to Paso Rivadavia, so called after H.E. the present Minister of Marine, in lat. 24° 27′ 56″ S., long. 61° 35′ 28″ W. of Greenwich. This river changes materially, running now in one channel only, from 100 to 300 yards broad, and widening itself in short reaches and sharp bends between low thickly timbered banks. It runs at a rate of from 3½ to 5 miles an hour in a south-east direction, over a bed of soft sand and mud, similar to its shores, which are low, and showed signs of having been recently overflown, the water-mark on the trees being some 5 feet above the ground. The depth, being apparently uniform and free from snags and rapids, is suitable for navigation by steamers of moderate size and draft. In general the country round about the river-banks is flat, and densely covered with a fair-sized growth of valuable timber down to the water's edge. Palo santo of a somewhat stunted growth is found. Cliffs are unknown in this extension until about 12 miles off Paso Rivadavia, where for a short distance they are found on both sides, being about 12 feet high, and covered with detached trees and fine grass. The course of the river seems to change somewhat, the stream itself cutting more direct channels through the soft soil, especially at this season, when the river is apt to overflow its banks. Although very fertile and healthy, this district is very scantily populated by white people, probably from its distance from any marketable centre and present mode of communication therewith. Several ranches or habitations are seen on the banks of the river; notable amongst them is that of Señor Tomas Ruiz at Puerto Belgrano (on the opposite side of the river), and distant about 3 miles from the old abandoned fort of the same name. Here the Mataco Indian has his home and happy hunting-grounds, but seems to live at peace with the white settler, who has invaded his domains without compensating him in any way for his loss, so it is not to be wondered at if animals are occasionally stolen.

Belle Ville—lat. 24° 21′ 10″ S, long. 61° 43′ 50″ W. of Greenwich—is the place where the last settlers (families) are, their dwellings being on the higher land at some little distance from the river, and right amongst the domains of the most powerful cacique (Indian chief) of this district, Sumaye. Soon after passing the Paso Rivadavia (which had 5 feet in it on April 2 over a hard bottom) to the confluence of the Teuco and Bermejo Central—lat. 25° 37′ 20″ S., long. 60° 14′ 50″ W. of Greenwich—this river changes considerably as it winds its crooked course, still in a more or less south-easterly direction, through a very flat, marshy district, where timber is scarce and of very poor quality. Its banks are scarcely a foot above the water, and covered mostly with kind of common pampa grass, and inhabited by the jaguar and mosquitos. The bed of the river is uneven, forming many rapids (saltos) and the Paso Roca (named after the actual president), where it crosses the 25th parallel of latitude. Here on April 3 only 3 feet of water was found over a hard bottom. Probably, on the other side of the island (isla del Carpincho) more water is to be found. A little further down, after passing between two cliffs 12 feet and the last rapid, Angostura (60 yards broad) is reached—the narrowest part of the river—and the coasts begin to be higher with a better class of vegetation, and timber of some value, though sparse, is seen. Palo mataco (*Acholocarpus præcox*) is found in small quantities after passing the 60½ parallel of longitude at Monte Sindo, so called as being the first timber of any size seen since leaving Paso Rivadavia. Again now the river seems to have a more uniform depth, as the surface was not disturbed nor bottom found at 12 feet. Toba Indians are the undisputed owners of this district, under their cacique Pedro, and the only time (on April 6) they were spoken with seemed to be friendly, asking for tobacco and wearing-apparel. This low marshy district between Paso Rivadavia and Paso Roca has the appearance of being once thickly timbered, as many dead trees, principally the Sempiternal quebradio colorado, are still visible, with their roots some 6 to 8 feet below the surface. Probably when all, or at least most, of the water of the upper Bermejo found its way down the Central Bermejo, this district was a large canada, and the Teuco unknown below Belle Ville, where it was a mere backwater, receiving some water from the Bermejo when flooded. Then a season has brought a greater amount of water than usual, which has cut its way through the bluffs, filling up the cañada and forming an immense lake, killing all the trees, and eventually, year after year, depositing its thickly impregnated water, until it has silted up to its present level, some 6 to 8 feet. Then, through another unusually big flood, the barrier at the south-eastern extremity (the cliffs just below Paso Roca) was broken through, and thus formed the present river Teuco. It is a well-known fact that these regions, as well as the rivers Paraguay and Parana, are periodically visited (about every ten years) by big floods.

Lower Bermejo.

April 7.—Light north-east wind, and cloudy. Left camp at 6 a.m., all day proceeding without anything occurring worthy of note. The shores seem to be higher, and covered with a thicker growth of vegetation. At 3.30 p.m. heavy squall from north-east with rain, so camped for night in a thick forest on right bank of river.

April 8.—Moderate north-east wind, and cloudy. Left camp at 6.30 a.m. The coasts here are about 10 feet high in places, and covered by thick grass and detached forest. At 9.45 a.m. we passed the site of the abandoned Fort Wilde. At 1.30 p.m. arrived at the first or outpost of civilization—Fort Regimiento 12 de Caballeria, situated on the left bank of the river, on top of a cliff 15 feet high. At 5 p.m. arrived at Fort Presidencia Roca, situated on right bank of river, in a bend, on the top of a cliff 15 feet high, where camp was formed for the night.

April 9.—Light north wind, and fine clear weather. Left camp at 6.30 a.m., arriving at 8.30 a.m. at the Arrayo Acacia, where a stop was made for the day to wash clothes and the boats in the clear water of this arrayo. At 4 p.m. moved about half a mile further on, where camp was made for the night.

April 10.—Moderate north-east wind, and fine morning. Left camp at 6.15 a.m., proceeding until 8 a.m., when the site of the abandoned colony Azara was passed. At 3.30 camped on left bank of river, it having commenced to rain heavily, with thunder and lightning, which lasted all night.

April 11.—Light north wind, with overcast sky and drizzling rain. Left camp at 8 a.m., soon afterwards passing a rapid (supposed to be Salto de Izo). At 11 a.m. arrived at the Comisaria de Formosa, where a stop was made for breakfast. At 3 p.m. arrived at the once prosperous, but now deserted Pueblo del Expedicion, where camp was formed for the night, the weather threatening rain.

April 12.—Light north-east wind, and dull cloudy morning, with rain up to 7.30 a.m. Left camp at 8 a.m., half an hour later passed the island Na Curutú, and at 3.45 p.m. the almost deserted colony of Grandolfi. Stopped for the night at 4.20 p.m.; a good camping-ground was difficult to find, as the coasts are low and marshy, in many places covered with water from the recent heavy rains. It began to rain soon after getting camped, and continued all night.

April 13.—At noon it began to clear up, with fresh south wind. Left camp at 12.30 p.m., passing through a zone of palm trees. At 2.14 p.m. we passed the telegraph wire which connects Formosa with Resistencia, camping at 4 p.m. for the night on the edge of the palms.

April 14.—Moderate north-east wind, and cloudy. At 6.20 a.m. the *Ledesma* left with chief of expedition on board, to go on ahead as far as Corrientes, leaving other boats to follow on in a day or two, when crews were rested.

April 15.—Light easterly wind, fine and clear. Some of the members shot, fished, etc. At 5 p.m. began to cloud over and rain.

April 16.—Fresh south wind, and cloudy; rained in showers all night. Left camp at 6 a.m., reaching mouth of Bermejo at 9.30 a.m., and Puerto Bermejo, or Timbo, at 2 p.m., when camp was made for the night.

April 17.—Moderate south wind, and cloudy. At 5.30 a.m. left camp at Puerto Bermejo, passing Humaita at 7.30 a.m., Las Palmas at 9 a.m., and the Boca del Paraguay at noon. Arrived at the city of Corrientes at 4 p.m., where the *Ledesma* had arrived at 8 a.m. The Lower Bermejo is perhaps better known than the Teuco, or upper Bermejo, on account of its proximity to a grand fluvial highway. The general course of this river is in a south-easterly direction, although very crooked, winding about in a most extraordinary manner, and flowing at the rate of from 3 to 5 miles an hour, over an uneven bottom of sand, and in places tosca (a soft sandstone). In some of the reaches snags are very common, making navigation extremely dangerous. Some twenty years ago several small steamers were sunk by running on these, while attempting to reach the province of Salta, by the river Paraguay, by this waterway. In those days the Teuco was a small stream of no importance, and the Central

Bermejo, with its flourishing colony Rivadavia, was thought to be the only practicable highway. But twenty years has seen changes, not only in a river, but also in shipbuilding; great and important strides have been made in the construction of shallow-drafted steamers, so that to-day this river, minus some of the numerous snags, and perhaps with a little dredging, could be made into a great commercial highway, and through this channel, probably, the riches of Bolivia will in the near future find their way to the over-sea markets. The shores and cliffs rise gradually until the locality of Presidencia Roca, when the latter are some 12 to 18 feet above the water, and continues, more or less, till Pueblo de la Expedicion is passed, when they begin to descend. Low coasts are found from below the Gandolfi colony to the mouth of the river, opposite the Isla Monterita in the Paraguay river. These shores are covered in all their extent with detached forest, intercepted by open ground, and in the low marshy regions covered with pampa grass, Caña de Castilla, and the higher regions with fine grasses. They are very thinly populated. At the last outpost, Fort 12 de Caballeria, there is a sergeant with six soldiers; also a small shop (almacen) kept by an enterprising individual, who trades with the Indians, exchanging bad liquor, tobacco, and clothes for skins of wild animals, bees-wax, feathers, and the like. At Fort Presidencia Roca a sergeant with eight soldiers, with some of their wives, were the only inhabitants. About 12 miles lower down is the site of the now completely abandoned colony Azara, with all its habitations in ruins, and its once valuable machinery about the long grass of this park-land region. Further down Colonel Uriburn has a fine cattle-ranch (Estancia). This, and the other, at the once flourishing, but now almost deserted camp-town of Pueblo de la Expedicion, with its single remaining house, are about the only places left of any note. Cultivation of any kind seems not to be practised at present, although anything of a semi-tropical character will grow—sugar-cane, castor-oil plant, tobacco, and the like all grow well, besides maize and vegetables. In several places piles of cut timber, palms, and charcoal were seen on the bank in an abandoned condition, having lain there some time, and half grown over by vegetation. All this goes to show the richness of this region, and how easily it could be populated and formed into a thriving district if only regular traffic was established, by which means a market could be reached at moderate cost. Toba Indians inhabit this region, but were not seen, keeping out of sight probably from their fear of the white people.

NOTES ON THE COUNTRY BETWEEN LAKE CHIUTA AND THE RIVER LULI, CENTRAL AFRICA.*

By Captain F. B. PEARCE.

THE Anglo-Portuguese military expedition (1899) against the slave-raiding chief Kwamba enabled me to traverse the hitherto blank piece of country between Lake Chiuta and the Luli river. I have, at the end of this article, noted the methods by which the accompanying map was compiled; so, leaving this part of the subject, I will note the character and features of the country through which I passed, commencing at Madziabango, situated at the north-eastern corner of Lake Chilwa.

Madziabango is not the name of a village, but of fresh-water holes. These shallow wells are situated on the wooded ridge which separates the respective levels of Lakes Chiuta and Chilwa. This ridge is about 30 feet above the flat level plain, which may be taken to represent Lake Chilwa; I say represent, for during the dry season (April—December) no signs of open water can be seen when looking south—only a dead level grass plain to the very horizon. The water, after deepening the existing holes, was good, and indeed all similar water-holes can be made to yield a fair supply of water by a little judicious digging and deepening. A good view of Chikala mountain, and beyond that Zomba mountain, can be obtained from Madziabango, while to the east the Luasi hills can be seen. The usual game, consisting of hartebeest, reed-buck, pig, and kwapi, can be found round Madziabango.

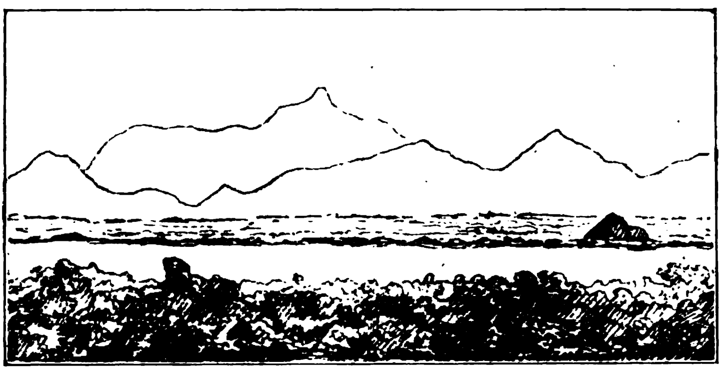
Leaving Madziabango, the path, which is level all the way, runs due east for a mile, when the No. 9 boundary pillar is arrived at. This post has been erected by the Anglo-Portuguese Provisional Boundary Delineation Expedition, and has been taking by them to mark the north-eastern corner of Lake Chilwa—lat. 14° 57′ 40″. The path then trends north-east and north, and runs through the usual scenery of small forest trees, with occasional open grass plains. One mile beyond the boundary pillar water-holes are arrived at. At 7 miles from Madziabango the Pamtundu water-holes are reached, and from an anthill close to the wells the first view of the southern open plain of Lake Chiuta can be seen. This plain resembles the northern plain of Lake Chilwa. It is quite flat and covered with short grass, and extends in an unbroken level as far as the eye can see. On this plain buffalo, gnu, hartebeest, and various smaller antelopes are to be found.

From the Pamtundu water-holes northwards the open plain is kept in view on the left until Tombowe hill is reached. Here there are villages with large mopeira (millet) and cassava fields. Tombowe hill is about 100 feet in height, and from its summit an excellent view of the surrounding country can be obtained. To the north the eye extends

* Map, p. 680.

across wooded undulating land, rising at intervals into small rounded hillocks. Lipembegwe mountain can be seen, and beyond that again the top of a large mountain, which must be situated near the Lujenda river. To the west the ground slopes gradually down to Lake Chiuta, and open water is seen opposite Mundi hill. The Mlinde hills rise about 6 miles from the lake's west shore, and beyond those hills Unango peak is remarkable as a fine bold summit.

Owing to wars and rumours of wars, the country to the east of Lake Chiuta is not now thickly populated, and most of the villages have been moved into British territory on the western shores, where there are now many villages. The portion of Lake Chiuta not covered with reeds is a pleasant piece of water, with clean level banks; it is shallow, the average depth appearing to be from 3 to 9 feet. The shores are covered with various fresh-water molluscs, whilst its waters are inhabited by



VIEW FROM TOMBOWE HILL, LOOKING WEST.

hippopotami. Since a channel has been cut through the thick reeds between Chiuta and Amaramba, I hear that crocodiles are finding their way into Chiuta. In Amaramba and the Lujenda outlet these reptiles are exceedingly numerous. One curious feature of the lake, which doubtless has been mentioned before, is the piles in the water, which still remain to mark the existence of lake dwellings. They are clustered towards the east side, and are generally situated about 50 to 200 yards from the shore. The water is now about 6 to 8 feet deep around them. These water-dwellings were, of course, a means of safety against raids and warfare, and besides being used as temporary dwellings, the year's food supplies were placed in this African Venice for safety. I think we can deduce from these piles that the rise and fall in the lake is very slight, for during the dry season (August) the forked tops of the piles on which the floors had rested were only generally about a foot from the water-surface. The large extent of reeds which separates Chiuta from Amaramba was this year (1899) traversed by a canal, cut at the instance of Mr. Alfred Sharpe, so that passage by water can now be had between the two lakes.

To return to Tombowe hill. Towards the south and south-west on a clear day Zomba and Chikala mountains can be distinctly seen, and Chilwa island. Between Tombowe and Chikala stretches the great Chiuta plain already mentioned, its monotony only broken by Nafisi hill on the opposite shore, but so low is this shore that the level appears to extend almost indefinitely. To the south the Luasi hills are visible, and towards the east very typical country is seen—dense forest land of small trees, broken here and there by the yellow grass of the open "dambos" (plains). The ground appears level to the horizon, but in reality it consists of enormous but gradual undulations, the ridges and furrows of which run north and south. Nearly due east on a clear day can be seen the mountain called Mtungwe, of which I shall have to speak more in detail later on. The water in the holes to the north of Tombowe hill, where my permanent base camp was pitched, was very good and fairly plentiful; I hear it never dries up. Tombowe camp is in lat. 14° 47′ 35″; height, 1707 feet.

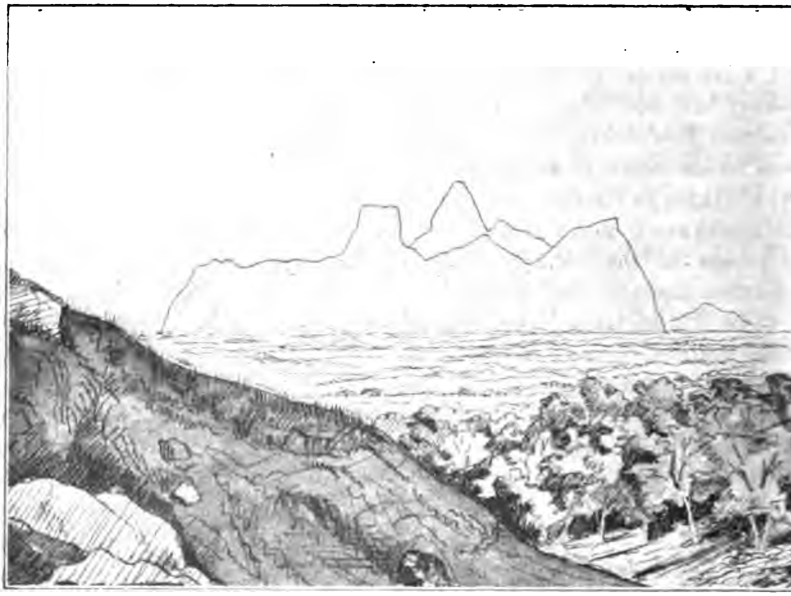
The objective of the expedition was Kwamba's village, on the eastern slopes of the Namwero hills. Guides towards Mtungwe mountain were difficult to procure, as every villager had fled on the approach of "war," and besides, the 40 or 50 miles of badly watered and uninhabited forest which separates Chiuta country from the Luli country, constitutes the latter a species of *terra incognita* to the natives living near Lakes Chiuta and Amaramba. The most direct way, I believe now, would have been along the road to Mtumbi hills, and thence to the main Kwamba-Mkanyela path, which follows the Mtamkulu river. Our guides, however, led us towards the Mkloma hillocks, which lie due north of Tombowe, and then cut off to the east towards Mtungwe.

At first the path leads through open country scattered with stunted forest clumps. After leaving Mkloma hills, however, and with our backs to the lake, the country changes somewhat, and the open plains (dambos), which form such a marked feature of the country round the lakes, become smaller and smaller and fewer in number until they may almost be said not to exist. The whole country is thickly covered with trees. The trees vary from 18 inches to 3 feet in diameter, and, except on the banks of streams, larger specimens are rarely met with. The highest varies from 10 to about 35 feet. There is little or no undergrowth except near the bed of streams. In this part of Africa this is known as forest, and theoretically the nomenclature is doubtless correct, but such forest must not be confused with such forests as are met, for instance, on the West Coast. These latter forests consist of masses of gigantic trees for the most part growing out of tangled masses of creepers and dense thicket-growth. The forests in this part of Africa, although equal in the extent of ground covered, consist of quite small trees with little undergrowth. Every few miles open plains are met with. These plains may be 200 yards in breadth, or may extend to as much as 2 or 3 miles; on these plains game is generally found.

After leaving Mkloma hills, the next rise is the north hill of Nangulukutuchi. These three hills form or stand on the watershed between Lake Chiuta and the Luli river, but this watershed is very indefinitely defined. After leaving Nangulukutuchi hill the road runs through the usual forest of small trees, with an occasional bamboo brake. At 5½ miles from Nangulukutuchi the path perceptibly tends downwards, and after a fairly long but gradual descent the Matawapa river is reached. After leaving Nangulukutuchi hill tsetse fly was observed for the first time, and these flies were noticed all the way from this point to the Mtamkulu river. They were most numerous in the vicinity of water, and I should judge this piece of country, during the rainy season, to be very bad with them. The Matawapa stream, like so many others, does not flow during the whole year, but, thanks to the overhanging trees on its banks, there are several large pools of indifferent water in the bed all through the dry season. The stream is about 30 feet broad, and the banks are 8 to 12 feet in height. Buffalo and elephant spoor are numerous in the vicinity. The path, after leaving the Matawapa, continues through similar forested country as before described.

The Nchere river (dry) is reached after 5¾ miles, and then the path tends south-east, and even at times south. As the Mtamkulu river is approached, the forest thins and open grass patches become more frequent and larger. The Mtamkulu river is, at the point of crossing, 60 yards in breadth, with an uneven rocky bed, which makes the crossing in the rainy season a very dangerous and difficult matter. In August the water was not flowing, but there was ample water in very large deep pools; the water was not clear nor very good. The banks vary in height, but were only a few feet high at the place of crossing. Crossing was effected over the rocky (limestone) edge of a "fall" between two large water-pools, the one towards the east being about 10 feet lower than the one on our right. The path passes through a scattered village (the first sign of habitation since leaving Tombowe hill) immediately after quitting the Mtamkulu, and proceeds towards the centre of the Mamwero hills. The hills, as will be seen on reference to the map, are 10 miles in length, and they attain a height of about 800 feet above the surrounding terrain. They are covered with small trees and bamboo thickets, while the summits are generally bare rock.

Four miles after leaving the Mtamkulu river the path bifurcates, that going to the right leads direct to Kwamba's villages, and that tending north-east or to the left passes between the northern slopes and Mtungwe mountain, and eventually leads to the same locality as the path on the right. For various reasons we took the north-east or left path, and this led us through a few small villages with the usual fields of cassava and mopeira. During this time we had the great mountain of Mtungwe straight ahead. A certain amount of verdure grows on the lower slopes, but the extreme precipitousness of its sides prevents growth to any height. There are two distinct features in this fine mass of rocks. They are (1) the cone summit on the eastern scarp, and (2) the round hump, or bluff, which tops the western precipices. The cone is the higher of the two, but both are wonderful specimens of great rock masses. Both cone and bluff are absolutely devoid of vegetation, and, indeed, for 2000 feet below their summit there can scarcely be said to be a sign of it. The Mtamkulu river flows close along the



VIEW OF MTUNGWE MOUNTAIN.
(Sketched from near the Matawapa river.)

southern face, and all around the neighbourhood of the river is thickly forested.

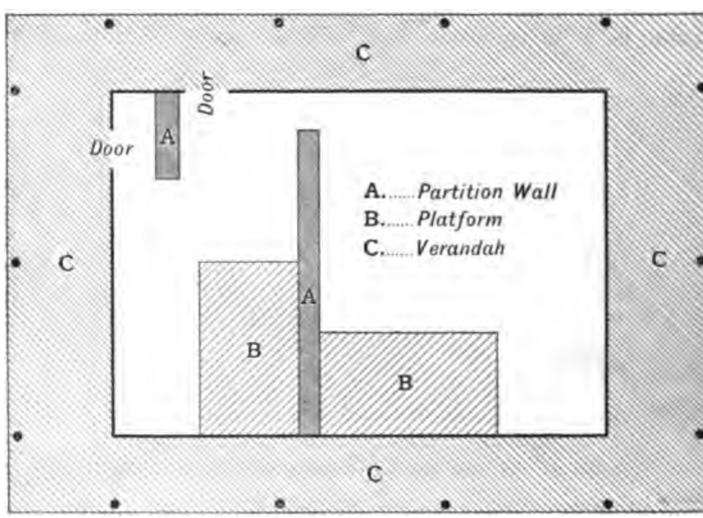
Several miles away from Mtungwe, we noticed what at first every one took to be water flowing from the south-western face of the precipice. What we saw were two very long brilliantly white stripes on the mountain face. The stripes, or streaks, were perhaps fifty yards apart and parallel, and I may not be far wrong if I judge the width of each to have been 20 to 30 feet. They appear to start suddenly from about 1000 feet above the foot of the mountain, and to descend perpendicularly until lost in the trees beneath. Even through glasses it was at first difficult to believe these enormous white stripes were not water, as they were so parallel throughout their course to each other, and appeared to fall so true. On approaching them closer, however, I think we all became convinced that these stripes were not water, but were evidently parallel seams of intensely white quartz (?) or limestone (?). (I fear my geological knowledge will not admit of my being more definite than this as to the formation.)

The path, as I have already mentioned, passes between the Namwero hills on the south and Mtungwe on the north. The distance between the two is generally about 3 to 4 miles, and the length of the pass thus formed is about 4 miles. Halfway through the pass the south-east precipices come into view. This is by far the grandest side of the mountain, and, indeed, I have never seen anything to equal the enormous face of smooth, bare perpendicular rock which forms the side. To the very summit there is not even an appearance of growth, and the sheer wall must be, I judged, over 3000 feet in height. The bareness and

VALLEY OF THE LULI FROM KWAMBA'S, LOOKING NORTH-EAST.

smoothness of this south-east face is evidently due to the fact that from this direction the south-east monsoon blows, and the wind and rain has, to all intents, planed smooth the great face of the mountain.

The impression of the Luli valley, when first seen, is that of a great forest-covered plain, shut in on the south by ranges of hills, but open to the east and north. The bold peak of Maripa, however, breaks the continuity of the horizon towards the north-east. No villages nor signs of human habitation are met with in or around Mtungwe; it is not until Kwamba's village is reached that any signs of life are seen. The villages in this part of Africa (except those of the Angoni) are scattered and indefinite collections of huts, and Kwamba's is no exception to the rule. The village, or, to be exact, the series of villages, extend for many miles along the slopes of the Namwero hills. Extensive fields of mopeira, cassava, tobacco, and a little sugar-cane surround the villages. Kwamba's houses are situated at the northern end of these series of villages, and the immediate valley in which his buildings are placed is almost entirely shut in by the Namwero hills on the north and west, and by small detached hills in the other directions. Some of the houses are circular, but these more generally appeared to be used as granaries. The natives store their grain in a neat and clean manner. The grain was stacked on a raised platform 4 feet in height. The interior of the granary, including the floor, is plastered with dark blue clay, and the whole is kept most scrupulously swept and cleaned. The dwelling-houses are generally rectangular, surrounded by verandahs. The interior of these houses is somewhat curious; it is divided off by two partition walls, which are 3 to 4 feet in height, and do not, therefore, extend to the ceiling or roof. One partition wall is built right across the house, with the exception of just room enough to squeeze



PLAN OF AN ALOLO HOUSE IN KWAMBA'S VILLAGE.

The partition walls are 3 to 4 feet in height and 1 foot thick.
The platforms are 6 to 8 inches high.
The earthen floor of the interior is on same level as outside ground. The verandah, however, is 12 inches above this level.
The doors are of board, and are removable.
The object of the smaller partition wall is not quite apparent, unless its use is to exclude the draught.

through at one end. The result of the partition wall is that the house is divided into two recesses or rooms. In each recess is a small platform about 6 to 8 inches high, which is evidently used as a bedstead and seat. The tops of the partition walls serve as tables. Over the door is a hole just under the eaves; this is for ventilation and for allowing the smoke of the fire to escape. The roof, of course, is thatched, and the verandah is raised about a foot above the natural level of the soil. There were no signs of goats or cattle, but each house had its fowl-house, which was generally formed out of a trunk of a tree hollowed out and laid on a pile of rocks and stones. One end was closed, and the log is kept from rolling away by rocks being piled upon it.

A good view of the Luli valley is obtained from the small hill exactly opposite Kwamba's houses. The range of hills to the east and south-east is higher than the Namwero hills, and there are some rather fine cliffs opposite Kwamba's. Our guide called this range the Makua hills, but this probably is the general name for all the country from Kwamba's to the coast. The Makua hills (for want of a better name) rise from 1000 to 1200 feet. The north-east and south-west limits of this range are accurately laid down on the map. The ranges lying beyond the Makua hills to the east are similar in appearance, and I judge them to attain a similar altitude (1000 feet). As far as the eye can see, the whole country is thickly forested, and there are no signs of clearings which might indicate fields or sites of villages. There are no villages between Kwamba's and the Luli river, but I noticed several fires on the slopes of the Makua hills, which would appear to indicate human habitation. I was informed that there were no villages in the neighbourhood of mount Maripa. The water-supply at Kwamba's was obtained from water-holes and a very small stream of water which issued from a rock close to Kwamba's house.

It was with regret that I found my duties prevented me from staying any length of time in the country and exploring thoroughly the surroundings. Our return route passed over the Namwero hills to the south. Except in two parts, the gradient was fairly easy, and, as already mentioned, the path from Kwamba's cuts into the path we had traversed a few miles to the east of the Mtamkulu river, and thus we regained the route by which we had approached the Namwero hills. The expedition returned to Lake Chiuta by the same path as that it had come by.

NOTES ON THE MAP.—This has been made by means of prismatic compass observations and by observations for latitude, the whole forming a system of triangulation. No attempt was made to obtain observations of longitude, the longitude on the map being based upon the position of Madziabango shown by O'Neill in his 'Preliminary Map of a Journey to Lake Kilwa.' For the observations north of the open water of Lake Chiuta, I am indebted to Mr. A. Sharpe's kindness. His observations were made during the early part of 1899, and the latitude of various points on Lake Amaramba fixed and many bearings by prismatic compass taken. The heights noted were obtained by average readings of two "boiling-point" thermometers. The height of Mtungwe mount has not been calculated, but my estimate of 9000 feet will not, I feel sure, be far wrong, as in a great many features this mountain was similar to the Mlanje mountain in the Protectorate territory. No base was actually measured, but the scale was obtained by reducing the difference of latitude between two places to statute miles, and as the various details shown on the map were obtained by triangulation, the respective distances are, of course, proportional to the distances between parallels of two points fixed by latitude. There is thus a difference of latitude of 10° (nearly) between

Madziabango and Tombowe water-holes. Between the parallels passing through these two points there is a difference, therefore, of 11·51 statute miles. On the same scale of latitude Mr. Sharpe's observations on Amaramba have been laid off. The difference between parallels of Tombowe water-holes and the point which marked our camp on the Matawpa river has also been used as a check, and, as will be seen, has worked out accurately. The position of intermediate points other than points of triangulation has been fixed by "time and marching" observations, and as the routes were traversed generally more than once, I am of opinion that very fair accuracy has been attained as regards these minor places. It is a good country for triangulation purposes, and had I had an opportunity for more extensive observations, the extent of ground which could have been mapped would have been very much increased.

A JOURNEY THROUGH SOUTH-WEST SECHUAN.

By EDWARD AMUNDSEN.

I STARTED on December 13, 1898, from Ta-chien-lu, my aim being to cross the unknown part of Chalag and Mili. These two districts, though within the jurisdiction of the province of Sechuan, are by the Tibetans called "kingdoms," and each has its ruler or Tibetan king. The Chinese officials at Ta-chien-lu tried to dissuade me from attempting the journey by representing the dangers of the road, and the character of the people; but, finding I was determined to go, they eventually procured passports for me in both Chinese and Tibetan, and furnished an escort of two men, one of each nationality, to protect and help me on the way. Two servants, one a Lhasa man—Yin Chung—kindly lent me by Mr. C. H. Polhill-Turner, completed the party.

Our first eleven days' march lay through the country of the "King" of Chalag, who resides at Ta-chien-lu. The much-scattered population of this district speak the official language of Kham to a certain extent, but in the family circle the dialect of the respective valleys is used, and each valley seemed to have its own dialect. Of the people and customs I need not speak much, my main intention being to give a few notes of the geographical features of the country traversed, but I may mention the fact that everywhere I received the greatest kindness from the simple hospitable people.

The "king" having sent word through his officials to the people along the road, my coming was everywhere expected, and unpleasantness was avoided. The country is a succession of mountain ranges. We crossed no less than thirteen passes from Ta-chien-lu to Ba-u-rong. Luxuriant pine forests abound everywhere except on the crest of the passes, where small shrubs only were to be seen. The forests increased in grandeur as we went farther south, till in the valley before reaching Ba-u-rong I imagined myself among the mountains of Norway. The land, when not used for pastoral purposes, is given up to the cultivation of barley, wheat, Indian corn, and buckwheat. After climbing the last pass, Ko-se-la, an almost perpendicular descent brought us to the village of Ba-u-rong, a place with about eighty families, Chinese and Tibetans, a cosy spot on the left bank of the Nak-chu river. The valley is warm and fertile, yielding three crops a year. Here we remained over Christmas, waiting for the people of Mili, the next "kingdom," to come and receive their charge. The two runners from Ta-chien-lu, having escorted me thus to the boundary river between Chalag and Mili, were now at liberty to return, having only to see us across the river and on to Milian soil.

A messenger had been sent on to the Mili chief with an order for "oola" (*i.e.* baggage animals) and escort to the palace of the Mili king. The manner of sending such an order is unique. My whip was tied on to a piece of wood, to which some feathers were also attached; this was sealed with the chief's seal, and couriers ran with all despatch carrying this queer official document to its destination. The Mili chief happened to be away from home, so the messenger had to go to a more distant point. Meanwhile the Mili people, in fear and trembling, received me, and, on the security of a Tibetan runner, gave me "oola" for the further journey.

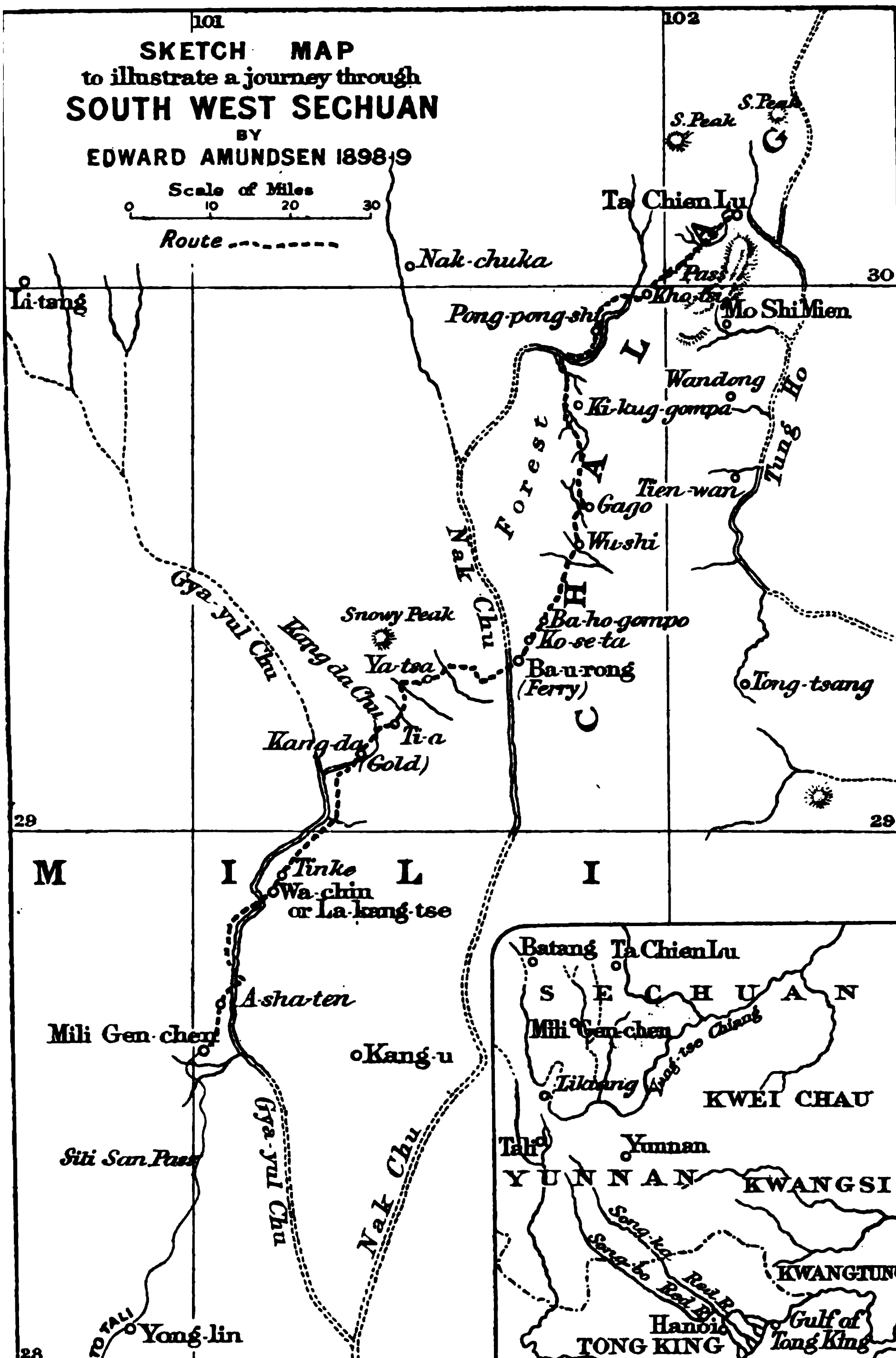
On Monday, December 26, we were escorted by about thirty people to the bank of the Nak-chu, and ferried over on a raft made of two pieces of timber, with a plank in the middle to stand upon. The horses had to swim across. During the high water in summer the raft cannot be used, and recourse is had to a bamboo rope stretched from bank to bank—a rather risky business, I imagine, as the river is probably 60 yards broad, and the rope bridge very high. We found the heat on the river-bank oppressive as compared with the atmosphere of the mountains we had been crossing. Having crossed the Nak-chu in safety, we climbed to the first Mili village, about 1000 feet above the river. The road on this side of the river is nothing but a poor footpath along cliffs and steep mountain ranges. A day's journey will often take the traveller no farther than he can call back to his last night's resting-place, traversing the deep valley between having occupied all his time from daybreak.

The Milians are poor, and have the appearance of an oppressed people. Their houses are small and dirty, with simply no furniture in them, save a stool or two to put the food on while eating, though in some of the better ones they are able to offer the traveller a cushion or piece of skin to spread on the floor for a seat. The one room, which has neither windows nor chimney, serves for bedroom, dining-room, parlour, guest hall, and kitchen. The family and guests, besides, perhaps, a goat or two and a pig, all find accommodation in this one room.

However, I did not hear much complaining on the part of the people; even the poorest with only Nature's covering on seemed to be content, and ate their buckwheat cakes with gratitude to the lama-deity for life and safety. These cakes are a staple diet among the Tibetans here, being easily made with just water and buckwheat, and cooked on a fragment of some discarded iron pot. I found them to be superior as an article of diet, and a welcome change from "tsamba" (barley meal). The Milians cling to Tibetan customs and fashions as far as they are able. They dress in orthodox Tibetan fashion when possible — the lamas, of course, always do so—but many of the people cover themselves with whatever they can get, adding, whenever they go out on a journey, the large heavy cloak of the Lolos, which is both clothes and tent in emergency. The people are peaceable and law-abiding, and always speak highly of their lama-king, or, as they sometimes call him, "the incarnate lama," who owns allegiance to the Dalai-lama at Lhasa, to whom he must pay an official visit before being recognized as the "king" of Mili. Tribute is also paid to China every twelfth year. In religion they adhere to the "Yellow Sect," or reformed church of Tibet.

To the Nak-chu I followed the road traversed by M. C. E. Bonin two years ago, but from that point to Mili Gen-chen (the principal place in Mili), so far as I am aware, no foreigner had ever travelled the road I took. On December 30 we reached the Gya-yul-chu, or "river of China," as the Tibetans call it. It flows, I was told, down from Litang, and is not more than half the size of the Nak-chu, and is very shallow in parts. Before reaching the Gya-yul-chu we passed along the Kang-da valley, through which falls the Kang-da-chu, emptying itself into the river just mentioned. This valley has made Mili famous for its gold, which is found in the river-bed. In past years this had proved a great attraction to the Chinese, who came as goldseekers, but it proved also their ruin. The Milians combined and killed off the immigrant Chinese by rolling rocks and trees upon them from the mountain-sides, and thus rid themselves of their undesirable neighbours. Now none but Milians wash for gold.

From the village of Kang-da, a thriving place, four women were sent to carry my things and escort me to the next place, and they did it singing as they went. One sang the solo part, and the rest took up the chorus, while now and again one of the more pious broke the melody by turning to prayer, a combination that greatly helped one to forget the rough and difficult road. On this stage darkness overtook us when we reached the place where the road bends to the south, following down the Gya-yul-chu, which we heard rather than saw on our right. The women carried pine torches to show the way through the forest, and we reached a solitary roadside house about 9 p.m. The woman of the house made great objections to us staying, but, as she knew the women carriers, she at length consented to our doing so. Once inside the house her feminine curiosity overcame all other feelings, and she came holding up the torch close to my face to inspect the new arrival. So astonished was she that she smote upon her breast, saying, "Holy Trinity!" as much as to say,



SKETCH MAP
to illustrate a journey through
SOUTH WEST SECHUAN
BY
EDWARD AMUNDSEN 1898-9
Scale of Miles
0 10 20 30
Route
101
102
30
29
28
S. Peak
S. Peak
Ta Chien Lu
Pass
Kho-tu
Mo Shi Mien
Nak-chuka
Li-tang
Pong-pong-shi
Wandong
Ki-lug-gompa
Tung Ho
Forest
Tien-wan
Gago
Wu-shi
Nak Chu
Gya-yul Chu
Kang da Chu
Snowy Peak
Ba-ho-gompo
Ko-se-ta
Ba-u-rong
(Ferry)
Ya-tsa
Tong-tsang
Ti-a
Kang-da
(Gold)
M I L I
Tinke
Wa-chin
or La-kang-tse
A-sha-ten
Mili Gen-chen
Kang-u
Siti San Pass
Gya-yul Chu
Nak Chu
TO TALI
Yong-lin
Batang
Ta Chien Lu
S E C H U A N
Mili Gen-chen
Yang tse Chiang
Likiang
KWEI CHAU
Tali
Yunnan
YUNNAN
KWANGSI
Song-ka
Song-bo
Red R.
Red R.
KWANGTUNG
Hanoi
Gulf of
Tong King
TONG KING

"What kind of creature have I admitted to my house?" Her fears were soon scattered, however, when I spoke to her in her own language, and commenced to make myself at home in her spacious kitchen, which became bath, dining, and bedroom to us for the night.

Passing the village of Tinke after some difficult travelling along cliffs and rocks, we reached Wachin, nicely built on the southern slope of a beautiful mountain. This monastery, which has two hundred lamas in residence, serves in turn with two others as the residence of the Mili king.

I had got thus far by official help, but now my fears were aroused for the future. "How will his Majesty look upon me? Will he help me further along, or will he blame me for using 'oola' without his permission, and send me back again?" were questions with which I puzzled myself at this time; but I did as I was advised to do by a Lhasa man—put on a big air such as becomes an official, and determined to push matters through. My Tibetan follower always tried to keep me up to the mark, and demanded respect for his master where he thought needful. At our first request the Wachin people showed us a poor dirty place near the monastery, in which we refused to stay. The lama in charge, however, came and begged us to put up with it till the arrival of the "king," who was expected in a few days. The woman of the house, who was a sweeper in the monastery, was of a different mind, however, so she locked the door in our faces and went off. As the lama had gone back to the monastery, I sent Yin Chung with another Tibetan to show my passport, and tell the lama who I was; but he was told to clear out, and was assisted thereto by a couple of men standing by. This Yin Chung felt to be too great an indignity, so, gathering himself together as well as he could, "Do you not even wish to see the papers from the Emperor?" he cried, and so left them. Things looked rather dark just at this juncture, and I spent some time in uneasiness, praying that help might be given. Soon, to my relief, some lamas came down and ordered the house to be swept, and begged me to be good enough to stay in it for a few days; also gave me some eatables, and apologized for the insults offered to my attendant, and so our feelings were mollified. Yin Chung thought his reference to the Emperor's papers effected the change. Our papers were copied, and much information elicited by questions and written out, and provisions promised for ourselves and horses.

After two or three days' waiting, the arrival of the "king" was announced by salutes from their guns, and much excitement among the people. He was carried in a sedan chair, as an official in China would be, the only person in Mili who may be thus carried. He was accompanied by a large retinue of lamas and officials. Soon after the "king's" arrival, Yin Chung was called up with the papers, but in a little while he returned, shouting when he came within hailing distance, "The very best thing possible—we shall get all we need for going on;"

for which we thanked God. Again the lama came, calling Yin Chung with papers; but he quickly came down again, saying that the "king" wished to see us all, so we got some presents ready and set out for the monastery.

In the big gateway leading to the "king's" residence we were met by the kutsab (or prime minister), who took us upstairs and seated us till the passports were again examined, presents exchanged, and so on. We failed to see the "king," however, for some reason not stated; but he gave us numerous presents, such as sheep, rice, tea, butter, salt, and whatever we needed in the way of food, promised us all we needed to continue our journey, only asking that we should stop at the monasteries on the way, and not with the lay people. Indeed we received much kindness at their hands. Next morning we got on the way for Mili Gen-chen—the metropolis of the Mili district—following still down by the Gia-yul-chu, road good and almost level, through a fine valley which I called Edward's dale, a warm cosy place with good camping-grounds. I spent a night here in the open waiting for "oola." The escort sent by the "king" acted as cook, and we had a royal feast from the "king's" bounty. The escort was a famous cook, and told us that he served the "king" for his food only, the service being compulsory, reckoning as the family tax.

The second day on this road we were joined by all the small lamas and officials returning to Mili Gen-chen, after escorting the "king" to Wachin. The kutsab and chan-tso, principal officials, were most polite to us. The second night out we stayed at A-sha-ten, and entered Mili Gen-chen next day before dinner. This place, though so famous in the kingdom of Mili, is really a big monastery built on the southern slope of a mountain range, with a fine forest of oak and pine in it, with an equable climate and not excessively cold. It is the principal residence of the "king;" he lives here a year or two, then goes to Wachin for a time, and thence on to Kang-u, and again returns to the Gen-chen. A nice bungalow was furnished us outside the monastery, where we stayed a couple of days and proved the truth of the "king's" promise to supply our needs. The officials visited me, wanted to see my things, some of which I had perforce to give them. Altogether we had a most pleasant time, and carried away good impressions of the kingdom of Mili.

From this point we crossed into Northern Yunnan by a route of some considerable length, and were then on ground which has been both travelled and described by others.

PROF. WAGNER'S TEXT-BOOK OF GEOGRAPHY.

By HUGH ROBERT MILL, D.Sc., LL.D.

Although Prof. Wagner's 'Lehrbuch der Geographie'* appears with a statement that it is the sixth edition of Guthe-Wagner's text-book, it is really a new work, and one of the first importance. The introductory volume, dealing with general geography, now before us, is marked by only one defect, probably the result of the method of publication, the volume having been brought out in four parts spread over the six years 1894–1899. One result of this is a somewhat formidable list of errata for the earlier sections. The bibliographies in several instances stop short of the period of publication of important books now available for students which have for years superseded those recommended as the best. This is particularly true with regard to Chapter I. of the Introduction, which deals with literature bearing on geographical science as a whole. The remainder of the introduction is devoted to a brief but admirably concise account of the history of geographical theory, and to a study of the scope and sub-divisions of geography.

The historical chapter is of peculiar interest, for it deals with an aspect of the subject that has been very much neglected. We are familiar with histories of geographical exploration in which the successive steps of the opening up of the world to knowledge are described in great detail, but here we have a history of the development of geographical ideas, the successive stages of the opening of the human mind to a correct appreciation of the Earth as an object of study. We observe with more regret than surprise the small part which the English language has played as a vehicle for the progress of geographical knowledge. No one would wish to deny the claims of German, French, and Dutch writers to the leading place in the modern restoration of geography, but we are inclined to believe that English minds have not been so exclusively engaged during the last three centuries in collecting the facts of travel, and so oblivious to the importance of general ideas as is usually supposed.

Only thirty pages are occupied with the introductory matter, the value of which is far greater than the space it occupies would lead one to expect.

General geography is treated in four books, methodically subdivided into chapters, sections, and paragraphs. Prof. Wagner's work is the latest expression of the most accomplished student of geographical literature, and his system of classification may be viewed as representing the science of geography as it exists to-day; a resultant of the original

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* 'Lehrbuch der Geographie, von Hermann Wagner.' Sechste gänzlich umgearbeitete Auflage von Guthe-Wagner's Lehrbuch der Geographie. Erster Band. Einleitung. Allgemeine Erdkunde. Mit 84 Figuren. Hannover und Leipzig. Hahn'sche Buchhandlung. 1900.

views of many men. Hence we consider it right to give such an epitome of the contents as may serve as a skeleton for a complete system of advanced teaching of the principles of geography.

Taking the names *Erdkunde* and *Geographie* as exactly synonymous, Prof. Wagner shows that geography, considered as to its historical development, exhibits a distinct duality of character, looking on the Earth from one point of view as a physical body, from the other point of view as the dwelling-place of man. From the first point of view geography is a pure natural science depending on exact measurements; from the other it is a connecting bond between natural science and history. But this quality, although far-reaching, is not fundamental, and Prof. Wagner believes that the gap between the two points of view may be successfully bridged, and geography looked upon as a unity.

General Geography is treated under the following subdivisions:—

BOOK I. MATHEMATICAL GEOGRAPHY (193 pp.).

Chap. I. Direction on the Earth's Surface.—Direction on the horizon—Direction on the celestial vault—Direction on the surface of the Earth—Determination of geographical position.

Chap. II. The Body of the Earth.—Figure and size of the Earth—Physical characteristics of the Earth as a whole: mass and mean density, internal heat, terrestrial magnetism.

Chap. III. Movements of the Earth.—Rotation—Revolution—The Solar System—Gravitational interaction of celestial bodies on the Earth.

Chap. IV. Geographical Maps.—Projections—Map-construction and drawing (topography)—Measurement on maps.

BOOK II. PHYSICAL GEOGRAPHY (334 pp.).

Chap. I. The Earth's surface as a whole.

Chap. II. The Land.—Internal structure of the Earth's crust—Contemporary movements of the crust—Modification of the Earth's crust by external agencies—General results of destructive processes—Land-forms—Lakes and rivers—Coasts and islands.

Chap. III. The Oceans.—The bed of the oceans—Sea-water—Movements of the sea.

Chap. IV. The Atmosphere.—Temperature of the air—Atmospheric pressure and winds—Water-vapour and precipitation—Climate.

BOOK III. BIOLOGICAL GEOGRAPHY (87 pp.).—The Biosphere—Distribution of Organisms—General results of migration—Vegetation of the land—Plants and animals of economic value.

BOOK IV. ANTHROPOGEOGRAPHY; OR, THE EARTH AND MAN (189 pp.).—The Human species—Natural divisions of mankind—Classification of the human race according to civilization—States (political geography)—Chief religions and their distribution—Settlements and density of population —Trade routes and modes of transport—International trade.

This plan covers the field of geography fully, and follows what must be held to be the natural order of the development of the subject, passing from one division to the next by the least abrupt transition. The greatest detail is given to the earlier and more fundamental questions involving measurement and differences of form, and considering the close but clear print and the concise style, these portions form the fullest and most systematic treatise on mathematical and physical geography with which we are acquainted. Facts and conclusions are stated, though rarely illustrated by descriptions of individual instances, and the number of pictorial and cartographic illustrations might have been increased with advantage. The references to literature on each branch of the subject are remarkably full, and, for German works, probably exhaustive. Excellent indexes complete the volume, but in spite of every care, several inaccuracies occur in these. The worst we have noticed is "Joudd, volcanoes, 208," where the name should be Judd and the page 268. Criticism of such minutiæ seems almost unjust when we consider the immense value of the work, the learning which it displays, and the thoroughly scientific and methodical plan on which it is arranged.

SOME UNPUBLISHED SPITSBERGEN MSS.

By Sir MARTIN CONWAY.

THE following documents seem deserving of a wider accessibility than they have possessed. Both Lancelott's and Gray's notes appear to be of about the same date, Lancelott's a little earlier than Gray's, say about 1660 or before. Both relate to the Bay Fishery, and do not refer to the killing of whales in the open sea. About the time of the foundation of the Royal Society the whale-fishery seems to have attracted much attention. In the MS. Register Book of the Royal Society (vol. ii. p. 76), under date December 17, 1662, are published a series of elementary "Enquiries for such as goe to Groenland, by Mr. Hoskins." Gray's replies in the same volume (p. 156) are addressed to a more elaborate series of questions, which were afterwards printed with little alteration in the *Philosophical Transactions* (vol. ii. p. 554). The following footnote is added to them in a neat handwriting in the copy in the Royal Society Library: "These have been since printed with Sir John Narborough's voyages * from Spitsbergen, 76 deg. N. lat. they sailed that year." I have seen it stated somewhere that, in the *Philosophical Transactions* for 1675, there is a reference to a circumnavigation of Spitsbergen. I have looked carefully through the book, and can find nothing to justify the statement. In Zorgdrager (German edition of 1750, p. 11) there is mention of a circumnavigation of Spitsbergen by Captain Goodlers in 1630; but no such exploit was accomplished by him (*vide* Pellham).

* London, 1694. 8vo.

British Museum. MS. Sloane 3986, ff. 78, 79.

An Account of Greenland from Capt. Lancelott Anderson a Hull-Merchant who has made 33 voyages thither.

1st that they usually went out of Hull in the Begining of May, and that it proved 3 weeks or 4 voyage to the place they went to which lay in 78 gr. of Latitude.

2dly that they sayld between great masses of Ice of 17 or 20 fathomes thick part of which stood out high above the level of the main mast, off which ran spouts of fair fresh water, when the sun shind upon them.

To some of these masses of Ice (which were of far lesser Bulk) they often times fastned their ship by the Ankor when the winds were higher than ordinary to hinder it for running too swiftly that it might not split it selfe upon those great ices.

3 that they caught their whales in some large Bay or other and particularly in the Bay call'd Bell Sound.* That they always swome to them in their Boates with harping irons of this shape  to strike them: and always strive to avoyd their tayls (because with that part they strike and if they hitt a Boate will break it in pieces) but if you beare up to their head and foreparts, then are you more secure. The whales are there of quick hearing (though they have but little ears) and if they bee suddainly surprised will quake and shiver, and strive to avoyd you by sinking down into the sea.

After they are struck they presently dive and run down towards the Bottom.

Now their harping Irons are fastened to a Cord (which lyes coyled up in the Boate, so that it may not run fould.) of 300 fathom's.

Which the whale will draw all after it and they follow hir with the Boate which way soever shee draw the Cord: and it be not of length enough they are ready (with another Cord in another Boate) to fasten to the end of it before the whale has drawn it quite out to its full Length both of which may extend to 1000 fathom.

The whale will toyle and weary hirselfe thus till shee be weary or not able to stay longer under water (and she will sometimes stay 1 hower or more under water before shee appear at all) yea and will run under great Ilands of Ice which are floating there, but will come back againe to the open sea and aire.

Lastly when shee is dead and floates they lett hir alone for 2 or 3 days in which tyme shee swells and so a greater part of hir Back appears on the water:

Then they goe to hir and cutt off Collops of hir back as deepe as the fatt reaches: and as far as the water permitts. which done they turn up one side and then the Belly and lastly the other side and so spades hir round and then leaving the rest of the Body (except the whalebone which they take out of hir mouth) to the mercy of the sea.

Then they take these Collops and Boyle them in their Coppers and so the fat runs all into oyle.

And an ordinary whale will yeild 12 tun of oyle: some 20 tun (if large and taken at a seasonable time).

One strange observable more hee relates off those seas about June when they whales come in there is a certain kind of fruite exactly like Cow-Cumbers which rise in the sea and swim all over it in infinite quantityes (so that the sea swarms with them) and as soone as ever they observe those Sea-Cow-cumbers to arise,

* The definite statement that the English were still accustomed to make Bell sound, by which the modern Recherche bay is intended, their principal base, is important. The chief English resort in the early years of the Bay Fishery was Cove Comfortless (English bay), and the neighbouring shores and waters of Foreland sound, King's bay, and Cross bay.

they doe infalliblely prognosticate the commeing in off the whales, which are poore and leane at their first arrivall there (as he observd of the venison) but in 1 or 2 months will be exceeding fatt with eating and feeding as they suppose on these Cow-cumbers.

For hee has observed that the throat of these sort of whales is very narrow respectively to their great Bulk, so that one can hardly thrust their Arm down it: But it might extend to a much greater bore when hee was alive.

These Cow-cumbers are conceived to be a submarine fruite, which grow at the Bottom of those seas and when ripe doe drop off and so are boyd up immediately to the top of the ocean:

Hee observed they lessened number and grew fewer and fewer toward the latter end of their stay there.

Hee concludes it probable that the whales come into those cold northren seas to cast their young ones there: for he tells mee hee has seene many young ones with the old and once killd a mother-whale with a young one sucking on hir, which was as big as a horse, which they killd also.

Though their whale fishing be their maine end and designe of goeing thither, yet sometimes they make a considerable proffitt of sea-horse teeth, of which kind of Animal there is great plenty in those seas.

He says he has seen on the shore of those seas one or two long horns white and wreathed exactly like those wee call unicorn hornes, which was doubtlesse the horn of some fish cast there: and is that which passes for the soveraige antidote* of the world, for there is not such an animal in the world as that which is one of the Royall supporters in the Arms of England, which is commonly called the unicorn.

About 14 August the ☉ begins to sett and so it grows night little by little till the 13 of 7br till the night was then 5 howers long, and that is the longest any person can or dare stay there.

That the starrs have sometimes fairely appeared there on those so short nights: that there are often great mists for 10 days together.

That the grounds in Greenland are all mossy and live and thrive good long grasse and great store of sorrell, and scurvygrass, which is best about the sea-shores and tis observed grows where the wild foules dung. But not a tree or shrubbe to be seen on all the countrey, which is full of very high-hills which constantly are covered over with snow.

That there are fresh fish both in the sea and in the fresh waters and lakes (which have noe commerce with any other waters) in that countrey.

That there are infinite store of wild ducks and geese and other foule, which lay their eggs in the islands thereabouts which they fetchd by whole Boats-full at once for an excellent dainty: they all desert the country before the merchants come away.

That there are no creatures to be seen there but wild Deare foxes and Beares: the Deare as leane as can be when they come thither and in 2 months will be extraordinary fatt, which they kill for their meal and salt some and bring it over and hang their tongues and sell them here for a tainty.

That there was 8 men once† had the misfortune to be left all winter in

* See 'The Embassy of Sir Thomas Roe' (W. Foster's edition), p. 290 and footnote. Hakluyt Society, London, 1899.

† This was the party whose adventures in 1630–1631 were more fully and accurately described in Pellham's 'God's Power and Providence' (London, 1631; Hakluyt Society's edition, 1855). Pellham merely states that they were relieved by two ships of Hull, but does not mention the captain's name.

Greenland, and that the next summer after it was hee and his ship had the fortune to relieve them.

That they were all alive and had kept an exact account of time.

That the occasion of their being left there the year before was this; they went up with Boates higher into the countrey to kill venison (which they kill there with doggs and guns) and stayd it seems too long so that the ship was gone away for England, before they returned into the Bay: which when they found, they began sometimes to crye out and lament their sad fate, other times to scold and fight: but at last with mutual persuasions to provide for so long and sad a winter (as was comeing on) and to that purpose went again up into the countrey to kill more venison, and after came home with 27 Bucks which they roasted very well (with the whale Collops formerly mentioned which they boyled their oyle with) and then caskd up for their use (for salt they had not).

That they made a shift to get a hogshead of oyle out of the religes of the whales which served them for Lamps (made of old ropesend there left) all the said winter.

That they got all the whale Collops they possibly could rake up together: and drew up their Botes (cutting them in pieces for their winter fewell):

That they made themselves a house halfe undergrown and halfe above and pulld down most of the Barne (where they Boyld their oyle) to build it with: and so sodded it extraordinary well over.

That in the cold and darke winter they had much Benefitt by the light of the moone and now and then caught foxes by Baytes (which came to their very hutt doore for they could not stir any way out (above 2 or 3 hundred yeards for looseing themselves and their hutt and being frozen to death to boot: which foxes proved very good meat.

That they once caught a Beare and eat off him roasted, but they had all like to have dyed of him.

That their drink was snow melted and their cask'd venison to their meat: which kept very well (for Capt Anderson tould mee hee tasted of it the year after when hee relieved them:

That the seas in those parts flow not above 4 foot high.

That the said 8 men were pale, leand, and ill-coloured when hee and his ship relieved them.

Register Book of the Royal Society, vol. ii. (1662, 1663) p. 156.

25 February, 1662.

Enquiries propounded to and answered by Mr. Gray; that hath been severall times in Grœnland. Brought in by Mr. Oldenburg.

1. What is the heat of the sun? etc.

2. What is then the most constant weather in summer? etc.

* * * * * *

6. What Currents there are, and which way they set, and how fast? whether they always run one way? Ans. There is but one constant Current; which sets away from the East-South-East, and runs up to the N.N.E., as far as 77 degrees latitude, where 'tis checkt; and from thence sets away again on the East-side of Greenland, between Duke's-Cove * and Greenland to the South-west; and then

* Duke's cove was therefore a bay in the east side of Wybe Jans Water (Stor fiord). In my large collection of tracings of Spitsbergen maps, I can only find it marked on one, "Carta particolare della Terra di Greneland." This is Carta 49 in the *Parte seconda del Tomo terzo* in the atlas called "Dell' Arcano del Mare di D. Ruberto Dudleo Duca di Nortumbria e Conte di Warvich: In Firenze Nella Stamperia

wheeling about the South-point of Greenland, sets up again N.N.W. to the Foreland of degr. Latitude, and then from the South-end of the Foreland, it drives away to the W.-N.-W. This current when there is much Ice upon the Coast is more forcible; but runs very easy, when the ice is gone from the Coast. It runs always one way.

11. Whether there be any pits or Mines? Ans. He knows of none but some Coalmines, which he had been digging in, not much beneath the surface of the Earth.

13. As to animals, birds, etc.

14. As to vegetables.

15. As to thunder.

17. As to fish.

18. Whether any people do, or have been known to stay there all the winter? and how they shifted? Ans. Once they themselves left * there, besides their intention, 7 or 8 men, that were gone a hunting; at which time they weighed anchor and went along the shoar, intending to meet them and take them in at a convenient place: but a wind and a fogg arising which made them lose the sight of land, and forced them to sea: their poor companions were left behind, but found alive at their next return, having lived upon Foul and Deer, and saved themselves from being frozen by the Coales they found there.

19. How neer any hath been knowne to approach the Pole? Ans. He told me, that once, he met upon the Coast of Greenland a Hollander, that swore he had been but halfe a degree from the Pole, shewing him his journall, which was also attested by his mate; where they had seen no Ice nor land, but all water.

This seems incredible (added in another hand).

REGISTER BOOK OF THE ROYAL SOCIETY, vol. ii. (1662, 1663) p. 308.

November 4, 1663.

The manner of the Whale-fishing in Grœnland. Given by Mr. Gray to Mr. Oldenburg for the Society.

[With 5 illustrations, in pen and bistre.]

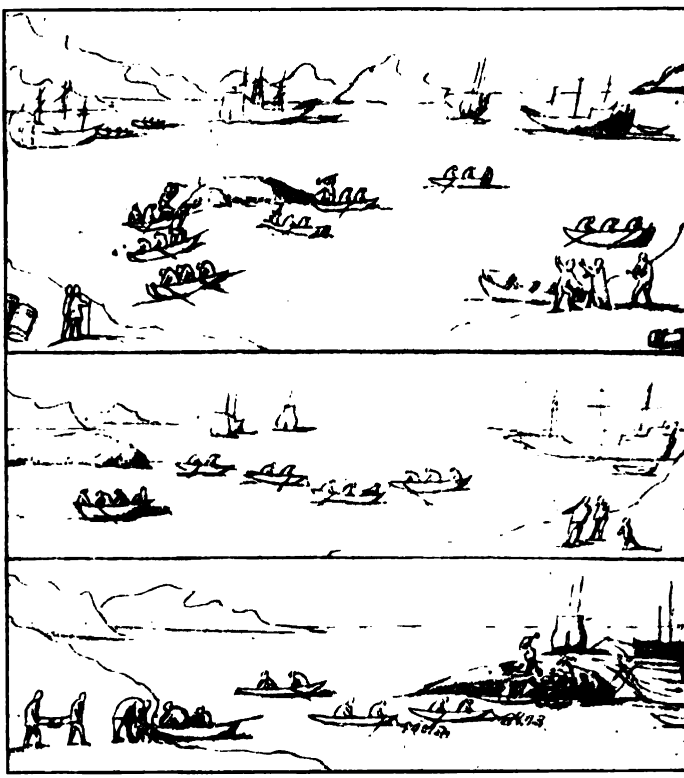
We have according to the bignesse or smalnesse of our ships, the more or fewer Boates: a ship of 200 tuns, may man six boats; A vessel of 80 or 100 tuns, 4 boats; A Vessel of 60 tuns, 3 boats or more, not lesse; 3 boats being as few as may be with convenience to kill a whale. Each boat hath 6 men; A Harpeneir, Steersman, and four Oars; to which men the merchant giveth, (besides their wages) for every 13 tuns of Oyle (which we call a Whale) when there is so much for each

di Francesco Onofri: 1647." It is clear that this is a copy of an English map, but I have not yet found trace of the original. It resembles Edge's chart more than any other, but materially differs from it in important respects. Probably the map represents the ideas of some Hull skipper. The most energetic of the early Hull whalers was Thomas Marmaduke. He is sometimes referred to in Purchas as Duke, of Hull. He was one of the first men to resort to the east side of Spitsbergen, and Duke's cove was probably named after him. On the Florence map it is marked "Duckes Coue," with "Athale Hed" south of it, and "C. di Duckes Coue" north. It is the Gotha cove, apparently, which is marked on the Admiralty chart in the west coast of Edge island.

* These winterers were again Pellham's party of 1630–1631. Pellham distinctly says that the captain of the ship *Salutation* that abandoned them so recklessly was Master Mason. Gray was therefore one of Mason's company.

boate, to the Harpenier 6*li.* 10*s.*, the Steersman 3*li.*, and to each Oar 30*s.*, in all for each boat 15*li.* 10*s.*, which we call whale-money.

We have several men and boats upon several convenient places, which we call *Look-outs*,* that constantly remain looking out by turnes for the Whale, which when we fish in Harbour, cometh into a smooth Bay, where is a good Harbour for our ships: And having discovered the Whale, which swimmeth with her back above water, or is descried by the water which she bloweth into the Air, one Lookout maketh signes to another, by hoysing up a basket upon a Pole, and then all the boats row after her and having opportunity to row up with her, before she goeth



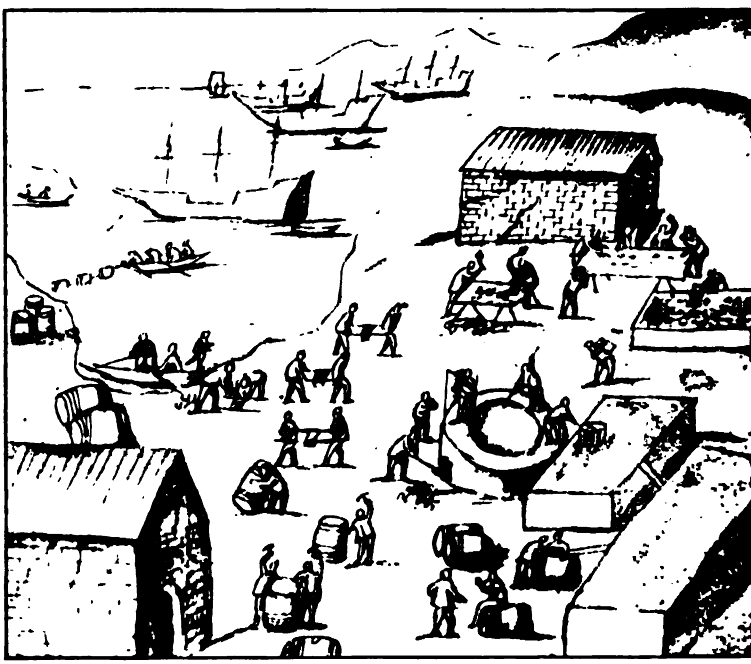
ENGLISH BAY-FISHERY IN BELL SOUND, ABOUT 1650–1660.

down, strike a Harping-iron into her, to which is a staffe joyned being about 6 foot long, called a *harping-staffe*, to the Socket of which Iron is a white rope, with an eye seazed very fast: This Rope is about 5 fathoms long, which Lying upon the forepart of the Boat (which we call a Shallop) always coyled over a little pin, ready to take up, to give scope to the Iron, when it is thrown at the Whale; and to this hand-rope, is a warpe of 300 fathoms seazed, to veer after the whale, lest, when she is struck, by her swift motion (which is often down to the ground, where the water is 60, 70 or 80 fathom deep) she should sink the boat.

* Hence the various points named Lookout, or Uytkyk, on the older Spitsbergen maps.

Thus having gotten our Iron into her, out boats row where they think she will rise (after she hath been beating her selfe at ground) and get 2 or 3 irons more into her, and then we account her secure. Then when she is neer tired with striving and wearied with the boats and ropes, we lance her with long Lances, the Irons and stands wereof are about 12 or 14 foot long, with which we prick her to death; and in killing her, many times she staveth some of our boats, beating and flourishing with her tayle above water, that the boats dare scarce come nigh her, but oftentimes in an hours time she is dispatched.

Thus having killed her, our boats tow her (all of them rowing one before another, one fast to another like a team of Horses) to the ship's stern, where, after she hath layn 24 hours we cut off the Blubber, and take the finns (which we



THE ENGLISH "TENTS" IN BELL SOUND.

commonly call the whalebone) and her tongue out of her mouth, and with a great pair of slings and tackle, we turn her round, and take all that is good off her, and then we turn her carcass adrift and tow the blubber (cut in pieces) to the shore, where works stand to mannure (*sic*) it.

Having made fast the blubber to the shore, we have a *Waterside-man* who stands in a pair of boots, to the middle leg in water, and flaweth such flesh as is not clean cut from the blubber: Then we have two men with a Barrow,* that when the Watersideman hath cut it in pieces about two hundred weight, carry it up to a stage standing by our Works, like a Table; then we have a man with a long knife, who we call a *Stage-cutter*, who sliceth it into thin pieces about halfe an inch thick, and a foot long or longer, and throws it into a Cooler, we call a

* *Not* a wheelbarrow; *vide* illustration.

slicing-cooler, betwixt which and another Cooler (called a *Chopping-cooler*) we have men we call *choppers* placed; five or six men, who upon blocks cut about a foot and halfe square (made of the tayle of the Whale, which is very tough) do take the sliced blubber and chop it very small and thin, not above a quarter of an inch thick, and an inch or two long; and thrust it off from their blocks into the Chopping-Cooler, which holds two or three tuns: Then upon a Plat-forme is built a Copperhole, about 4 foot high, to which there is a stokehole, and on this Copperhole is a broad Copper, which containeth about a Butt, hanged with Mortar and made tight round the edges. And over the Stokehole, upon an Arch, stands a Chimney, which draws up the smoke and flame. And we have one we call a Tub-filler, who with a Ladle of Copper, whose handle is about 6 foot long, taketh the Chopt blubber out of the chopping-cooler and puts it into a hogshead made with strapps for that purpose, and he drawes this hogshead from the chopping-cooler's-side to the Copper and putteth it in; under which having once kindled a fire of wood and boyled a Copper or two of Oyle, the scruffe which remains after the Oyle is boyled out of the blubber (which we call Fritters) we throw under the Copper, which makes a feirce fire, and so boyleth the Oyle out of the blubber without any other fewell.

Then when we find that it is boyled enough, we have two men which we call coppermen who with two long-handled copper ladles take both oyle and fritters out of the Copper, about halfe, and put it into a Barrow (we call a Fritter-barrow) made with two handles and barrell-boards set about halfe-a-quarter of an inch one from the other, through which the oyle runneth and the Fritters remain; from which the Oyle being drained whilst another Coper of Oyle boyles, they are cast into the Stokehole and burnt, and the barrow stands ready again on the first Oyle-Cooler, to receive what is taken out of the next Copper. Out of this barrow the Oyle runs into a great thing we call a Cooler made of Deal-boards, containing about five tuns, which is filled within an inch of a hole (made in the side for the Oyle to run into the next spout) with water to cool the Oyle, and so the Oyle runs upon the water, through this hole into a spout about 10 or 12 foot long, into another cooler filled as aforesaid and out of that, through a long spout into a third filled as aforesaid and out of that, in a long spout into a Butt laid under the end of this spout, which being full, the hole of the Cooler, next the Butt is stopt till another Butt is laid under, and then the plugg being taken out, it filleth another, till we have done boyling: Then we fill up our Oyles, when they are thoroughly cold, and marke them and roule them into the water, rafting 20 together, and so tow them aboard, hoyst them into our ships, and stow them to bring them home.

And for our Finns, which grow in two Gumms in the whales mouth (whereof in a whales mouth, great and small are about 600, 460 whereof being merchandable) we cut them one by one out of the gumms and having rubb'd them clean we bind them up 60 in a bundle, and so taking account of them ship them aboard in our Long-boat.

Upon the shoar we have a Tent * for our Land-men, built of stone, and covered

* The description applies to the English settlement at Bell sound, and should be compared with Pellham's description of the same place. The illustration reproduced herewith from Gray's paper (p. 312), is evidently a rough representation of the Bell sound "tents," which, however, were much larger than here depicted. I have been unable to learn whether any remains of the foundations of these buildings can still be traced. They are to be looked for on the west shore of Recherche bay, in the flat ground between Fox point and Fox glacier. Perhaps some of the many tourists who now visit Recherche bay, with a few hours to spare there, would search for foundations, and let me know if they find any.

with Deals, and Cabbins made therein for our Blubber-men to lodge; And we have a great Working-tent with a Lodging-room over it, where, about 6 Coopers work, to get ready Cask to put the Oyle into.

p. 308 has a drawing inset.

p. 312 contains 4 drawings.

MEMORIAL TO DR. LIVINGSTONE.

It has long been felt desirable, by the many admirers of Dr. Livingstone, that the spot on which the great traveller breathed his last should be permanently marked by a suitable memorial. When, on the discovery by Mr. Weatherley of the precarious condition of the

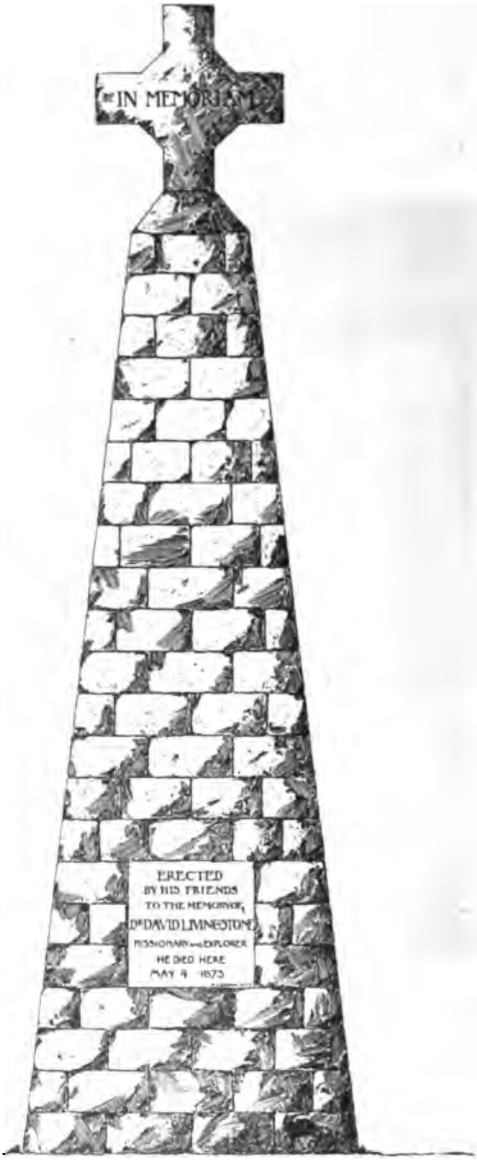
THE MPUNDU TREE NEAR LAKE BANGWEULU, UNDER WHICH LIVINGSTONE'S HEART WAS BURIED, AND ON WHICH HIS NATIVE FOLLOWERS CARVED AN INSCRIPTION.

tree which marked the locality, it was decided by the Royal Geographical Society to take steps to secure the section of the tree bearing the commemorative inscription for safe-keeping in this country, it was hoped that arrangements might also be made for the worthy commemoration of a spot to which, in the eyes of Englishmen, an almost sacred character attaches. At the same time a movement had been set on foot, and funds raised, among residents in Nyasaland and others, with the support of Sir H. M. Stanley, for the furtherance of a similar object, and it was found possible to concentrate the efforts of all interested on a single scheme by the formation of a joint committee, representing our Society and the other body of sympathizers. The labours of this committee have, we are glad to announce, led to a

SECTION OF THE LIVINGSTONE TREE CONTAINING THE INSCRIPTION.

satisfactory result, all the arrangements having been made for carrying out the design.

It has been decided that the memorial shall take the form of an obelisk, 20 feet high, surmounted by a cross. In the absence of suitable stone in the region in question, the material chosen is the best concrete, which, it is thought, will be the most satisfactory from the point of view of durability. It will be taken out in 450 air-tight cylinders, each of 50 lbs. weight. Moulds, of oak with metal lining, have been prepared for the formation of the blocks, of which over 300 will be used. Tablets, in blackened bronze, will be embedded in the blocks as moulded.



SKETCH OF THE MEMORIAL TO BE ERECTED TO LIVINGSTONE ON THE SITE OF THE TREE.

Two of these, placed on opposite sides of the monument, will bear the following inscription: "Erected by his Friends to the Memory of Dr. David Livingstone, Missionary and Explorer. He died here, May 4, 1873."

On the other faces of the obelisk two more tablets will be placed, on which the following will appear:—

> "This monument occupies the spot where formerly stood the tree, at the foot of which Livingstone's heart was buried by his faithful native followers. On the trunk was carved the following inscription: 'David Livingstone. Died May 4, 1873. Chuma, Souza, Mniasere, Uchopere.'"

The undertaking has met with the cordial support of the British South Africa Company, while its success may be considered assured through the co-operation of Mr. Alfred Sharpe, British Commissioner in Nyasaland, who has kindly made himself responsible for its execution. Mr. Robert Codrington, the company's representative in the Bangweulu region, has also shown himself active in furthering the necessary preparations. It will be remembered that to Mr. Codrington was due the securing of the section of Livingstone's tree—a mission with which he was entrusted by Mr. Alfred Sharpe, who, at the request of the Council, kindly agreed to act as the Society's agent. The task has been accomplished with entire success. The section has now arrived in this country and is deposited in the house of the Royal Geographical Society. The thanks of the Society are due to the British South Africa Company, who, through their representative, Mr. Codrington, have most generously carried out the Society's wishes in having the section transported from Central Africa to England. It is only fair to state that Mr. Alfred J. Brown, who designed the memorial, and has taken all the trouble to obtain and pack the material and design the moulds, has given his services gratuitously.

THE MONTHLY RECORD.

THE SOCIETY.

The Annual Awards.—The annual awards of the Society have been made as follows for the present year: The Founder's Medal to Captain H. H. P. Deasy, for the exploring and survey work which he has accomplished in Central Asia; the Patron's Medal, to Mr. James McCarthy, for his great services to geographical science in exploring and mapping all parts of the kingdom of Siam; the Murchison Award to M. H. Arçtowski, for the valuable oceanographical and meteorological work which he performed on the Belgian Antarctic Expedition; the Gill Memorial to Mr. Vaughan Cornish, for his researches on sea-beaches, sand-dunes, and on wave-forms in water; the Back Grant to Mr. Robert Codrington, for his journeys in the region between Lakes Nyasa and Tanganyika; the Cuthbert Peek Grant to Mr. T. J. Alldridge, for his journeys during the past ten years in the interior of Sierra Leone.

Retirement of Mr. Coles, the Society's Map Curator.—The announcement that Mr. John Coles, the Society's Map Curator and Instructor, has been compelled to retire, owing to failing health, will be received with sincere regret by all the Fellows of the Society. Mr. Coles has filled his important and responsible position for twenty-three years, and has discharged the duties of his post in a manner which has gained for him the unqualified approval of the Council, and the respect of all who have come into contact with him. The difficult task of keeping the Society's enormous collection of maps and photographs up to date, of maintaining order in their arrangement, and of affording assistance to the numerous Fellows and visitors who desired information, has been performed by Mr. Coles with complete efficiency. As an Instructor in the use of instruments and in practical topographical surveying, he passed many travellers through his hands; as a teacher he was probably unsurpassed. In these and other ways Mr. Coles has rendered great service, not only to the Society, but to the promotion of scientific geography. His retirement is a great loss to the Society. He will be succeeded in the map curatorship by Mr. E. A. Reeves, who has been assistant to Mr. Coles for twenty-two years. The Society's system of instruction has become so important under Mr. Coles that the Council propose to make it a separate department, under a competent official, who will devote his whole time to the work.

EUROPE.

Climatology of the Sonnblick Group.—Dr. Fritz Machaček (a pupil of Prof. Penck) contributes a paper on the climatology of the glacier region of the Sonnblick to the report of the *Sonnblickverein* for 1899, dealing specially with Eduard Richter's observations of the remarkably low level of the snow-line in the eastern part of the Hohe Tauern. The recent considerable developments in the system of observations, especially the increase in the number of summit stations, has provided a large quantity of new material. The glaciers cover, or covered in 1871, an area of 16 square kilometres (6·2 square miles) on the north side of the group, and about half as much on the south side. The mean elevation of the glaciers on the two sides is 2680 metres (8800 feet) and 2730 metres (9000 feet) respectively, the same as the position of the "climatic" snow-line. Above this level, say 2700 to 3100 metres (8900 to 10,200 feet), lie the catchment basins of the glaciers. Calculating from the rainfall, the yearly increase in thickness corresponds to from 14 to 17 metres (46 to 56 feet) of freshly fallen snow—as much as Heim allows for the Western Alps, and twice as much as Schlagintweit estimated at a time when few observations at high-level meteorological stations existed. The annual mean of temperature is $+0^{\circ}\cdot1$ C. ($32^{\circ}\cdot2$ Fahr.), and the summer mean 7° C. ($44^{\circ}\cdot6$ Fahr.) at an elevation of 2200 metres (7200 feet); at 2700 metres (8900 feet) the summer mean is $3^{\circ}\cdot6$ C. ($38^{\circ}\cdot5$ Fahr.); and at the top of the Sonnblick, 3106 metres, or 10,190 feet, the annual mean is $-6^{\circ}\cdot1$ C. (21° Fahr.), summer mean, $+0^{\circ}\cdot4$ C. ($32^{\circ}\cdot7$ Fahr.). The new observations confirm Hann's supposition that the level of the snow-line changes from month to month within comparatively narrow limits. The lower edge of the snow-covering—the temporary snow-line—rises from 1400 to 1600 metres (4600 to 5200 feet) in April, to 2400 to 2700 metres (7900 to 8900 feet) in July, and snow disappears from the valley slopes almost entirely in August. The rule that the snow limit rises towards the centre of the mountain mass holds good for the temporary as well as for the climatic snow-line. Slopes with southerly exposure are specially favoured; they are clear of snow half the year up to 2000 metres (6600 feet), and for 140 days to 2400 metres (7900 feet), while northerly exposures are only clear for 60 days at the same elevation. The proportion of snow removed from the "Firn" region by melting, estimated from the air-temperatures above freezing, is markedly greater in the glaciers exposed to the south than in those exposed to the north, notwithstanding similar precipitation and mean temperatures—a significant example of the importance of this element. The cause of the low level of the climatic snow-line—2700 metres (8900 feet)—is therefore primarily the abundant precipitation, which favours large Firn deposits; but the low summer temperature, preventing extensive melting of snow, is also an important factor. Great local variations of level—2600 to 2900 metres (8500 to 9500 feet)—are due to the conditions of exposure and the shadows thrown by the mountain masses.

Farming Industries of Bosnia and Herçegovina.—From the excellent and detailed publications on the agriculture and stock-rearing industries of Bosnia and Herçegovina, issued by the Austro-Hungarian Government (Sarajevo, official press, 1899), it appears that, according to the returns for 1895, more than 88 per cent. of the civil population, comprising about 220,000 heads of families, are engaged in farming industries. Of this number only 2·6 per cent. belong to the class of landed proprietors, while over 39 per cent. are independent cultivators, and 40 per cent. "Kmeten," or hereditary tenants, who, during the Turkish period, were to the landowners practically in the relation of serfs. Since 1885 the number of independent cultivators has increased, relatively to that of the "Kmeten," by almost 13 per cent. Bosnia and Herçegovina belong to the most extensively wooded countries of Europe, more than 52 per cent. of the surface consisting of forest (oaks and conifers), which is State property and under systematic control. Yet almost a quarter of the land (22 per cent.) is now under agriculture, the amount having increased by 7 per cent. in one decade. Gardens and orchards have likewise increased 23 per cent., and vineyards 18 per cent. The chief decrease is in pasturage, while forests and unproductive ground (the latter barely 2 per cent. of the whole) show but a slight decline. Taking the average of the five-yearly period 1892–96, the annual yield of corn has risen since 1882 from 1·2 to 3 million metric centners, the chief increase being in maize, the staple crop of the country, though the yield of wheat and barley has also risen. That of potatoes, which were first introduced by the Austrian troops in 1878, has, however, shown the greatest increase, amounting to 190 per cent. on the average of the first five years. Cattle, and especially sheep, abound, the latter having increased from 840,000 in 1879 to 3,230,000 in 1895, the number per square kilometre being 63 (163 per square mile), or twice that of the inhabitants. Goats number 1,450,000, cattle 1,150,000, the former being three times, the latter twice, as numerous as in 1879. Of swine there are 13 to the square kilometre (34 to the square mile). Sheep are most largely exported (130,000 head in 1879), but cattle and goats both show an increase of late years. Swine have, on the contrary, been less exported since 1894.

Rainfall of the Central Rhine Provinces.—The latest addition to the *Forschungen zur deutschen Landes- und Volkskunde* is a paper by Dr. P. Polis, director of the meteorological station at Aix, on the rainfall of the central Rhine provinces and the surrounding regions. The period covered by the material used is only the one decade 1886 to 1895, but the discussion has the merit, all too rare in such investigations, of attempting to estimate the probable errors of the results: the mean uncertainty in differentiating one station with another is found to amount to about five per cent. A very clear set of maps shows the distribution of rainfall in the four seasons, and the percentage of the total annual fall received during each. The special points of local importance are pointed out, but some conclusions of general interest, based on the examination of this particular area, are suggestive when compared with the rainfall types recognizable in the British Isles. The rainfall is in the first instance determined by the distribution of pressure, condensation occurring in the ascending currents associated with low barometric pressure; and along with this the temperature and humidity, largely depending on the position with regard to sea and land, must be taken into account. Given the general conditions controlled by these factors, the local inequalities are primarily regulated by the surface relief of the region. Mountains cause a general increase of rainfall on their weather side, and diminution on their lee side; an increase of winter and autumn rainfall, and a diminution of summer rainfall. A maximum in October is due to the greater humidity of the atmosphere and the larger number of cyclones during that month. The increase of rainfall with height is closely connected with open position of mountains concerned; sheltered elevations of equal height diminish the rainfall. A mountain range diminishes the annual range of temperature on its weather side, and increases it on its lee side; hence on the former the winter rainfall, on the latter the summer rainfall, is increased. We may compare this with the west coast and the midland and eastern counties of England. The alteration of weather and lee sides due to the seasonal changes in the direction of prevailing winds tends to increase the winter rainfall on south-west exposures, and the summer rainfall on north-east exposures. Spring rainfall is increased on eastern slopes by the prevailing easterly winds. The long-period records of Aix show that snow falls most frequently in March, January coming second, and February third; but for the 1889–95 period January and February are the months of most frequent snow. The number of days of snowfall increases rapidly with increase of height. Old snow may give as much as 3·5 mm. of water per centimetre of depth, equivalent to nearly one-third.

ASIA.

Mr. D. Freshfield's Explorations round Mount Kanchinjinga.—The February number of the *Alpine Journal* contains a short sketch of the tour of Kanchinjinga carried out last autumn by Mr. Douglas Freshfield, accompanied by Mr. E. J. Garwood and Sig. V. and E. Sella. Darjiling was left on September 5, and after being hospitably received at Gantok, the capital of Sikkim, by the Political Resident, Captain Le Mesurier, to whom the party were indebted for the most valuable aid in arranging their transport, the travellers reached Lachen, on the road to the Donkia pass, on September 17. Here the horses were left, the route lying up the pathless gorge of the Zemu to the glacier which flows from the north-east base of Kanchinjinga. The great storm which did so much harm at Darjiling was encountered, at a camp at 16,000 feet, in the form of forty hours' snowfall, which prevented any attempt at high ascents. Proceeding north across the Tangchung La and The La passes, both over 17,000 feet, the party reached the lofty pasture valley of Lhonak,* Tibetan in character and uninhabited. Thence,

* This (*Proc. R.G.S.*, 1892, p. 613) is the upper Zemu valley of Hooker, while the Thlonok of that traveller is the stream descending from the Zemu glacier of White and Hoffman. On the 2 miles to the inch survey of India the Lhonak stream is called the Lanok Chu, the glacier stream the Pokie Chu, and the united streams the Zemu Chu.

after a visit to the Chorten Nyima pass (19,000 feet) leading to Tibet, the ridge running north from Kanchinjinga was crossed into Nepal by the only known pass, the Jongsong La, 21,500 feet according to the Government maps, 21,300 by the travellers' observations. On the farther side a great glacier runs first south, then west under Kanchinjinga into one of the heads of the Kangbachen valley. Five days were occupied in crossing from the stream of the Lhonak valley to the point where the ice was left in Nepal. At Khunza, Sir Joseph Hooker's Kambachen, the track of that traveller in 1848 was crossed. Since Hooker's visit, no European had visited this side of Kanchinjinga, owing to the difficulty of penetrating Nepal. Mr. Freshfield, however, met with a friendly reception at Khunza, the only permanently inhabited spot in Nepal he visited. A superb view across the Arun valley to the Mount Everest of English maps was obtained. Sikkim was again entered by the Kangla pass, and some days were spent in the neighbourhood of Jongri, whence the Guicha La, south-west of Kanchinjinga, was visited, and a view obtained of the 19,000-feet gap leading to the Zemu glacier. It appeared exceedingly steep and difficult on the south side. Mr. Freshfield speaks in glowing terms of the glacier scenery of the Sikkim Himalaya, and of the beauties of its vegetation. Signor Vittorio Sella and Mr. Garwood obtained several hundred photographs of the peaks and glaciers, the forests and flowers; and the latter, who is a member of the Council of the Geological Society, collected much information and the material for a physical sketch-map of the Kanchinjinga group. The Government maps were found to be incomplete in topographical detail at high altitudes on the eastern side of the range, and on the western, where they are based on the observations of native pundits, they proved wholly inaccurate.

Dr. Sven Hedin's Expedition.—News of the progress hitherto made by Dr. Sven Hedin in his present journey to Central Asia is given in the fourth number of *Petermanns Mitteilungen*. From Kashgar, which was reached on September 1, 1899, Dr. Hedin proceeded to Lailik, on the Yarkand-darya, for the purpose of entering on the first section of his programme—the exploration of the Tarim. Between September 15 and December 7 he navigated the whole river from Lailik to Janzi-koll, on Lob Nor, the result being a complete survey of the Yarkand-darya and the Tarim. At Lob Nor he met the French traveller, M. Bonin. Some weeks having been spent in the thorough exploration of the region of the lake, Dr. Hedin made his way to Cherchen, which he reached on January 12, 1900.

Typhoons of the China Seas.—The Manila Observatory has issued an important memoir on the typhoons of the Philippine region, by Father José Algué, S.J. The work is in three parts; first, a full discussion of the typhoon, the distribution of pressure within it, the wind-directions and clouds in its different parts, the progressive movements of the whole, and the general conditions under which typhoons are developed. Next comes an account of appearances associated with typhoons, particularly such as are of value in forecasting their approach; and, lastly, a detailed account of a selected number of typical and anomalous specimens of typhoons. One of the most important parts of the treatise is the practical application of the results obtained to ascertaining the position and motions of typhoons. A table of mean pressures for different areas and seasons is given, and a certain departure from the mean—which may be indicated by a red movable needle on a ship's barometer—marks the neighbourhood of a typhoon. With the help of a new instrument, called the baro-cyclonometer, it is then possible to determine the position of the centre of the typhoon, and with a second barometer-reading and observations of wind-direction, to find the direction of its motion. The cyclonometer, which consists of a dial representing a horizontal section through a typhoon, and three movable needles to be adjusted in accordance with the observations, is a perfectly simple device, but should be a valuable aid in interpreting the indications of the barometer. Father Algué's full memoir is in Spanish, but a small pamphlet in English is issued along with it, describing the cyclonometer and its use in practical navigation.

AFRICA.

Return of Mr. Moore's Expedition.—The arrival of Mr. J. E. Moore at Mombasa, on his return from the scientific expedition to Tanganyika, was reported about the middle of May. The expedition is said to have been very successful, having carried out the proposed zoological investigations throughout the chain of lakes from Nyasa to the Albert Nyanza. The main result is the discovery that the marine forms of life found in Tanganyika do not extend to any of the more northern lakes, as had previously been thought possible. Evidence was collected that Tanganyika must have formerly extended farther both towards the Congo valley and towards the north and south. A successful ascent of one of the snowy peaks of Ruwenzori was made, and the results will be of much interest as affording a comparison with the phenomena of the other high peaks of East Africa.

Major Gibbons's Expedition.—Major Gibbons writes to us from Chienje, at the north-east corner of Lake Mweru, under date January 21, giving an account of his journey to that place from Lialui, on the upper Zambezi. The first section up-river was performed by canoe, the banks in this section being high, undulating, and well wooded, so that the landscape was most picturesque. Navigation is less obstructed than Major Gibbons had supposed, most of the rapids offering no obstacle to the passage of light-draught stern-wheelers. At Nana Kandundu, east of Lake Dilolo, porters for the route to the Zambezi sources were unobtainable, though any number could have been procured for the journey by the old trade-route to Garenganze. This difficulty had, however, been forestalled by Major Gibbons, who, before leaving Lialui, had procured five donkeys, which were driven along the river-bank during the voyage. The commencement of the rains rendered the land journey exceedingly difficult, but Major Gibbons retained his usual robust health. The ground rose in gradual undulations to an altitude of 5000 feet at the Zambezi source, and was covered with forest, with a little undergrowth. The neighbourhood of the Kapombo sources is exceptionally attractive, consisting of high undulating open downs, with bracing air and good pasture. The loss of two donkeys through the attacks of lions necessitated the abandonment of some of the ammunition and supplies, but the party held on, and when nearing the Mumbeshe overtook the Lemaire Expedition, in company with which the journey was continued for some time. The watershed, which was followed to the Lufira system, consisted of a high belt of undulating ground falling away to the north and south. A wild raspberry, similar to the English, was here met with, though apparently unknown to the north and south. Before reaching Lukafu station, Major Gibbons was attacked by dysentery, but soon recovered, and made his way in twelve days to Mpwetu, where he fell in with Mr. Weatherley, of the value of whose geographical work he speaks highly. Throughout the whole journey only one hostile demonstration was encountered, and this was soon brought to a friendly issue. Major Gibbons has continued his careful survey of his route, every change of direction being noted, and distances recorded, while star observations were always made when the state of the sky admitted. While travelling with Lieut. Lemaire he continued his work quite independently, but his results agree well with the astronomical longitudes fixed by the latter. He had met with courteous consideration at the hands of all the Congo State officials. At the time of writing, he was already on his way home *viâ* Lado and Khartum.

Dr. Donaldson Smith's Expedition.—A telegram has been received at the Society from Dr. Donaldson Smith, dated Gebel Ain, May 21. Gebel Ain is on the Upper Nile, and is probably the first telegraph station met with by Dr. Smith. He states that he has traversed the region between the river Omo (about 5° 30′ N.) to Fort Berkeley on the Upper Nile, and that he found no rivers "west of the Omo," that is presumably between the Omo and the Upper Sobat. His collections and maps, he states, are "good," and his companion, Mr. Fraser, is well.

Journey to Lake Mweru.—Through the courtesy of the Foreign Office, a recent report of Mr. Alfred Sharpe on a journey to Kazembe's and the Luapula has been communicated to us. It is accompanied by a detailed account, by Dr. G. D. Gray, who accompanied the expedition, of the country traversed, and by a sketch-map of the route. The journey was occasioned by the contumacy of the chief Kazembe, whose raids had been a constant cause of disquiet to the Mweru district, but who fled with his people across the Luapula before the arrival of Mr. Sharpe. A British station was established near the site of his town, to which his people soon began to return, and it is hoped that the country will now settle down, the whole Luapula valley down to 11° or 12° being thus thrown open to trade. On the Luapula, Mr. Sharpe was well received by the chief Kafimbi, a son of Kazembe. On the Nyasa-Tanganyika plateau Arab influence has almost disappeared, while the natives are no longer collected under influential chiefs, a fact which, though favouring peace, removes them to some extent from the control of the authorities. Labour is exceedingly difficult to obtain, and ox-transport, for which the greater part of the Stevenson road is suitable, is regarded as indispensable for the needs of the country. The route followed by the expedition lay for the most part through well-known country, but Dr. Gray's notes give some useful information regarding its present condition. From the south end of Tanganyika Mr. Sharpe took a more southerly route than that followed by him in 1892, crossing the Lofu in about 9° S., and travelling partly along a hoed road and partly by native paths. On the second day the high plateau was left, and the difference in temperature was most marked, the sun beating down more fiercely, while no cool breeze tempered its heat. The country was at first thickly wooded and little inhabited; afterwards several Awemba villages were passed. Mr. Sharpe reports that the Awemba country has lately been opened up both by the Chartered Company's officials and by the French missionaries, it having been divided up among petty chiefs on the death of Ketimkulu. Passing south of the Mweru swamp and crossing the Mkubwe, the largest and best running water between Tanganyika and Lake Mweru, Dr. Gray proceeded direct to the Kalungwizi station, while Mr. Sharpe turned aside to visit the swamp. The declaration of this as a game reserve was, he thinks, a wise step, and likely to prove effectual in preventing the extermination of the elephant. Dropping down into the Kalungwizi valley, Dr. Gray found the country more open and fertile. The valley was uninhabited during Mr. Sharpe's visit in 1890, owing to Arab depopulation, but since the establishment of the Kalungwizi station, natives have flocked to it from all parts. South of Kalungwizi, a thickly wooded country with many rubber trees was entered, and, being well watered, was free from the parched appearance presented by the plateau at the time—the close of the long dry season. The Luapula swamps, which were subsequently visited, were formerly a great haunt of elephants, but these are rapidly diminishing in number owing to the persecution by the natives. Other game has disappeared owing in part to the rinderpest. On the return journey, Dr. Gray visited Kilwa island, which he considers of much prospective value as a sanatorium. It is one of the most beautiful spots in the whole country, and on its plateaux, 600 feet above the lake, the air is cool and balmy, the soil dry, with short turf grass, and dotted over with large shady trees. From Chienje station, near the north end of Lake Mweru, the return journey was made round the north side of the Mweru swamp. Beyond this the country was a series of high and low levels, giving the impression of having once been a lake region. A flowing river (the Chisela) seen by Mr. Sharpe in 1892, had quite disappeared, a fact which Dr. Gray thinks to favour the idea of a general desiccation of the country.

Lieut. Lemaire's Expedition.—A few additional particulars respecting the geographical results of the Belgian expedition to the southern borders of the Congo State are given in the *Mouvement Géographique* for April 15 and 29. From the village of Kazembe on the Lualaba the expedition reached the Nzilo falls, whence the route led north-west across the Lufupa to the Lubudi. This was ascended towards the south, but a westerly direction was afterwards resumed, and the Kuleshi, a more important stream than the Lubudi, was reached. On arrival at the Kasai (the Lukoshi having meanwhile been crossed), the expedition ascended that river and one of its affluents to Lake Dilolo. This is a vast swamp with no connection with the Kasai, while only after very heavy rains does it appear to communicate with the Zambezi through the Lotembwa. The line of parting between the Zambezi and Congo basins, which was crossed and re-crossed during the return journey, proved much better marked than has hitherto been supposed, no intercommunication between the two basins having been observed. The principal river crossed was the Mualaba, evidently the Lualaba of the Pombeiros, and of Arnot, Capello, and Ivens, though Lieut. Lemaire seems to imply that the Portuguese travellers placed its sources a degree too far south. The Kuleshi mentioned above as more important than the Lubudi is evidently the Lokoleshe of Arnot, who did not, however, speak of it as of exceptional size. M. Wauters considers that the information sent home by Lieut. Lemaire justifies his belief that the main branch of the West Lualaba, and, according to his view, of the Congo itself, lies west of the Lubudi, which name was originally, however, applied by him to the stream occupying the position of the Kuleshi. Lieut. Lemaire's full account must be awaited before these hydrographical questions can be entirely cleared up.

The Mashonaland Railway.—The resident engineer, Mr. Harry Good, writes and points out in connection with the map of the Mashonaland railway, published in the February *Journal*, that the railway was opened for traffic on May 24, 1899; also that the Beira railway is now being relaid to a gauge of 3 *feet* 6 *inches*, uniform with the Mashonaland railway and the South African system; this widening was expected to be completed in May. The original distance from Beira to Umtali by the former gauge (2 feet) was 222 miles, this distance will be reduced to about 207½ miles on completion of the widening, as several deviations have been made from the old route.

AMERICA.

Railway Project for French Guiana.—The issue for May 2 of the *Dépêche Coloniale* contains an account, by that journal's correspondent in French Guiana, of the proposed railway from Cayenne to the interior which has lately been under discussion in the *Conseil Général* of the colony. The scheme was set on foot by M. Levat, an engineer, to whom a concession for the railway for a period of ninety-nine years was voted in January last by the Colonial Chamber, the decision of which, it is hoped, will be upheld by the supreme authority. From Cayenne the line will proceed south up the valley of the Comté river, afterwards striking across to that of the Apruag, which it will ascend as far as the Saut Kanori. Here it will bifurcate, one branch running south and south-east to the Oyapok and the territory in dispute between France and Brazil, the other striking west for the Awa, the upper branch of the Maroni on the

Dutch frontier. The whole of the projected lines will have a length of nearly 400 kilometers (250 miles), but the section to be first taken in hand will extend only to the Arataye, a tributary of the Apruag (about 60 miles). Within this distance it will, however, traverse districts in which gold is already being mined. Great hopes are said to be based on the influence of the railway towards the development, not only of the mining resources, but of the agriculture of the colony. The latter has of late years been in no flourishing condition, but it is thought that with proper means of communication an era of prosperity will dawn for the fertile Isle of Cayenne, as well as for the forest industry of the interior.

Dr. Hermann Meyer's Second Xingu Expedition.—The main outlines of Dr. H. Meyer's latest expedition have already been given in the *Journal*, but the fuller account given before the Berlin Geographical Society in February last—and since published in the *Verhandlungen* (Nos. 2 and 3)—enables us to add more details. Of the various head-streams of the Xingu, the Kulisehu, Batovy, Tatoba, and part of the course of the Kuluene, had been explored by former expeditions; but in order to complete our knowledge of the hydrography of the river, the task of laying down the course of the Ronuro—one of the most westerly branches—remained to be performed. From the size of this river at its mouth, Dr. Meyer had been inclined to consider it the true upper course of the Xingu; but a difficulty existed in determining its place of origin, as the Formoso and Profundo, the only streams descending the northern watershed in this region which had not yet been explored, were ascribed by the Indians to the Paranatinga, a tributary of the Tapajos. The solution of this problem therefore formed—together with ethnographical research—the main object of Dr. Meyer's expedition. After various difficulties, Cuyaba was left in March, 1899, the route to beyond the Paranatinga following in the main ground already traversed by Dr. Meyer. As, however, he had set out before the close of the rains, the country, instead of the monotonous grey appearance which it had before presented, was decked in the freshest green. A deviation was made over the Serra Trombador in the tracks of a party of Cayabi Indians, who had for the first time made an incursion among the Brazilian settlements, and who will, Dr. Meyer thinks, cause trouble to the authorities unless wisely handled. From the summit of a hill beyond the Paranatinga, the clearness of the atmosphere allowed an extensive view over the unknown country to the north, in which direction countless streams seemed to converge on a dark strip of forest, which marked the course of the Rio Formoso. This Dr. Meyer determined to follow. Trees were found for building canoes, ten of which were ready in a fortnight, and the voyage was commenced on May 23. Dr. Meyer speaks in glowing terms of the beauty of the wooded banks of the river, which soon attained a large size. After eight days mountains closed in on either hand, the trees disappeared, and the flow of the stream became accelerated. Rapids were soon encountered, and presented almost insurmountable difficulties. Over a hundred and fifty frightful passages had to be made, ending in disaster thirty-five times, so that more than half of the total equipment was lost. By far the finest fall is that named "Bastian" by Dr. Meyer, which, with a drop of 50 feet, is the first great waterfall discovered on the Xingu. Finally, as already related, Indian villages were met with, the confluence of the Kuluene was reached and the return effected by that river and the Kulisehu. The chief problem now remaining is that of the origin of the Atelchu, which joins the Ronuro from the west. Dr. Meyer thinks that after his experiences no traveller will choose the Ronuro as a route to this region.

Physico-Geographical Aspects of the Nicaragua Canal Question.—In the March number of the *Bulletin* of the Geographical Society of Philadelphia, Prof. Heilprin brings forward certain phases of the Nicaragua canal project, to which he thinks sufficient attention has not yet been paid. They are connected with the physical geography of the region through which the canal will pass, and especially with the volcanic phenomena, which, he thinks, may greatly endanger the existence of the canal, if made. Prof. Heilprin reviews the principal manifestations of volcanic activity which have occurred within the past century, and shows the small ground that exists for believing, with the supporters of the canal scheme, that the activity of the region is on the wane. He lays particular stress on the violent earthquake which agitated the whole of Nicaragua in April, 1898, as to which he quotes the opinion of Dr. Sapper that its character was purely tectonic, as against the view of Major Dutton, that earthquakes in this region are mere incidents of the volcanic activity. Another question of vital importance to the scheme is that of the level of Lake Nicaragua, which Prof. Heilprin shows, by comparison of the older with the newer surveys, and the analogy of other lakes both in Central America and elsewhere, to be in all probability inconstant, a fall of 15 to 20 feet having, it seems, taken place in the course of little more than half a century. Lastly, attention is called to the deformation of the Nicaragua coast-line by the rapid silting up of harbours, etc., a subject with which the permanency of the proposed canal is closely bound up. From all these facts Prof. Heilprin considers doubtful the advisability or practicability of a canal such as is contemplated, thinking that it may properly be questioned whether, if the canal had been constructed a century ago, it would be in existence to-day.

AUSTRALASIA AND OCEANIC ISLANDS.

Expedition in Western Australia.—An account of a prospecting expedition to the Barrow, Cavenagh, and Warburton ranges in Western Australia is given by Mr. Hugh Russel in a recent publication (vol. xvii., 1899) of the Victorian Branch of the Royal Geographical Society of Australasia. The party, consisting of Mr. H. V. Smith, Mr. F. W. Leech, and the author, with two natives, left Coolgardie on May 3, 1897, the route chosen being between that of Forrest in 1874, and of Lindsay in 1890. They followed the track by Mount Margaret to Kirkpatrick's Well, and then struck nearly due east for Mount Shenton. Thence an east-north-east direction was taken to Point Virginia (Wells), a large conglomerate "breakaway" with cliffs 50 or 60 feet high. After crossing the Salt Lake country, sand-ridges were encountered for nearly 100 miles, with occasional patches of mulga and desert gums, and a few quandongs and acacias, besides spinifex. On July 12, in lat. (by sextant) 26° 59′ 40″ S., a place which was called the Three Point conglomerate was reached; here there was plenty of water, as also kangaroo and rock wallaby. The Townsend ridges are described as a long narrow line of outcropping jasperoid rocks, running 50 or more miles, and highest at the western end. From Mount Squires, the highest point in Barrow ranges, trips were made in all directions. On August 29, travelling a little to the north of west, the party made for Elder creek, which they struck in about 60 miles, at its junction with the Hughes creek. The Warburton ranges from the watershed of Elder and Hughes creeks. Natives were met with in the Barrow and Cavenagh ranges, those of the latter being described as men of fair physique and in good condition. These ranges were prospected, but apparently with no success. On the return journey Coolgardie was reached on October 13. A detailed map of the route of the expedition illustrates the paper.

German Occupation of the Carolines.—The *Deutsches Kolonialblatt* for February 1 contains the report by Governor von Benningsen on his voyage round the Caroline, Palau and Marianne groups, made during the latter part of last year, for the purpose of taking over the government from the Spanish authorities. It gives some interesting details as to the present condition and prospects of the new German possession. The eastern part of the Carolines was first visited, a German flag being left with the native chief of Kusaie, where, as everywhere, the new authorities were well received. The population is about 500, though formerly much greater. The people cultivate largely, and possess an excellent breed of cattle, which the governor thinks might be reared on a larger scale than at present. The production of copra might also be increased. At Ponape, possession was taken on behalf of the German Government with appropriate ceremonies. The port of Santiago is hardly suited to an extensive trade, and the seat of government might with advantage be removed to the much superior harbour of Metalanim. The reception accorded to the Germans was particularly friendly at Ponape, and the prospects of peaceable development are extremely good, the character of the people presenting a striking contrast to that of the New Guinea natives. The island is especially suited for the cultivation of vanilla and cacao. The Ruk Archipelago was next visited. The population is here fairly dense, being estimated at 15,000, and is still increasing, in spite of the constant civil wars. The people are little touched by civilization, but though firearms have been imported to some extent from Japan, have not hitherto molested Europeans. In the Palau group the population is likewise said to be increasing. The formation of the islands is very various. The smaller are often of a bee-hive shape, and composed entirely of coral. The larger are in part of volcanic origin, and in their upper portions present terrace-like flats, with no deep covering of soil, while the lower grounds show a rich layer of humus. The governor made an attempt to verify the existence of coal in the group, and though time did not admit of a visit to the deposits, which are said to occur on the southern part of Baobeltoab, specimens were obtained from the natives. The beds are said to extend for miles, and though the sample obtained was not altogether promising, better is said to exist. The existing charts of the group are said to be untrustworthy, and there is urgent need of a new survey, which would doubtless lead to the discovery of good harbours. At Yap many signs of progress were seen, and, thanks to the energy of the late Spanish governor, German enterprise will find a well-prepared field. The geological formation resembles that at Palau, and minerals may possibly be found. The last group to be visited was that of the Mariannes, where a landing was effected on Saipan and Tinian.

The "Albatross" Expedition to the Pacific.—The fourth and final letter from Dr. Agassiz to the U.S. Fish Commission (dated "Yokohama, Japan, March 5, 1900"), relative to the *Albatross* expedition, appears in *Science* of April 13. It deals with the cruise from Suva, Fiji, to Guam, one of the Ladrones, during which the Ellice, Gilbert, Marshall, and Caroline groups were visited. Owing to the unfavourable weather, but little deep-sea and pelagic work was done. A number of soundings were made from south of Nurakita, the southernmost of the Ellice islands toward the Marshall group, which indicate that the Ellice islands are isolated peaks rising from depths of from 1500 to over 2000 fathoms, and that the same is the case with the Gilbert islands. About thirty soundings were made between the atolls of the Marshalls. These islands rise from depths of from 2000 to 2500 fathoms. The atolls of the Marshall group are noted for their great size and the comparatively small area of the outer land-rims. Among the Carolines, one of the most interesting groups visited was the Truk archipelago. Dr. Agassiz is of opinion that this group owes its formation to submarine erosion, and not to subsidence, as at first sight might appear probable. Truk affords a good illustration of the important part played by the existence of a submarine platform in the growth of coral reefs. The author attaches great importance to the action of the north-east trade winds in shaping the atolls of the different groups, and points out that the coral reefs are all situated practically within the limits of the trades both north and south of the equator. The line of soundings, run from the northern end of Namonuito to Guam, developed the eastern extension of a deep trough running south of the Ladrones. About 100 miles south-east of Guam, a depth of 4813 fathoms was obtained. This island is described in some detail. A number of birds, plants, insects, and reptiles were collected during the cruise, and a large number of photographs were taken illustrating the coral reefs of the Pacific.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Division of Geological Time.—We have received a reprint, from the *Journal of Geology*, of a paper, by Prof. T. C. Chamberlain, on the "Ulterior Bases of Time Divisions, and the Classification of Geologic History." Mr. Chamberlain examines the present state of knowledge in certain departments of geology and geophysics, with the view of ascertaining how far recent progress has indicated a direction in which we may look for a logical classification and division of geological time. It is recognized that if natural divisions resulting from simultaneous phases of action of world-wide extent can be detected, they must be accepted as the true basis of division. But it is taken as proved that there were no universal breaks in sedimentation or in the fundamental continuity of life, and that therefore if we seek for *absolute* divisions we shall seek in vain; the question is whether the continuity of physical and vital action proceeded by "heterogeneous impulses" or by "correlated pulsations." If the latter, the history of the earth assumes a "rhythmical periodicity susceptible of natural classification and of significant and rational nomenclature;" if the former, "the contradictory phases of local actions will inhibit all but the most general unity, and render classification and nomenclature either arbitrary or provincial." Prof. Chamberlain argues that the theory of "correlated pulsations" is probably the true one, and that on three grounds. First, great earth movements affect all quarters of the globe—this follows from the recognized causes of such movements, such as secular cooling, change of speed of rotation, etc. Second, the major movements of the Earth's surface have consisted of the sinking of the ocean bottoms and the withdrawal of additional waters into the basins, whose capacities are thereby increased. This leads to an examination of the nature of shrinkage movements, and brings the function of the continental shelf, with its profound influence on faunal distribution, into prominence. Third, the periodic changes taking place in the quantity of carbonic acid in the atmosphere, and consequent variations in climate. Here stress is laid on the periodic exposure of large areas of crystalline rocks to the atmosphere and their decomposition by weathering, although curiously enough little is said about the periodicity induced by the physical changes in the atmosphere themselves. Prof. Chamberlain is of opinion that along these lines it may be possible to arrive at adequate natural bases for the more important divisions of geological time. These may be subdivided in relation to the migration of faunas, or to special features of continental development, and in this way the present arbitrary systems may be largely eliminated.

POLAR REGIONS.

Dr. Nansen's Next Voyage.—Dr. Nansen has briefly described the programme of the voyage in the northern seas which he has undertaken for the present summer, in a note in the April number of *Petermanns Meitteilungen*. Its leader is Dr. J. Hjort, well known for his work in connection with the Norwegian fisheries and oceanographical research, and its object is the detailed examination at all depths, from a physical and biological point of view, of the sea between Norway, Iceland, Jan Mayen, and Spitsbergen. Dr. Nansen hopes, with the help of the best modern instruments, to obtain accurate determinations of the constants of temperature and specific gravity of the ocean water at different depths, while Dr. Hjort will make the examination of the plankton of the sea-water, in part by new methods, his special task. The party will sail in a new steamer, the *Michael Sues*, which has been built specially for oceanographical research, and which will be placed at Dr. Hjort's disposal for the prosecution of the Norwegian section of the proposed international work in that direction. Dr. Nansen hopes that the new results will be of value as extending and explaining his researches during the voyage of the *Fram*.

Russian Arctic Expedition.—Baron Toll, the well-known explorer of the New Siberia islands, had, a year ago, worked out a plan for the exploration of the northern portion of the New Siberia archipelago, as well as of the hypothetical Sannikoff's land. The Russian Government and the Academy of Sciences have supplied the necessary funds, and the preparations have been pushed forward so energetically that the expedition is now ready to start. About its arrangements and plans Baron Toll has kindly communicated to us the following: A Norwegian whaler, *Harald Hårfager*, has been bought for the purpose, and she has been rechristened *Zaryá* (Morning Dawn). She has been re-arranged for her new purpose at the well-known wharf of Colin Archer, the builder of the *Fram*. The superstructure on the deck has been transformed into a spacious laboratory for zoological, bacteriological, and oceanographical work, and at the beginning of May the steamer started for St. Petersburg. Baron Toll will be the leader, as well as the geologist of the expedition; Lieut. N. Kolomeitsoff, who has won arctic experience in his journeys to the Ob and Yenisei, will be the captain. His second will be the Swedish lieutenant, T. Matthieson, geodesist and meteorologist, who took part in the Russian meridian-measurement expedition to Spitsbergen. Lieut. A. Koltschak, who has already made journeys in the Northern Pacific, will be the oceanographer; and A. Birulya, who also took part in the Spitsbergen expedition, will act as zoologist; F. Seeberg, a Swede, undertakes the astronomical and magnetic observations; and Dr. Walter, who took part in explorations along the Murman coast and in Novaya Zemlya, sails as surgeon, bacteriologist, and assistant-zoologist. The expedition will consist, all told, of twenty men, the crew being all Russians, Arkhangelsk fishermen. Baron Toll's travelling companion, the Cossack Rostorguyeff, will join the expedition as dog-driver and interpreter. Dogs are an important factor in a modern arctic expedition; sixty will be taken on board—forty of the West Siberian breed, and twenty of the very best of all Siberian breeds which is found about Ust-Yansk. Provisions are taken for three and a quarter years. Briefly stated, the plan of the expedition is the following: Early in June the *Zaryá* will sail from St. Petersburg to Tromsö, where she will stay for a while, as well as in the new Russian military harbour of Catherine, in the Kola peninsula. Thence the steamer will sail to the Yugor Strait in Novaya Zemlya, which the expedition intends to reach by the end of July—this being the best time for entering the Kara sea. As soon as this is done, they will sail for Cape Chelyuskin. The arctic sailing season being short, there will hardly be time left for advancing in the same year round the New Siberia islands, and Baron Toll intends, therefore, not to undertake this part of the voyage before the summer of 1901. He will winter the first year on the eastern coast of the Taimyr peninsula, in the north of Khatanga bay, in about 76° N. lat. This is certainly a good point of the programme, because the Taimyr peninsula, which is nearly as big as all Sweden to the south of Laponia, remains still nearly unknown. About twelve months will then be at the disposal of the expedition for the exploration of the peninsula. If the conditions of the ice are favourable, the New Siberia islands will be circumnavigated in the summer of 1901. If not, a place will be found for wintering, and the winter of 1901–2 will be spent there. The third summer will be given to the return journey, and, if possible, it is intended to return *viâ* Bering strait to Vladivostok.

Lakes and Valleys of the Upper Nugsuak Peninsula, North Greenland.—Mr. T. L. Watson, who was a member of the Cornell University Expedition of 1896 to Greenland, has made a careful study of the lakes and valleys of the Upper Nugsuak peninsula, especially with regard to their origin and topography. His "Notes" on the subject are published in the *Journal of Geology* for October to November last. The peninsula is 25 to 30 miles long, averaging from 4 to 6 miles in width, and is characteristically rough and rugged, intersected by numerous fjords, which in many cases penetrate to the edge of the ice-cap. The results of glaciation are everywhere apparent. Much of the uncovered land is occupied by lakes. The largest of these are mostly confined to the large valleys, while many tarns are scattered over the higher ground. These lakes appear to owe their origin largely to glacial action, and are, with possibly one or two exceptions, true rock basins. As a class the valley lakes observed on the peninsula range in size from over a mile in length down to the smallest-size basin. They varied from a few feet to 150 feet in depth. Soundings were taken of the largest lakes, and two showed their beds to be considerably below sea-level. Two types of valleys were observed on the peninsula. The larger of these are described as being very deep and broad, and somewhat U-shaped in section. The facts collected pointed to the conclusion that this type of valley was due to differential preglacial decay, with subsequent ice-erosion. The second type of valley is of minor importance on account of slight development, and can be classed as strike valleys.

GENERAL.

The Development of Habitable Lands.—Under this title, Dr. Mill has contributed to the *Scottish Geographical Magazine* (March, 1900) a careful study of the conditions which should govern the opening up of new lands within the temperate zone to European civilization. By development he understands "such a treatment of its natural resources as will enable the land to continue to support its inhabitants as their number increases;" regarding as foreign to the investigation, the endeavour to extract from a country the largest possible present gain, without regard to the wants of future generations. Thus considered, the process is essentially one of securing a permanent adjustment of people to the land on which they live, and the problem to be solved is that of enabling a country (or association of countries, such as the British Empire) to become or continue self-supporting. Dr. Mill considers the natural resources of such a country under the heads of (1) materials for food and clothing derived from reproducible vegetable (and animal) sources; (2) material for houses, implements, machinery, etc., coming chiefly from the limited resources contained in the Earth's crust; (3) the power of doing work, obtainable without risk of exhaustion only from the forces of nature due, directly or indirectly, to solar radiation. He shows how a due proportion must be maintained in drawing upon these several resources, none being unduly developed to the detriment of the others. The attempt to work only the most profitable resources of a country and to rely on external supplies for the rest, must, under existing laws of human society, be attended with risk. After a sketch of the influence of geographical conditions in determining the relation of the people to the land in old countries, Dr. Mill proceeds to consider the case of a new country just appropriated by a civilized power. Its proper development will demand, in the first place, a stock-taking of natural resources by a complete system of surveys; and in the next, the provision of serviceable communications, the wise selection of sites for towns, and the proper adaptation of their street plan to the ground, and, most important of all, the introduction of the right sort of inhabitants. In considering some of the complications which may have to be faced, Dr. Mill makes some remarks on the mutual relations which should prevail between higher and lower races, showing alike the wickedness of treating the latter as people without rights, and the folly of regarding them as in every way capable of equal treatment with Europeans. As mentioned above, it is to the development of new lands only that attention is directed in the paper, and the more difficult problem presented by lands incapable of self-support is not entered into. In the main, Dr. Mill is, by the nature of his subject, limited to a strictly utilitarian point of view, small consideration for the requirements of the artistic sense being, it is to be feared, possible in the supposed prosaic struggle for the satisfaction of more material wants.

OBITUARY.

Field-Marshal Sir Donald Martin Stewart, Bart., G.C.B., G.C.S.I., D.C.L.

Sir Donald Stewart was born in 1824, at Forres. He was the son of Mr. Robert Stewart, one of the Stewarts of Fincastle, who traced their descent from King Robert II. During his boyhood much of his spare time was spent among the fishermen of the coast, and it was then that he acquired that love of the gentle craft and skill with the rod which he never lost, and which took him in later days year after year to spend his holiday in Canada. Entering Aberdeen University, he proved his ability as a classical scholar before a cadetship landed him in India (1840), as lieutenant in the 9th Bengal Infantry, of which, much to his credit as a smart officer, he shortly became adjutant. In 1854 he saw his first service on the frontier; but it was the Mutiny of 1857 which gave him the first real chance of proving the soldierly grit that was in him. On June 18 of that year he set out on his perilous (and now famous) mission of carrying despatches from Agra to the camp of the Delhi field force, which he succeeded in reaching in safety. He was with Colin Campbell at the relief of Lucknow, and subsequently with the Rohilkand Brigade, and after the suppression of the Mutiny joined the Staff Corps. His next service was in Abyssinia in 1868, where, though employed on the line of communications, he, like Roberts, both maintained and consolidated his reputation.

After promotion to the rank of major-general, Stewart was selected by Lord Mayo for the responsible task of governing the Andamans, which under his able administration became transformed into a well-regulated industrial colony. In 1875 we find him in command at Lahore, and in 1878 he was selected for the chief command of the Southern Afghan field force when the war broke out—a command which involved the highest political as well as military responsibility. The passage of the Khojak range, the occupation of Kandahar, and the final advance in 1879 by the Kalat-i-Ghilzai road to Cabul, in the face of an active enemy, are matters of history. The crisis was encountered at the place known historically as Ahmad Khel, where Sir Donald Stewart fought his one great battle, winning a brilliant victory. His eventual retirement of 7000 troops by the Khaibar, a movement which involved great risk, was no less brilliantly carried out. He had likewise proved himself a most able diplomat throughout the difficult political negociations with Afghanistan. As commander-in-chief in India, Sir Donald saw the conquest of Burma effected, and he practically inaugurated the modern system of posts and communications on the north-west frontier. He was a consistent advocate and supporter of geographical mapping, the advantages of which both for administrative and military purposes he fully grasped. An immense amount of topographical work was done under his command in Afghanistan, and to this extent he claims recognition as a geographer. On leaving India in 1885, he was placed on the India Council, and became field-marshal in 1894. At his death, which occurred on March 26, he held the post of governor of Chelsea Hospital.

Sir Donald's kindly nature and innate simplicity of character, no less than his shrewd good sense, won him many warm friends, whom, whatever their rank or position, he was always glad to welcome, or to help with a kind word of advice. His heart was ever young, and he would be "commandeered" by his youngest grandchild as readily as by a viceroy. Few of the distinguished guests at "Snowdon," where Sir Donald reigned as military chief of India, were aware of the spirit of fun that would occasionally break loose in that happy-hearted household when "the coasts were clear." To the end of his days he remained alike unhardened by trial and unspoiled by success. He married, early in life, a daughter of Commander Dabine, R.N.; and five children (two sons and three daughters) survive him. His eldest son, Norman Stewart, succeeds to the baronetcy.

Lieut.-General A. H. Pitt-Rivers, D.C.L., F.R.S.

The death occurred early in May of Lieut.-General Lane-Fox Pitt-Rivers, well known for his valuable work in the field of ethnology. The deceased general was a son of Mr. W. A. Lane-Fox of Hope Hall, and was born in 1827. Entering the army in 1845, he served with distinction in the Crimean war, being present at the battle of the Alma and the siege of Sebastopol. He became major-general in 1877 and lieut.-general in 1882. General Pitt-Rivers' taste for ethnology was early aroused, for when only twenty-five he commenced the collection of objects illustrating the life of savage man, which eventually reached such extensive proportions, and which he presented to the University of Oxford. Succeeding to the Rivers estates in 1880, and adopting the name and arms of Pitt-Rivers, the general devoted his leisure to the investigation, by excavations and otherwise, of the interesting archæology of the country round Rushmore, in Wiltshire, publishing the results in a series of volumes. He was for some years President of the Anthropological Institute, and took an active part in the proceedings of the British Association. He had been a member of our Society since 1859, and had served for a time on its Council.

CORRESPONDENCE.

The Map of Central and Southern Manchuria.

The following notes may be of use to those consulting the Society's new map of Central and Southern Manchuria, published in the September number of last year.

The localities shown on the La-Lin—Sansing road are unknown. There is a mountain track to Ma-yi-ho, which I have followed for some 30 miles; but the regular road passes through Pin-cho, striking the river Ma-yen-ho at a small walled town called Ma-yi-ho.

From this town the river flows for 48 miles in a north-westerly direction, joining the river Sungari at Nan-tien-munn. Between Nan-tien-munn and Sansing the country is mountainous and unbridged torrents frequent. I was told at this village that there was no road along the right bank of the Sungari to Sansing, and consequently had to turn west and cross the river at the regular ferry at Pu-yang-mu, and so reach Sansing by the right bank.

The A-shih-ho river joins the Sungari to the south-west of Hulan. The A-shih-ho-Hulan road crosses this stream a few miles north of A-shih-ho. On this road should be shown the large Russian settlement of Harbin, where the railway across Manchuria forks, one branch to Nikolsk and Vladivostok, the other to Kwan-chüng-tzu and Port Arthur.

The road from Kuan-chüng-tzu passing through Lung-wan (called by its official name Nung-an-cheng on the map) strikes the valley of the Sangari about 30 miles from Petuna, a little south of Kong-ye-fu, a charming semi-Mongol settlement nestled in an elm grove. Thence, though the river makes several bends towards the east, it runs generally parallel to the road. The latter has a forward bearing of 334° to Hsin-chüng, or Petuna.

The very prominent shoulder given to this river above Petuna, with the road shown as bearing to the east of north, is not correct; the direction of this road is truer in the 1887 map.

The river Hsin-Kai has been omitted. This is a shallow muddy stream about half a mile wide, which, flowing from the west, joins the Yi-tung-ho river about 8 miles to the south of Lungwan.

The road to Kwen-chüng-tzu leaves the imperial Kirin-Mukden road at the village of Ta-shwei-haw, 20 miles west (by road) of Kirin. I am inclined to think that the Imperial road is shown as bending too much to the east, which places Yi-tung-cho in too high a latitude. This town can scarcely be north of 43°–20′, because by a rough compass sketch I found that Kwan-chüng-tzu is practically in the same latitude as Kirin. Now, Yi-tung-cho is 36 miles by road from Kwan-chüng-tzu, but the direct distance on the map is only 20 miles, which, with every allowance for sinuosities, is too short; either Kwan-chüng-tzu is further to the north or Yi-tung-Cho further to the south than shown on the map. I believe the latter to be the case.

If this deduction be correct, then Kai-yuan should be more to the east, and the same with the valley of the Liu-ho or Hwei-fa; in fact, the position of Chao-yang-chüng is probably 20 miles east and slightly to the south of the position assigned to it. This would place Kwan-Kai in about lat. 43° N. and long. 127° E., for the Whei-fa does not take such a northerly course as shown on the map, as proved by its road distance from Kirin, about 80 miles. On the map the direct distance between these places is shown as 37 miles, whereas in the position I assign to Kwan Kai its direct distance from Kirin would be 56 miles.

I may mention that the general course of the Sungari above Kirin is south-easterly. I drove on the ice up to its junction with the La-fa river, and from that point saw that the Sungari came through the mountains from a south-easterly direction. Doubtless it makes a large bend back to the junction of the Wheifa, but I doubt, except perhaps in its upper reaches, that, after leaving the immediate neighbourhood of Kirin, its course is ever west of long. 127°.

The late Governor of Kirin told me that his jurisdiction extended down the Imperial road to Wei-yuan-phu-munn (marked on the map as Wu-Yuan-fu). As its name indicates, it is a gate where tolls are levied on goods passing between the provinces of Kirin and Shunn-King. The willow fence has long since disappeared, but the gates remain, and very summary punishment is meted out to any who attempt to evade the tolls by passing the provincial frontier at any other points.

The provincial boundary between the provinces of Kirin and Shunn-King follows the crest of the hills which separate the Imperial from the Kwan-chŭng-tzu—Kai-yuan road, crosses the former road as above stated at Wei-yuan-phu-munn, turns north-east to the Chao-yang-shan, thence south-east, crossing the Whei-fa valley midway between Chao-yang-chŭng and Hei-shih-to, and so to the great northern bend of the river Yalu. While on the subject of boundaries, it may be well to notice that the province of Shunn-King is not shown as extending up to the Great Wall at Shan-hai-Kwan, though all other maps indicate this as the boundary of Manchuria; certainly the 'Official Chinese Gazetteer' shows the divisions of Chung-ho-so and Chung-chien-so as included within the chou of Ning-yuan.

The little town of Hsin-min-tun, or Hsin-min-ting, as it is designated in official parlance, has recently attained European notoriety, and, as the present terminus of the Shan-hai-Kwan—Chin-cho railway extension, has some claim to be correctly shown on the map. From a commercial point of view, it is of importance to note that it is 8 miles distant from the river Liao. The Imperial road from Mukden to Shan-hai-Kwan crosses the Liao at 32 miles from the capital, and then, turning west by south, continues for 8 miles before the little town is reached. It is also shown too far to the west; the map places it at 39 miles in a direct line from Mukden, though the road distance is at the outside 40 miles. A more correct position for this town would be lat. 42°, long. 122° 50′.

The main road from Liao-yang passing over the Mo-tien-ling to the mouth of the river Yalu, should be shown as roughly running along the parallel of lat. 40° as far east as long. 124°, when it turned south to Feng-hwang-Hwang-chŭng. It will be seen that on the map there are two places named Lien-shan-Kwan on separate roads. These are one and the same place on the same road. Lien-shan-Kwan is the village where the Mo-tien-ling road turns southwards. The map might be made more correct if the main road between Ta-tung-ku and Feng-hwang-chŭng were deleted, and shown as passing through the more northerly of the two Lien-shan-kwans.

The road from Sai (not Sa)-ma-chi to Lien-shan-Kwan should stand; it was used by the Japanese in 1894, when they advanced to reconnoitre the Motien-ling pass. But, to be accurate, it should be shown as joining the Feng-hwang-chŭng—Mo-tien-ling road a few miles south of Lien-shan-kwan, at a village called Tsao-ho-ku, which must, I think, be identical with the place shown on the map as Chao-huo-ku. The Ai-kiang join the river Yalu near Chiu-tien-chŭng, and Feng-hwang-chŭng is on a tributary of this stream.

As regards the very prickly subject of the spelling of names,* apart from typographical errors, it is observed that the orthography generally used by English-speaking people has not been invariably followed. Thus, Hsin (new) in Hsin-ch'êng (Petuna) and Hsin-min-tún is spelt Shin. In a recent diplomatic note it is spelt Sin; but the generally accepted spelling is Hsin, and certainly both of these more nearly approach the native pronunciations than Shin. Another less defensible innovation appears in the word *Chou*, which has been written *Chau*. To an ear untrained in the subtleties of Chinese tones this particular monosyllable resembles "jou" in sound. The conventional method of expressing this sound in English has hitherto been *chou*. *Chou* may be a nearer approximation to the true sound than Canton is to Kwang-tung, but it is merely a question of degree, hence the futility of deviating from the conventional spelling in order to approximate more closely the true pronunciation. No system has yet been devised to satisfactorily reproduce Chinese sounds and tones with English letters, and whether the un-

* The Council have adopted certain rules for spelling Chinese geographical names, which as far as possible have been given effect to above.—Ed. *G.J.*

initiated European says *jou*, *chou*, *chau*, *tshon*, or *tcheon*, he will be equally unintelligible to the Chinese.

In concluding these notes, I take the liberty of congratulating the Society on having supplied its Fellows with an extremely useful map of Central and South Manchuria, and one which is a distinct advance on any that has yet appeared. Manchuria is a most interesting country, favoured by nature with a splendid climate and a luxuriant soil, helped by an active and vigorous race, and beyond a doubt rich in mineral wealth; it is destined some day to become what nature has intended it to be—one of the richest and most flourishing countries in the Far East.

G. F. Browne, Lieut.-Colonel,
Military Attaché in China.

Shanghai, March 7, 1900.

The Map of Kashmir.

I have recently read with interest and pleasure a book lately published on sport and travel, named 'A Summer in High Asia,' by Captain F. E. S. Adair, late Rifle Brigade, for many of its pages recalled to memory a people and country I once saw much of. As I am responsible for the accuracy of the map of a part of Kashmir territory I am about to refer to, I trust I may be permitted, after a reference to my journal and original map, to reply through the medium of the Geographical Society's *Journal* to the following extracts. On p. 56, when in Camp Kande in the Hushe valley, Captain Adair writes, "An old man eventually told us that a small ravine that we saw opening up to the west, and which was apparently closed by a big mountain about a mile from its mouth, turned a corner and became a large valley, which had never yet been explored by a white man (this I believe to have been true, as I found on this occasion only that the Government survey was not correct), and was full of ibex." On his return through the same village, on p. 76, this valley is again referred to: "I found on this occasion, the only one during the whole of my trip, that the Government map was incorrect. The entrance to the valley is most curious; it runs east and west, and looks as if it were a narrow nalah (watercourse) about a mile long, and closed by a big mountain. However, the volume of water pouring down the stream denotes a ravine of some length; and indeed, on reaching the head of the apparent *cul-de-sac*, you find that the river takes a bend at right angles, the valley running about north." These remarks convey to the reader an impression that a very important valley had neither been seen nor mapped by the surveyor.

The Hushe Loomba or valley, which is one of the main tributaries of the Shayok, receives the drainage of four great glaciers, viz. the Aling, Masherbrum, Atosur, and Nanga, descending from that remarkable vast semicircle of lofty peaks commencing on the west of the Hushe valley with B_{13}, Zoah (21,207 feet), to K_1, Masherbrum (25,676 feet), K_6 (25,119 feet), K_7 (22,764 feet), K_8 (23,906 feet) on the east side. This tributary was explored by me in 1860, and surveyed by plane-table on the scale of 4 miles to the inch. I entered it from the Thulle valley, another main tributary of the Shayok on the west, crossing the dividing lofty ridge of 19,000 feet and upwards, and descending to Kande. Fortunately, I have a photograph copy of my original plane-table work of this part of Baltistan made in the surveyor-general's office, Calcutta. This shows the valley visited by Captain Adair, that joins the Hushe river at Kande, quite true, meeting it with an east and west course, turning towards the northward after about a mile; even the path leading to the grazing-grounds referred to is entered. The name I received for this lateral valley was the Apo-brok. I see, on reference to the engraved atlas sheet of this part of Kashmir territory, this name is inserted, but not the path up the ravine; not being a main line of communication, I presume it was omitted. I do not know what Government map Captain Adair had with him. I may say here I did not go up into the grazing-grounds, and he was probably the first white man to do so; but I saw the whole valley well when I ascended the peak of Chungoksigo (18,848 feet) on August 17, 1860. This peak is situated south-west of Kande, on the southern watershed of the Apo-brok, which was seen from the junction with the Hushe river up to the glaciers at the head of it, the largest branching into three smaller ones under peak B_{18}. In mountains such as these little can be seen from the depths of the valleys on the grazing-grounds, and it is only by ascending to points high up on the main ridges, from whence the great peaks laid down by the triangulation work become visible, that an accurate position can be fixed on the plane-table, and the surrounding minor peaks, pinnacles, and other topography sketched in. Thus, in this valley—the Hushe, the least-known ravines to me are those joining the Hushe river on the east or left bank, of which the Ngamah is one joining it also close to Kande village. I did not penetrate into one of them; their courses were sufficiently well seen from points on the mountain spurs west of the river. These side valleys are not very accessible; most of it is terrible ground, with the swollen streams and rock shoots, but for purposes of sport some might no doubt be visited. Ibex are very abundant in this part of the country, and I read in my journal that I counted no less than forty together in a ravine below Chungoksigo peak. Shooting was out of the question; my whole time and attention had to be devoted to the survey work, for the days of summer, when high points can be ascended, are very limited.

To those who do not know how the survey was conducted, and discover in parts shortcomings in the Kashmir survey maps, I may say at once many such can be found, and that it might, for the scale, be shown in far greater detail; but what would it have cost, and what may be the value of this mass of rock and snow and ice far away from the lines of communication? I could point out the head-waters of many large rivers, and details of the highest ground that were never visited, but sketched from a distance—ground which during the last forty years has, no doubt, been penetrated by officers on shooting-expeditions. I can recall how often it was impossible to get into such ground, and how many contingencies might occur to prevent it, such as the absence of the usual rope or wooden bridge, when there was no time to construct another; the melting of the snow bridges; heavy rain or snow, swelling the rivers and closing passes; the dearth of provisions when a certain point had been reached; and, in those days, the apathy and even passive opposition of ill-disposed local officials, leading to the bolting of all the male population of a village. All this had to be contended with. On account of the great expense this survey entailed, a certain limit of time had to be given to the topography, much of which therefore comes under the head of reconnaissance, although I think it may well be termed reconnaissance of the first order, as it is free from all accumulating errors. Many officers who annually visit Kashmir and penetrate into its more remote valleys in search of sport, have a sufficient knowledge of surveying to correct and improve the topography of the existing maps of this and other portions of the Himalayan range. They might submit this information to the Surveyor-General's office. If the amount of error was large, it would be worth while deputing some regimental officer (partly for purposes of instruction) to execute a piece of plane-table work over the area in question, to be embodied eventually in future editions of the map. To gain an eye for ground and grasp its capabilities in attack and defence in a broad way, so essential to successful military operations in a mountainous country, no work is more valuable or instructive than surveying with a plane-table. I wish all our officers (who are naturally good draftsmen) could have this training put in their way, and I see no difficulty in organizing such a system, particularly in India.

H. H. GODWIN-AUSTEN.

Nore, Godalming, April, 1900.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1899–1900.

Tenth Ordinary Meeting, April 30, 1900.—Sir CLEMENTS MARKHAM, K.C.B., President, in the Chair.

ELECTIONS.—*Bernard F. Hall, M.A.; William Knighton S. Keavington-Weston; Sydney de Courcey Thompson, F.Z.S.; Edmund Tydeman; Charles Hunter Ward; William Nance Williams.*

The PRESIDENT said: We are honoured this evening by the presence of His Majesty the King of Sweden and Norway. We do not receive him here as an august visitor, but as one of our colleagues and as one of the most illustrious of our honorary members. His Majesty is well known to us all for the interest he has always taken in geographical science, and for the liberal and enlightened way in which he has supported and encouraged expeditions for exploration and discovery in unknown countries. It has been my duty and my great pleasure to present to two subjects of His Majesty, the Queen's Royal award, after their return from dangerous and most important expeditions, which were supported and encouraged by their sovereign. But we have never before had the great honour and pleasure of receiving His Majesty here in person. I hope it may not be the last time, and in your names I offer to him a most hearty and most cordial welcome.

H.M. the KING OF SWEDEN AND NORWAY: Sir Clements Markham, I beg to return my very sincere and heartfelt thanks for the greeting with which you have received me. I am happy to assist at a meeting of this learned and highly distinguished Society, of which I feel it a really great honour to be an honorary member.

The PRESIDENT: We have the pleasure of welcoming here two of our foreign gold medallists, Major Wissmann and Captain Binger. You will be interested to hear that we have received the piece of wood containing the inscription which was carved on the tree under which Dr. Livingstone's heart was buried, by his African boys.

The Paper read was:—

"Through Africa from the Cape to Cairo." By Ewart S. Grogan.

Eleventh Ordinary Meeting, May 14, 1900.—Sir CLEMENTS MARKHAM, K.C.B., President, in the Chair.

ELECTIONS.—*Don. F. Avelino Aramayo, Bolivian Minister; Thomas Bowyer Bower, A.M. Inst. C.E.; F. W. Carey; Percy Irwin Clark; James B. Halcrow; Major Arthur E. Hay, late R.A.; Major Thomas George Johnson, I.S.C.; R. D. Oldham, Supt. Geol. Survey of India; Owen Arthur Parrack; Horatio Gibbs Powell; Colonel James Gardner Stowe, Consul-General for the United States; Robert T. Turley.*

The Paper read was:—

"The Anthropogeography of British New Guinea." By Prof. A. C. Haddon, F.R.S.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By HUGH ROBERT MILL, D.Sc., LL.D., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Com. = Commerce.
C. Rd. = Comptes Rendus.
Erdk. = Erdkunde.
G. = Geography, Geographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. = Memoirs, Mémoires.
Met. = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. = Review, Revue.
S. = Society, Société, Selskab.
Sitzb. = Sitzungsbericht.
T. = Transactions.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Austria-Hungary—Surveys. *Z. Ges. Erdk. Berlin* **34** (1899): 425–445. **Stavenhagen.**
Die geschichtliche Entwickelung des österreichischungarischen Militär-Kartenwesens Von W. Stavenhagen.

A sketch of the history of the official surveys in Austria-Hungary.

Belgium. *B.S.R.G. d'Anvers* **23** (1900): 421–441. **Haulleville.**
De la nécessité d'une plus grande Belgique. Par M. A. de Haulleville.

An appeal for the expansion of Belgian interests in China.

France—Dauphiné. *Annuaire Club Alpin Français* **25** (1898): 101–113. **Lory.**
A l'Obiou, quelques notes d'un touriste géologue. Par M. P. Lory. *With Illustrations.*

France—Dauphiné. **Marcheval and Guillemin.**
Annuaire Club Alpin Français **25** (1898): 515–543.
Tournée d'un intendant dans le Haut-Dauphiné en juillet 1762, manuscrit inédit de Pajot de Marcheval, publié et annoté par M. Paul Guillemin.

France—Mount Ventoux. **Barrême.**
La Géographie du Mont-Ventoux. Mémoire présenté au Congrès de Géographie tenu en Septembre 1898 à Marseille. Par Eug. Barrême. (Extrait du Bulletin de la Société de Géographie, tome xxii., nos. 1 et 2.) Marseille, 1899. Size 10 × 6½, pp. 38. ***Presented by the Société de Géographie, Marseilles.***

France—Pas de Calais. *B.S.G. Lille* **33** (1900): 55–63. **Vermersch.**
Les Excursions de la Société de Géographie de Lille en 1899. Au pays de la houille. Excursion aux Mines de Bruay, 8 Juin 1899. *With Map.*

Notes on the coalfield of the north of France.

France—Pyrenees. *Annuaire Club Alpin Français* **25** (1898): 242–284. **Salomé.**
Amélie-les-Bains. Par M. Th. Salomé. *With Illustrations.*

France—Var. *Annuaire Club Alpin Français* **25** (1898): 371–430. **Nœtinger.**
La vallée du Var. Par M. Fernand Nœtinger. *With Illustrations.*

Germany. *Petermanns M.* **45** (1899): 283. **Langhans.**
Geographische Verbreitung von Industrie und Landwirtschaft im Deutschen Reiche. (Begleitworte zu Tafel 18.) Von Paul Langhans. *With Map.*

Germany—Meteorology. ———

Veröffentlichungen des Königlich Preussischen Meteorologischen Instituts. Herausgegeben durch dessen Direktor Wilhelm von Bezold. Ergebnisse der Niederschlags-Beobachtungen in den Jahren 1895 und 1896. (Maps, pp. lviii., 210, and 212.) Ergebnisse der Beobachtungen an den Stationen II. und III. Ordnung im Jahre 1899 zugleich Deutsches Meteorologisches Jahrbuch für 1899 Beobachtungssystem des Königreichs Preussen und benachbarter Staaten, 1899. Heft i. Size 13 × 10, pp. 62.
1895. Heft iii. Ergebnisse der Beobachtungen an den Stationen II. und III. Ordnung im Jahre 1895 zugleich Deutsches Meteorologisches Jahrbuch für 1895 Beobachtungssystem des Königreichs Preussen und benachbarter Staaten. Berlin: A. Asher & Co., 1899. Size 13½ × 10, pp. xx. and 99-314. *Map.*

Iceland. *G. Tidskrift* **15** (1899): 71–87. **Bruun.**

Arkæologiske Undersøgelser paa Island. Foretagne i Sommeren 1898 af Kaptajn Daniel Bruun. *With Plans and Illustrations.*

Observations on the ancient buildings of Iceland.

Italy. **Orsi.**

Modern Italy, 1748–1898. By Pietro Orsi. (The Story of the Nations.) London: T. Fisher Unwin, 1900. Size 8 × 5½, pp. xxiv. and 404. *Map and Illustrations. Price* 5s. *Presented by the Publisher.*

Italy—Vesuvius. *Atti R.A. Lincei Rendiconti* **8** (1899): 276–281. **Matteucci.**

Sulla causa verosimile che determinò la cessazione della fase effusiva cominciata il 3 luglio 1895 al Vesuvio. Nota del Prof. R. V. Matteucci.

Mediterranean. **Black.**

Narrative of Cruises in the Mediterranean in H.M.S. *Euryalus* and *Chanticleer* during the Greek War of Independence (1822–1826). By William Black. With an Appendix on the Climate, and Meteorological and Nosological Tables. Edinburgh: Oliver & Boyd, 1900. Size 9 × 6, pp. xii. and 356. *Illustrations. Price* 14*s. net. Presented by the Publishers.*

In a preface, Dr. W. G. Black explains that the manuscript of a journal kept by his uncle during naval service in the Mediterranean in 1822–26 having recently come into his hands, he considered that its historical interest makes its publication advisable.

Mediterranean—Crete. *P.R. Artillery I.* **26** (1899): 519–539. **Simpson.**

With the International Field Force in Crete, 1897. By Major H. C. C. D. Simpson, R.A. *With Map.*

Russia. ———

The Russian Journal of Financial Statistics, 1900. Specimen Number. St. Petersburg, 1899. Size 10½ × 7, pp. 236.

This new journal, published in English at St. Petersburg, is intended to supply British and American readers with accurate statistics, and a portion of this specimen number is occupied with instances of errors made in various publications in rendering Russian figures. There is no statement as to whether the *Russian Journal* is an official or a private undertaking.

Spain—Balearic Islands. *Annuaire Club Alpin Français* **25** (1898): 431–452. **Vuillier.**

La Sierra de Majorque et les nouvelles cavernes de Manacor. Par M. Gaston Vuillier. *With Illustrations.*

Spain—Early Maps. **Marcel.**

Gabriel Marcel. Les origines de la Carte d'Espagne. Extrait de la *Revue Hispanique*, Tome vi. Paris, 1899. Size 10 × 6½, pp. 36. *Map. Presented by the Author.*

A critical study of the maps of Spain from the thirteenth to the sixteenth centuries.

Sweden—Boundaries. *Ymer* **19** (1899): 283-331. **Kjellén.**

Studier öfver Sveriges politiska gränser. Af Rudolf Kjellén.

On the political boundaries of Sweden considered historically.

Sweden—People. *Ymer* **19** (1899): 405–408. **Retzius.**

Om de af Svenska sällskapet för antropologi och geografi föranstaltade antropologiska undersökningarna i Sverige. Af Gustaf Retzius.

Anthropometric results of the measurements of Swedish recruits.

Sweden—Temperature. *Ymer* 19 (1899): 221–242. **Ekholm.**
Sveriges temperatur förhållanden jämförda med det öfriga Europas. Af Nils Ekholm. *With Maps.*

On the mean atmospheric temperature of Sweden with maps of isotherms and isanomalous lines for January and July.

Switzerland. *Annuaire Club Alpin Français* 25 (1898): 201–241. **Cuënot.**
A travers le Canton d'Unterwald. Par M. Henry Cuënot. *With Illustrations.*

Turkey—Kosovo. *Abh. G. Ges. Wien* 1 (1899): 327–372. **Oestreich.**
Reiseeindrücke aus dem vilajet Kosovo. Von Dr. Karl Oestreich. *With Map and Illustrations.*

Turkey—Macedonia. **Ilitscheff.**
Ein Beitrag zur Geographie von Makedonien. Inaugural-Dissertation der Hohen philosophischen Fakultät der Universität Leipzig zur Erlangung des Doktorgrades vorgelegt. Von Dimiter Chr. Ilitscheff. Leipzig: B. Georgi, 1899. Size 9 × 6, pp. 48. *Presented by Prof. Ratzel.*

A monograph on the geography of the province of Macedonia, taking account of all aspects of physical and political geography.

United Kingdom. ———
Mines and Quarries. General Report and Statistics for 1899. Advance Proof (subject to correction) of the Tables relating to the Output of Coal and other Minerals and the number of persons employed at mines worked under the Coal and Metalliferous Mines Regulation Acts during the Year 1899. London, 1900. Size 13½ × 8½, pp. 12. *Presented by the Home Office.*

United Kingdom—Agricultural Census. *Fortnightly Rev.* 67 (1900): 591–601. **Bear.**
The Next Agricultural Census. By William E. Bear.

Suggestions for the inclusion in the schedules of the forthcoming census of headings for the more accurate determination of the status of the various elements of the agricultural population.

United Kingdom—Channel Pilot. **King.**
The Channel Pilot. Part i.—South Coast of England, originally compiled by Staff-Commander John W. King, R.N. Ninth Edition. London: J. D. Potter, 1900. Size 9½ × 6, pp. xx. and 450. *Index Chart.* *Price* 2*s.* 6*d.* *Presented by the Hydrographer, Admiralty.*

United Kingdom—England. **Mossman.**
Quarterly J. R. Meteorolog. S. 25 (1899): 330–334.
The Average Height of the Barometer in London. By R. C. Mossman.

Discussion of observations to complete the gaps in Mr. Eaton's monumental discussion of barometric pressure in London, and to extend these so as to take account of one hundred and twenty years.

United Kingdom—Meteorology. ———
Report of the Meteorological Council, for the Year ending March 31, 1899, to the President and Council of the Royal Society. London: Eyre & Spottiswoode, 1899. Size 10 × 6, pp. 136. *Map.* *Price* 7½*d.*

United Kingdom—Scotland. **Watt.**
A History of Aberdeen and Banff. By William Watt. Edinburgh and London: W. Blackwood & Sons, 1900. Size 8½ × 6, pp. xvi. and 438. *Maps.* *Price* 7*s.* 6*d.* net. *Presented by the Publishers.*

An interesting volume which, although accompanied by several maps, pays perhaps the absolute minimum of attention to the geographical conditions which largely guided the historical events that are recorded in its pages.

United Kingdom—Scotland. *Quarterly J. Geolog. S.* 56 (1900): 198–204. **Blanford.**
On a Particular Form of Surface, apparently the Result of Glacial Erosion, seen on Loch Lochy and elsewhere. By W. T. Blanford. *With Illustration.*

This is referred to in the *Journal* for May, p. 530.

United Kingdom—Wales. *Geolog. Mag.* 7 (1900): 58–61. **Dakyns.**
Some Snowdon Tarns. By J. R. Dakyns.

This is referred to in the *Journal* for May, p. 530.

ASIA.

Asia—Historical Peoples. *Rev. Scientifique* 13 (1900): 173-178, 204-207. **Saint-Yves.**
Les peuples retrouvés de l'Asie Centrale. Par M. G. Saint-Yves.

The findings of this paper are discussed by M. Zaborowski in the same review, pp. 466-467.

China. ———

China. No. 1 (1900). Further Correspondence respecting the Affairs of China. London: Eyre & Spottiswoode, 1900. Size 13 × 8½, pp. xxiv. and 412. *Plan. Price* 3s. 7½d.

Diplomatic dispatches written during the year 1899.

French Indo-China—Annam. **Sainson.**

Ngann-nann-tche-luo. Mémoires sur l'Annam. Traduction accompagnée d'un lexique géographique et historique. Par Camille Sainson. Péking: Imprimerie des Lazaristes au Pé-t'ang, 1896. Size 10 × 6½, pp. viii. and 582. *Price* 16s.

Translation of a book written in the beginning of the fourteenth century by an Annanese refugee in China, named Li Tai. The translation is accompanied by notes and a geographical index.

India. **Maunder.**

British Astronomical Association. The Indian Eclipse, 1898. Report of the Expeditions organized by the British Astronomical Association to observe the total Solar Eclipse of 1898, January 22. Edited by E. Walter Maunder. London: Hazell, Watson, & Viney, Ltd., 1899. Size 10 × 6½, pp. xii. and 172. *Illustrations. Presented by W. H. Maw, Esq.*

Particulars of the observations of the solar eclipse of 1899 in Talni, Buxar, and Jeur.

India—Baltistan. *Alpine J.* 20 (1900): 3-10. **Bullock-Workman.**

Two Pioneer Ascensions in Baltistan. By Mrs. Bullock-Workman. *With Illustrations.*

India—Bengal. ———

List of Proceedings, etc.: Bengal, 1859-1897. Preserved in the Record Department of the India Office, London. London: Printed by Eyre & Spottiswoode, 1899. Size 13½ × 8½, pp. iv. and 40. *Presented by the India Office.*

India—Himalaya. *Alpine J.* 20 (1900): 1-3. **Freshfield.**

The Tour of Kanchinjinga. By Douglas W. Freshfield.

Mr. Freshfield and Mr. Garwood, with the Signori Sella, left Darjeeling on September 5 last year, and made a journey round Kanchinjinga, crossing the Jongsong La, a pass of 21,500 feet, and returned to Darjeeling on October 25.

India—Kashmir. **Neve.**

Picturesque Kashmir. By Arthur Neve. Illustrated by Geoffroy W. Millais. London: Sands & Co., 1900. Size 10 × 8, pp. xvi. and 164.

A graphic account of Kashmir written by a medical missionary of the Church Missionary Society. The scenic grandeur of the country is illustrated by Mr. G. W. Millais' photographs.

India—Marine Survey. ———

Administration Report of the Marine Survey of India for the Official Year 1898-99. Size 13 × 8½, pp. 18. *Presented by the Survey.*

India—Wrecks. **Falle.**

Return of Wrecks and Casualties in Indian Waters for the year 1898. Prepared by Commander P. J. Falle. Calcutta, 1899. Size 13 × 8½, pp. 84. *Chart and Diagram.*

Indian Ocean—Christmas and Cocos-Keeling Islands. **Baxendale.**

Christmas and Cocos-Keeling Islands. Report for 1899. Colonial Reports, Annual No. 286, 1900. Size 9½ × 6, pp. 16. *Price* 1d.

Indian Ocean—Christmas Island. **Andrews.**

A Monograph of Christmas Island (Indian Ocean): Physical Features and Geology. By Charles W. Andrews, B.A., etc., with descriptions of the Fauna and Flora by numerous contributors. London: Longmans & Co., 1900. Size 9 × 6, pp. xlv. and 338. *Map and Illustrations. Presented by the British Museum.*

After an account of the history and physical features of Christmas island by Mr.

Andrews, there follow eighteen articles by specialists on different zoological groups, ten articles on botany, and five on geology and palæontology. There is a bibliography of the island, and the monograph is illustrated by numerous maps and drawings.

Japan—Earthquakes. **Omori.**

J. College Sci. Imp. University Tōkyō 11 (1899): 389–437.

Notes on the Earthquake Investigation Committee Catalogue of Japanese Earthquakes. By F. Omori, D.SC. *With Maps and Diagrams.*

Japan—Earthquakes. **Sekiya.**

J. College Sci. Imp. University Tōkyō 11 (1899): 315–388.

The Earthquake Investigation Committee Catalogue of Japanese Earthquakes. Superintended by the late Prof. S. Sekiya.

Malay Archipelago. *Petermanns M.* 45 (1899): 290–292. **Wichmann.**

Die Insel Miangas. Von Prof. Dr. A. Wichmann.

On the controversy as to the identity of the island "Meangis," first described by Dampier.

Malay Archipelago—Celebes. *Petermanns M.* 45 (1899): 249–260, 273–280. **Bücking.**

Beiträge zur Geologie von Celebes. Von Prof. H. Bücking. *With Map.*

Persia. *Ymer* 19 (1899): 187–201, 243–264. **Falk.**

Persien, folk och stat. Af A. Falk.

Philippine Islands. **Doyle.**

Observatorio de Manila. Tifones del Archipiélago Filipino y mares circunvecinos 1895 y 1896. Estudio de los mismos por el P. Juan Doyle S. J. Manila, 1899. Size 12½ × 9, pp. 106. *Diagrams.*

Russia—Caucasus. ——

Die Cypriniden des Kaukasus. Tiflis, 1899. Size 10 × 7, pp. viii. and 158. *Plates. Presented by Dr. G. Radde.*

Russia—Siberia. *Meteorolog. Z.* 17 (1900): 28–32. **Woeikof.**

Temperatur und Bewölkung am Ufer des Baikal und auf den benachbarten Höhen. Von A. Woeikof.

Comparison of meteorological observations at two stations on Lake Baikal and one at a considerable elevation on the neighbouring mountains.

Straits Settlements. **Swettenham.**

Straits Settlements. Report for 1898. Colonial Reports, Annual No. 287, 1900. Size 10 × 6, pp. 20. *Price* 1½*d.*

Turkey—Armenia. *Verh. Ges. Erdk. Berlin* 27 (1900): 128–133. **Rohrbach.**

Herr Dr. Paul Rohrbach: Armenier und Kurden.

Discusses the difficulty of estimating the number of Armenians and Kurds in the Turkish dominions in the absence of authentic statistics. The author suggests one and a half million Armenians in the country and a quarter of a million in the towns of the Turkish empire as a probable approximation.

Turkey—Asia Minor. **Deryugin.**

Zoo-geography of the country watered by the Chorok. By K. M. Deryugin. [In Russian.] Size 9 × 6¼, pp. [66]. *Presented by M. Venukoff.*

Turkey—Asia Minor. **Maercker and Schäffer.**

Z. Ges. Erdk. Berlin 34 (1899): 363–407.

Beiträge zur Erforschung Klein-Asiens. I. Das Stromgebiet des unteren Kyzyl Yrmak (Halys). Von Hauptmann G. Maercker. II. Erkundungen und-Routen-Aufnahmen im Gebiet des Kyzyl Yrmak und des Jeshil. Von Hauptmann Schäffer. III. Bemerkungen zu den Karten. Von Hauptmann Maercker. *With Maps.*

AFRICA.

Algeria. *B.S.G. de l'Est* (1899): 357–374. **Collesson.**

Cinq jours en Kabylie et aux gorges du Chabet-el-Akra. Par P. Collesson.

Algeria—Wargla. *Ann. G.* 9 (1900): 141–153. **Blanchet.**

L'oasis et le pays de Ouargla. Par M. P. Blanchet.

British Central Africa. *Scottish G. Mag.* 16 (1900): 235–245. **Robertson.**

The Commercial Possibilities of British Central Africa. By Patrick Robertson.

British South Africa. *National G. Mag.* 11 (1900): 81–96. **Hilder.**

British South Africa and the Transvaal. By F. F. Hilder. *With Illustrations.*

German East Africa. **Oechelhaeuser.**

Die Deutsch-Ostafrikanische Centralbahn. Von Wilhelm Oechelhaeuser. Berlin: J. Springer, 1899. Size 9½ × 6½. pp. xvi. and 120. *Map.*

Plan of a projected railway from Bagamoyo and Dar-es-Salaam to Tabora, and thence in two branches to Ujiji, on Lake Tanganyika, and to the extreme south of the Victoria Nyanza.

German East Africa—Kilimanjaro. **Meyer.**

Der Kilimandjaro. Reisen und Studien von Prof. Dr. Hans Meyer. Berlin: D. Reimer (Ernst Vohsen), 1900. Size 12½ × 8½, pp. xvi. and 436. *Map and Illustrations. Price 25m. Presented by the Publisher.*

This splendid volume is described by the author as a jubilee offering, since his last visit to Kilimanjaro in 1898 took place exactly half a century after the discovery of the mountain by the German missionary Rebmann. One of the most interesting features in the very thorough study which Dr. Meyer has made of the mountain is the investigation of the glaciers, of which he has obtained very striking photographs.

German South-West Africa. *Petermanns M.* 45 (1899): 281–282. **Fleck.**

Meine Reise in die Tsanchabschlucht (Deutsch-Südwestafrika). Von Dr. Ed. Fleck. *With Map.*

Together with observations on the map by Herr Paul Langhans.

Madagascar. **Grandidier.**

Histoire de la fondation du Royaume Betsimisaraka. Par M. Guillaume Grandidier. Extrait du Bulletin du Comité de Madagascar, Juin 1898. Paris: A. Challamel. Size 10 × 6½, pp. 14. *Presented by the Author.*

This paper is derived, the author states, from a manuscript in the British Museum, written by de Froberville from the narrative of Mayeur, who lived in Madagascar from 1758 to 1787. It relates how Ratsimilaho, the son of an English pirate and a Malagasy princess, began an inter-tribal war which led to the formation of the Betsimisaraka, or "Inseparables."

Madagascar. *Scottish G. Mag.* 16 (1900): 1–17, 68–82. **Oliver.**

The Land of Parrots. By Captain Pasfield Oliver. *With Maps.*

Mauritius—Seychelles. **Brown.**

Seychelles. Report for 1898. Colonial Reports, Annual No. 285, 1900. Size 10 × 6, pp. 16. *Price 1d.*

Natal. ——

Correspondence relating to the Defence of Natal. London: Eyre & Spottiswoode, 1900. Size 13½ × 8½ pp. iv. and 26. *Price 3d.*

Nigeria. ——

Royal Niger Company. 1. Copy "of Letter from the Foreign Office to the Treasury, dated June 15, 1899, with respect to the revocation of the Charter of the Royal Niger Company, and to the taking over by Her Majesty's Government of the Administrative Rights and Powers of the Company, together with Copies of the Treasury Minute on the subject, dated June 30, 1899, and relative Schedules." 2. "Notes on the Niger District and Niger Coast Protectorates, 1882–93; Notification, British Protectorate over Niger Districts, June 5, 1885; Royal Charter, 'National African Company,' July 10, 1886; Notification, British Protectorate over Niger Districts, 'National African Company,' now called 'Royal Niger Company,' October 18, 1887; List of Treaties, National African Company and Royal Niger Company with Native Chiefs, 1884–92; Notification, 'Oil Rivers Protectorate to be called the Niger Coast Protectorate,' May 13, 1893." 3. "Balance Sheets of the Royal Niger Company for each Year from 1887 to 1898, inclusive." And 4. "Statements of Revenue and Expenditure of Niger Government from 1887 to 1898, inclusive." London: Eyre & Spottiswoode, 1899. Size 13½ × 8½, pp. 60. *Price 6d.*

Nigeria. **Robinson.**

Nigeria, our Latest Protectorate. By Charles Henry Robinson, M.A. London: H. Marshall & Son, 1900. Size 8 × 5½, pp. xii. and 224. *Map and Illustrations. Price 5s. net. Presented by the Publishers.*

A popular sketch of the Hausa people, life in Nigeria, the Royal Niger Company, the cause of African fever, and other matters connected with the country.

Rhodesia. *Scottish G. Mag.* 16 (1900): 92–105. ——

Rhodesia. *With Maps and Illustrations.*

This is a review of the last report of the South African Company, and of parts of Mr. Bryce's 'Impressions of South Africa,' with additional material from other sources.

Somaliland. **Peel.**

Somaliland. Being an Account of Two Expeditions into the Far Interior, together with a complete list of every animal and bird known to inhabit that country, and a list of the reptiles collected by the author. By C. V. A. Peel. London: F. E. Robinson & Co., 1900. Size 10½ × 6½, pp. xvi. and 346. *Map and Illustrations. Price* 18*s. net. Presented by the Publishers.*

The narrative is that of sporting adventures, but interspersed with many acute remarks on the general natural history of the country traversed during the expedition, and there is a comprehensive list of the animals of the whole region.

South Africa. **Bertrand.**

En Afrique avec le Missionnaire Coillard. A travers l'État Libre d'Orange, le Pays des Ba-Souto, Boulouwayo. Départ de M. Coillard pour le Pays des Ba-Rotsi. Mon retour par la côte orientale: Matébéléland, Mashonaland. Territoire de la Cie de Mozambique, Beira.—Diégo-Suarez au N.-E. de Madagascar. Par Alfred Bertrand. Genève: Ch. Eggimann & Cie., [1899]. Size 8 × 6, pp. 204. *Map and Illustrations. Presented by the Author.*

Narrative of a journey to the Barotse country in 1895–96, and of a visit to Basutoland and Rhodesia in 1898–99.

South Africa. **Keane.**

The Boer States, Land and People. By A. H. Keane. London: Methuen & Co., 1900. Size 8 × 5½, pp. xx. and 314. *Map. Price* 6*s. Presented by the Publishers.*

This is a useful book on account both of its subject-matter and its standpoint. It gives a concise and accurate account of the geography and ethnography of the Boer states, treating the history of the countries and the character of the people in an impartial manner. A minor feature of great interest is a short vocabulary of South African words now in common use, stating their meaning and origin.

Transvaal. **Olds.**

The Witwatersrand Gold-Fields. A paper read before the South Staffordshire and East Worcestershire Institute of Mining Engineers. By Francis Olds. Annual General Meeting at Birmingham, October 9, 1899. Excerpt from the Transactions of the Institution of Mining Engineers. London and Newcastle-upon-Tyne: A. Reid & Co., 1899. Size 10 × 6½, pp. 22. *Presented by the Secretary of the Institution.*

Transvaal—Zoutpansberg. **Stouart.**

The Mineral Wealth of Zoutpansberg: the Murchison Range Gold-Belt. By Douglas S. S. Stouart. Excerpt from the Transactions of the Institution of Mining Engineers. London and Newcastle-upon-Tyne: A. Reid & Co., 1899. Size 10 × 6, pp. 42. *Maps and Illustrations. Presented by the Secretary of the Institution.*

Uganda. **Thruston.**

African Incidents. Personal experiences in Egypt and Unyoro. By Brevet-Major A. B. Thruston. With an Introduction by General Sir Archibald Hunter, K.C.B., D.S.O. A Memoir of the Author by his brother, E. H. Thruston, and an Account of Major Thruston's last stay in 1897 in the Protectorate, his death, and the Mutiny of the Uganda Rifles. London: John Murray, 1900. Size 8½ × 5, pp. 332. *Portrait, Maps, and Illustrations. Price* 14*s. Presented by the Publisher.*

The late Major Thruston wrote an account of his experiences in Egypt and Uganda, of the many journeys he took in Unyoro, and of the expedition to Dongola. "All that I have written has happened," he says in the preface, "and all that has happened I have written."

West Africa. ——

Africa Pilot. Part i., or Sailing Directions for the West Coast of Africa, from Cape Spartel to the River Cameroon, also the Azores, Madeira, Canary, and Cape Verde Islands. Sixth Edition, 1899. London: J. D. Potter, 1899. Size 9½ × 6, pp. xxii. and 596. *Index Charts. Price* 4*s. Presented by the Hydrographer, Admiralty.*

West Africa—Benue. **Moseley.**

Regions of the Benue. By Lich H. Moseley. [From the *Geographical Journal* for December, 1899.] Size 10 × 6½, pp. 8. *Map.*

NORTH AMERICA.

Alaska. *B.G.S. Philadelphia* 2 (1900): 108-114. **Davidson.**

The Lynn Canal and Taiyá Inlet, Alaska. By Prof. George Davidson. *With Illustration.*

British America. **Various Authors.**

British America. With Two Maps. (British Empire Series. III.) London: Paul & Co., 1900. Size 8½ × 5½, pp. x. and 546. *Price 6s. Presented by the Publishers.*

Although the maps are not up to date, this volume contains a number of able papers on the Dominion of Canada, on its various provinces, and on the West Indies and British Guiana. Most of the articles were originally given in the form of lectures at the South Place Institute, Finsbury.

Canada—Geological Survey. ———

Geological Survey of Canada. Annual Report (New Series), volume x. Reports A, H, I, J, M, S. 1897. Ottawa, 1899. Size 10 × 7, pp. xii., 156, 66, 302, 160, 128, 232, and xxii. *Maps and Illustrations. Presented by the Geological Survey of Canada.*

This gives a full account of the activity of the Canadian Geological Survey for 1897, with official statistics of mineral production, many maps and illustrations, and several memoirs on special regions.

North America—Historical. **Friederici.**

Indianer und Anglo-Amerikaner. Ein geschichtlicher Ueberblick. Von Georg Friederici. Braunschweig: F. Vieweg und Sohn, 1900. Size 7½ × 5½, pp. 148. *Presented by the Publishers.*

The author gives an account of the treatment of the native Indians in the United States and Canada, which is not pleasant reading. The facts which are stated are authenticated by references to historical works; but these facts deal only with one side of the question.

North America—Mound-Builders. **Campbell.**

P. and T.R.S. Canada 4 (1898) (Sec. 2): 3-22.

Recently Discovered Relics of the American Mound-Builders. By John Campbell, LL.D. *With Illustrations.*

United States—Chesapeake and Ohio Canal. **Ward.**

Johns Hopkins University Studies. Series xvii., Nos. 9, 10, 11. The Early Development of the Chesapeake and Ohio Canal Project. By George Washington Ward, PH.D. Baltimore, 1899. Size 9½ × 6, pp. 114.

United States—Geological Survey. ———

Nineteenth Annual Report of the United States Geological Survey to the Secretary of the Interior, 1897-98. In six Parts. Part i.—Director's Report, including Triangulation and Spirit Leveling (pp. 422): Part ii.—Papers chiefly of a Theoretic Nature (pp. 958); Part iv.—Hydrography (pp. viii. and 814); Part vi. (in 2 vols.)—Mineral Resources of the United States, 1897 (pp. (1st part) viii. and 652; (2nd part) viii. and 706). Washington, 1898-99. Size 12 × 8. *Maps and Plates.*

Twentieth Annual ditto, 1898-99. In Seven Parts. Part vi. (2 vols.)—Mineral Resources of the United States, 1898. Washington, 1899. Size 12 × 8, pp. (i.) viii. and 616; (ii.) x. and 804. *Plate. Presented by the Survey.*

United States—Maryland. ———

Maryland Geological Survey. Volume Three. Baltimore: The Johns Hopkins Press, 1899. Size 10½ × 7½, pp. 462 and 80. *Maps and Illustrations. Presented by the Maryland Geological Survey.*

This report deals with the relation of geology to road-construction, and gives a complete history of the high-roads of Maryland, with maps of the existing roads, a full account of the road-making materials of the State, and various articles on subjects connected with road-making in general.

United States—Maryland. ———

Maryland Weather Service. Volume i. Baltimore: The Johns Hopkins Press, 1899. Size 10½ × 7, pp. 566. *Maps, Charts, and Illustrations.*

The lines of investigation pursued by the "Weather Service" of Maryland are very comprehensive, including Topography, Physiography, Meteorology, Hydrography, Medical Climatology, Agricultural soils, Forestry, Crop conditions, Fauna and Flora. This volume contains a long account of "The Physiography of Maryland," and several articles on meteorology and climatology considered theoretically and in relation to Maryland.

United States—Massachusetts. ——

The Annual Statistics of Manufactures. 1898. Thirteenth Report. Boston, 1899. Size 9½ × 6, pp. xxviii. and 312. *Presented by the Bureau of Statistics of Labour, Mass.*

United States—Massachusetts. ——

Twenty-ninth Annual Report of the Bureau of Statistics of Labour, March, 1899. Boston, 1899. Size 9 × 6, pp. xxviii. and 660. *Presented by the Bureau of Statistics of Labour, Mass.*

United States—Massachusetts. **Horsford.**

Vinland and its Ruins. Some of the Evidences that Northmen were in Massachusetts in Pre-Columbian Days. By Cornelia Horsford. [Reprinted from *Appleton's Popular Science Monthly* for December, 1899.] Size 9½ × 6½, pp. 18. *Illustrations. Presented by the Author.*

United States—Taxation. **Hollander.**

Johns Hopkins University Studies. Series xviii. Nos. 1, 2, 3, 4. Studies in State Taxation, with particular reference to the Southern States. By Graduates and Students of the Johns Hopkin's University. Edited by J. H. Hollander, PH.D. Baltimore, 1900. Size 9½ × 6, pp. 254.

CENTRAL AND SOUTH AMERICA.

Bahamas. *J.R. Colonial I.* **31** (1900): 338–352. **Robinson.**

The Bahamas. By Sir William Robinson.

Sir Wm. Robinson spent six years as Governor of the Bahamas.

British Guiana. **Edmundson.**

The Swedish Legend in British Guiana. An historical investigation by the Rev. George Edmundson. Size 13½ × 9. *Presented by E. F. im Thurn, Esq.*

British Guiana—Boundary. ——

British Guiana Boundary. Arbitration with the United States of Venezuela. Appendix to the case on behalf of the Government of Her Britannic Majesty. Vols. i.–iv., 1593–1814, and vii. (pp. vol. i., xii. and 254; vol. ii., xvi. and 228; vol. iii., vi. and 184; vol. iv., xii. and 220; vol. v., x. and 232; vol. vii., 380). —The Counter-case (pp. 142); Appendix to ditto (pp. x. and 410).—The Argument (pp. 56). London: Printed at the Foreign Office, 1898. Size 13½ × 8½.

Venezuela—British Guiana Boundary Arbitration. The case of the United States of Venezuela before the Tribunal of Arbitration to convene at Paris under the Provisions of the Treaty between the United States of Venezuela and Her Britannic Majesty signed at Washington, February 2, 1897. 3 vols. (pp. vol. i., 236; vol. ii., Appendix, Parts 1 and 2, xxvi. and 488; vol. iii., Appendix, Parts 3, 4, 5, 6, 7, and 8, xviii. and 426).—The Counter-case of the United States of Venezuela. 3 vols. (pp. vol. i., 118; vol. ii., Appendix, Part 1, 312; vol. iii., Appendix, Parts 2, 3, 4, 5, 6, and 7, xiv. and 459).—The Printed Argument on behalf of the United States of Venezuela. 2 vols. (pp. 766 and lxxx.). New York, 1898. Size 10 × 7. *Presented by E. F. im Thurn, Esq.*

These volumes practically complete the Society's collection of the literature of the arbitration on the boundary between British Guiana and Venezuela, which forms a unique epitome of the geography and political history of an extensive region.

British Guiana and Venezuela. **Im Thurn.**

An Alphabetical List of Place-Names occurring in the British Case against Venezuela. [By E. im Thurn.] Size 13½ × 8½, pp. 60. *Presented by the Author.*

Brazil. *Verh. Ges. Erdk. Berlin* **27** (1900): 112–128. **Meyer.**

Herr Dr. Herrmann Meyer: Bericht über seine zweite Xingú-Expedition. *With Map.*

A journey in 1898–99 into Matto Grosso from the Argentine Republic.

Chile. ——

Sinopsis estadistica i jeografica de la Republica de Chile en 1897. Santiago, 1898. Size 10 × 7, pp. 296.

Chile—Auca language. *Verh. Deutsch. W. V. Santiago de Chile* 4 (1899): 1–53. **Lenz.**
Kritik der Langue Auca des Herrn Raoul de la Grasserie. Von Rudolf Lenz.

Chile—Rainfall. *Verh. Deutsch. W. V. Santiago de Chile* 4 (1899): 63–74. **Martin.**
Der Regen in Südchile. Von Dr. K. Martin.

General account of the character of the rainfall in Southern Chile, with tables of rainfall and number of rainy days at Puerto Montt for each month from January, 1888, to March, 1899. The average annual rainfall was 78 inches, with a maximum of 10·94 inches in July, and a minimum of 4·28 inches in February. The average number of rainy days in the year was 195, with a maximum of 20 days in July and August, and a minimum of 11 days in February.

Chile—Swamps. *Verh. Deutsch. W. V. Santiago de Chile* 4 (1899): 55–62. **Martin.**
Sümpfe und ñadis. Von Dr. K. Martin.

The name "ñadi" is applied to a class of swamps common in Chile, which are composed of the roots of the ñadi plant. This plant is not certainly identified, but may be the *Dichromene atrosanguine.*

Chile and Argentine. *Petermanns M.* 45 (1899): 285–288. **Polakowsky.**
Die von Chile und Argentinien beanspruchten Grenzlinien. Von Dr. H. Polakowsky.

Colombia. **Regel.**
Kolumbien, von Professor Dr. Fritz Regel. (Bibliothek der Länderkunde, herausgegeben von Prof. Dr. Alfred Kirchhoff und Dr. Rudolf Fitzner, Siebenter und achter Band.) Berlin: A. Schall, [1899]. Size 10½ × 7, pp. xii. and 274. ***Maps and Illustrations.*** *Price* 10*m.*

A complete and richly illustrated geographical account of the republic of Colombia, partly based on the author's travels in that country, partly compiled from a carefully selected collection of the works of previous travellers.

Colombia and Costa Rica. **Silvela.**
Limites entre la Colombie et le Costa-Rica, Exposé présenté à son Excellence M. le Président de la République Française en qualité d'Arbitre. Par Don Francisco Silvela. Madrid, 1898. Size 11½ × 7½, pp. 74.

Différend entre la Colombie et le Costa-Rica, Arbitrage de son Excellence M. le Président de la République Française. Deuxième Mémoire présenté au nom de la République de Colombie. Paris, 1899. Size 11½ × 7½, pp. 106.

Official documents regarding the arbitration as to the boundary between Colombia and Costa Rica, which for practical purposes is the boundary between South and Central America.

Costa Rica. *Globus* 77 (1900): 1–8, 28–31. **Sapper.**
Ein Besuch bei den Chirripó- und Talamanca-Indianern von Costarica. Von K. Sapper. *With Illustrations.*

Jamaica. **Hemming.**
Jamaica. Report for 1898-9. Colonial Reports, Annual No. 283, 1899. Size 9½ × 6½, pp. 76. *Price* 4*d.*

Nicaragua. **Niederlein.**
The State of Nicaragua of the Greater Republic of Central America. By Gustavo Niederlein. The Philadelphia Commercial Museum. Philadelphia, 1898. Size 9½ × 6, pp. 94.

Patagonia. **Fonck.**
Viajes de Fray Francisco Menendez a Nahuelhuapi. Publicados i comentados por Francisco Fonck. Valparaiso: Carlos F. Niemeyer, 1900. Size 10 × 7, pp. xx. and 528. *Map and Illustration. Presented by the Author.*

The narrative of the four journeys of Menendez to Lake Nahuel-huapi between 1791 and 1794, with a historical introduction, and supplementary matter treating of the more recent explorations and maps of the district, and of the question of the boundary-line between Chile and the Argentine Republic.

Peru. *B.S.G. Lima* 9 (1899): 1–14. **Balta.**
Labor de Raimondi. Por José Balta.

Peru. *B.S.G. Lima* 9 (1899): 123–124. **Haenke.**
Descripción y análisis de las aguas de Yura. Por Tadeo Haenke.

Peru. *B.S.G. Lima* 8 (1899): 361–387. **Raimondi.**
Itinerario de los viajes de Raimondi en el Perú: Cuzco, Quispicanchi, Lucre, Pisac, etc., y regreso hasta Albancay (1865).

Peru. *B.S.G. Lima* 8 (1899): 417–450. **Robledo.**
La hoya del Urubambá. Por el Sr. Luis M. Robledo. *With Map.*

The paper has the title "La via fluvial del Urubamba" in the text, and deals with the upper part of the river Urubamba as a traffic route.

San Salvador. **Juárez.**
Estudio sobre San Salvador desde el punto de vista médico . . . por Isidro B. Juárez. San Salvador, 1899. Size 9½ × 6½, pp. 20. *Presented by the Author.*

On San Salvador from a medical point of view.

AUSTRALASIA AND PACIFIC ISLANDS.

Australia. *G.Z.* 6 (1900): 199–209. **Jung.**
Die Wasserversorgung des Australkontinents. Von Dr. Emil Jung.

Discusses the systems of irrigation practised in Australia.

British New Guinea. ——
Queensland. Annual Report on British New Guinea from 1st July, 1898, to 30th June, 1899; with Appendices. Brisbane, 1900. Size 13½ × 8½, pp. xxxiv. and 116. *Maps.*

Easter Island. **Cooke.**
Rep. Smithsonian I. (1897), *U.S. National Museum* 1 (1899): 689–723.
Te Pito Te Henua, known as Rapa Nui; commonly called Easter Island, South Pacific Ocean. By George H. Cooke.

This report is based on a visit of the U.S.S. *Mohican* to Easter Island for twelve days in December, 1886.

Fiji. *T.R.G.S. Australasia (Victoria)* 17 (1899): 40–51. **Thomson.**
Fiji: Past and Present. By Captain Wm. Campbell Thomson. *With Illustrations.*

Captain Thomson contrasts two visits paid to the Fiji islands at an interval of twenty-three years.

New Zealand. *T. and P. New Zealand I.* (1898) 31 (1899): 590–593. **Hogben.**
Notes on the Comparison of some Elements of Earthquake Motion as observed in New Zealand, with their Theoretic Values. By George Hogben, M.A.

New Zealand. *T. and P. New Zealand I.* (1898) 31 (1899): 583–590. **Hogben.**
The Wanganui Earthquake of the 8th December, 1897. By George Hogben, M.A.

New Zealand. *T. and P. New Zealand I.* (1898) 31 (1899): 471–482. **Walsh.**
On the Future of the New Zealand Bush. By Canon Philip Walsh.

On the change in the character of the New Zealand bush in the past, and its probable farther change in the future.

New Zealand—Taupo District. **Friedlaender.**
T. and P. New Zealand I. (1898) 31 (1899): 498–510.
Some Notes on the Volcanoes of the Taupo District. By Benedict Friedlaender, PH.D.

Pacific—Volcanoes. *T. and P. New Zealand I.* (1898) 31 (1899): 510-551. **Phillips.**
The volcanoes of the Pacific. By Coleman Phillips. *With Plate.*

Pacific Islands. *Abh. G. Ges. Wien* 1 (1899): 373–438. **Mauler and Kesslitz.**
Die Missions-Reise S.M. Schiff *Albatros*, 1895–1898. Von J. von Mauler und Wilhelm Kesslitz. *With Map and Plate.*

The cruise of the *Albatros* was the occasion of making a series of observations on oceanic conditions, and on the climate of the Melanesian islands.

Queensland. ——
Greater Britain Exhibition, Earl's Court, London, 1899. Catalogue of Exhibits in the Queensland Court. Size 8½ × 5½, pp. 94.

Queensland. ——
Information relating to Queensland and its Resources. Also a complete list of towns in the Colony, with descriptive particulars thereof. Issued *Gratis* by the

Agent-General for Queensland. Reprinted from the 'Australian Handbook' for 1899, published by Messrs. Gordon & Gotch, London. Size 10 × 6½, pp. 62. *Maps.*

Queensland. **Evans.**

"The Garden of Queensland" (Darling Downs). Compiled and Edited by Essex Evans. Illustrated by James Bain. Toowoomba, Queensland: J. H. Robertson & Co., 1899. Size 6 × 10, pp. 94. *Maps and Illustrations. Presented by the Agent-General for Queensland.*

Queensland—Rockhampton. ——

On the Tropic Line. Rockhampton. Central Queensland's chief City. The Commercial Capital of a Rich District. Its History, Surroundings, and Resources. By J. T. M. The Queenslander, Brisbane, August 5, 1899, pp. 269–284. *Illustrations.* Size 18 × 12.

Tasmania. *J.R. Colonial I.* **31** (1900): 153–179. **Fysh.**

Tasmania: Primitive, Present, and Future. By the Hon. Sir Philip O. Fysh, K.C.M.G.

Tasmania. *T. and P. New Zealand I.* (1898) **31** (1899): 594–601. **Hogben.**

The Tasmanian Earthquake of the 27th January, 1892. By George Hogben.

Western Australia. ——

Western Australia. Report of the Department of Mines for the year 1898. Perth, 1899. Size 13½ × 8½, pp. xciv. and 126. *Maps.*

Western Australia. *R.G.S. Australasia Victoria* 17 (1899): 64–72. **Russel.**

Expedition to the Barrow, Cavenagh, and Warburton Ranges, Western Australia. By Hugh Russel. *With Map.*

A journey of 350 miles from west to east, undertaken in 1897.

POLAR REGIONS.

Arctic—Andrée's Expedition. *Ymer* **19** (1899): 333–335. **Svedenborg.**

Om den på Island funna flytbojen från Andrée-expeditionen. Af G. V. E. Svedenborg. *With Map and Illustration.*

On the buoy found in Iceland which was thrown out of his balloon by Andrée on July 11, 1897, in lat. 82° and long. 25° E. The last words before the signatures are in English, "All right," but the word "well" has been written over "right" on second thought.

Arctic—New Siberian Islands. **Toll.**

Mém. A. Imp. Sci. St.-Pétersbourg **9** (1) (1899): 1–20.

Geological Report on the New Siberian Islands. By Baron E. Toll. [In Russian.] *With Maps. Presented by the Author.*

Arctic—Norwegian Expedition. **Nansen.**

The Norwegian North Polar Expedition, 1893–1896. Scientific Results, edited by Fridtjof Nansen. Volume i. London, etc.: Longmans & Co., 1900. Size 12 × 9½, pp. viii., 16, 147, 26, 53, and 137. *Plates. Presented by Dr. Nansen. A second copy presented by the Publishers.*

The scientific results of the *Fram*, of which this is the first volume, are being published in the English language only, and the accuracy of the printing is a matter on which the Christiania printers deserve to be congratulated. This volume contains a short article by Colin Archer on the *Fram*, giving a full account of the plan of the ship, with working drawings. J. F. Pompeckj and F. Nansen discuss the geology and the Jurassic fauna of Cape Flora, Franz Josef Land; A. G. Nathorst describes the fossil plants from Franz Josef Land; R. Collett and F. Nansen describe the birds collected on the voyage of the *Fram*; and G. O. Sars deals with the crustacea in great detail.

Greenland. *G. Tidskrift* **15** (1899): 53–71. **Amdrup, Kruuse, Poulsen.**

Den østgrønlandske Expedition, 1898–99. Ved G. Amdrup, C. Kruuse, Knud Poulsen. *With Map.*

This expedition is referred to in the *Journal*, vol. xiv. (1899) p. 449.

Greenland. *National G. Mag.* **11** (1900): 118–122. **Merrill.**

A Hunting Trip to Northern Greenland. By Fullerton Merrill.

The trip was undertaken on the Peary supply steamer *Diana* in the summer of 1899.

Greenland Seas. **Garde.**

The State of the Ice in the Waters East and West of Greenland, 1899. By V. Garde. Special print of the nautical-meteorological annual of the Danish Meteorological Institute. [In Danish and English.] Size 12 × 9½, pp. xvi. *Maps.*

Contains maps of the distribution of ice in the sea around Greenland in the respective months March, April, May, June, July, and August, 1899.

Polar Climates. *Meteorolog. Z.* 17 (1900): 75–79. **Woeikof.**

Arktis und Antarktis. Von A. Woeikof.

On the climate of the arctic and antarctic regions.

Spitsbergen. *C. Rd.* 130 (1900): 304–306. **Monaco.**

Sur la deuxième campagne de la *Princesse-Alice IIe*. Note de S. A. S. le Prince Albert I[er] de Monaco.

The principal work of this expedition in the summer of 1899 was the exploration of Red bay and other parts of northern Spitsbergen, which were sounded and surveyed.

MATHEMATICAL GEOGRAPHY.

Astronomy. **Gall.**

An Easy Guide to the Constellations, with a Miniature Atlas of the Stars. By the Rev. James Gall. New and Enlarged Edition. London: Gall & Inglis, 1900. Size 5½ × 4½, pp. 62. *Price 1s. Presented by the Publishers.*

Navigation. *Ann. Hydrographie* 28 (1900): 21–24. **Shrader.**

Die Beschickung von Lothungen auf Niedrigwasser. Von Dr. C. Schrader.

Method and tables for facilitating the comparison of soundings with figures on a chart by calculating the low-water depth of soundings taken at any time when the hour of high water and the total rise of the tide are known.

Navigation—Position. *Ann. Hydrographie* 28 (1900): 29–31. **Bolte.**

Zur Berechnung des Schiffsortes aus zwei Gestirnshöhen nach der Höhenmethode. Von Dr. Bolte.

Time. *T. and P. New Zealand J.* (1898) 31 (1899): 577–583. **Hudson.**

On Seasonal Time. By G. V. Hudson.

A proposal to utilize the long days of summer by calling midnight 2 a.m., and to utilize the short days of winter by calling 2 a.m. midnight.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Geology. **Lapparent.**

Traité de Géologie. Par A. de Lapparent. Quatrième édition. Fasc. iii. Géologie proprement dite. Paris: Masson et Cie, 1900. Size 10 × 6½, pp. 1241–1912. *Maps and Illustrations. Presented by the Publishers.*

This completes the new edition of Prof. de Lapparent's great treatise on geology, the earlier part of which was noticed in the *Journal* for March, p. 287.

Glaciers. **Danneberg.**

Ueber die festen Aggregatzustände des Wassers unter besonderer Berücksichtigung der Gletschertheorie. Inaugural-Dissertation zur Erlangung der Doktorwürde der Hohen Philosophischen Fakultät der Universität Leipzig vorgelegt von Rudolf Danneberg. Zwickau: R. Zückler, 1899. Size 9 × 6, pp. 56. *Presented by Prof. Ratzel.*

On the plasticity of glacier ice, considered in the historical development of the researches and theories upon the subject, with a supplement on the origin of the glacier ice from snow, névé, and ordinary ice. The memoir was published in the *Jahresbericht* of the Verein für Naturkunde of Zwickau for 1899.

Kumatology. *Z. Ges. Erdk. Berlin* 34 (1899): 408–424. **Baschin.**

Die Entstehung wellenähnlicher Oberflächenformen. Ein Beitrag zur Kymatologie. Von Otto Baschin. *Also a separate copy, presented by the Author.*

Herr Baschin treats of wave-forms in water and air, of ripple-marks and dunes, and contests some of the views upheld by Mr. Vaughan Cornish on these matters.

Lake Life. *Science* 11 (1900): 374–389. **Marsh.**

The Plankton of Fresh-water Lakes. By C. Dwight Marsh.

Mountain-building. *C. Rd.* 130 (1900): 291–298. **Bertrand.**
Essai d'une théorie mécanique de la formation des montagnes. Déplacement progressif de l'axe terrestre. Note de M. Marcel Bertrand.

Oceanography. *Ymer* 19 (1899): 341–352. **Pettersson.**
Om systematisk hydrografisk och biologisk undersökning af Europas haf, innanhaf och djupa sjöar. Af Otto Pettersson. *With Maps.*

On oceanographical and limnological desiderata in connection with the proposed systematic study of the seas bordering Northern Europe.

Oceanography—Apparatus. *Atti R.A. Lincei, Rendiconti* 9 (1900): 9–12. **Guglielmo.**
Intorno ad alcuni modi per correggere e per evitare l'errore di capillarità negli areometri a peso costante e a volume costante ed intorno ad alcune nuove form dei medesimi. Nota II. di G. Guglielmo.

Oceanography—Apparatus. *Atti R.A. Lincei, Rendiconti* 9 (1900): 33–41. **Guglielmo.**
Intorno ad alcuni nuovi areometri ad immersione totale, ad inclinazione variabile e a riflessione. Nota I. di G. Guglielmo.

On new total-immersion hydrometers.

Oceanography—North Sea. **Phaff.**
Institut Météorologique Royal Néerlandais. Étude sur les courants de la Mer du Nord. Noord-Hinder. Par J. M. Phaff. La Haye: Monton & Cie. Size 13½ × 10, pp. 58. *Plates. Presented by the Institut Royal Météorologique des Pays-Bas.*

Lieut. Phaff has been engaged for several years in the study of the currents on the coast of Holland, near the north Hinder, and here presents the data in full, with diagrams illustrating the direction and velocity of the current at each hour of the lunar day.

Plant-geography. **Goebel.**
Ueber Studium und Auffassung der Anpassungserscheinungen bei Pflanzen. Festrede gehalten in der öffentlichen Sitzung der k. b. Akademie der Wissenschaften zu München zur Feier ihres 139. Stiftungstages am 15 März 1898. Von Karl Goebel. München, 1898. Size 11 × 9, pp. 24. *Presented by the k. b. Akademie der Wissenschaften, München.*

On the adaptation of plants to their environment.

Spherical deformations. *B.A.R. Belgique* 35 (1898): 270–286. **Schoentjes.**
Sur les déformations que fait naître la pression dans un hémisphère creux métallique. Par H. Schoentjes. *With Diagram and Illustrations.*

On the nature of the deformations produced by pressure on the surface of a hollow hemisphere of brass. The manner of yielding of the spherical shell is of interest from its bearing on the deformations of the crust of the Earth.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Commercial Geography. **Harper.**
Mulhall-Harper Comparative Statistical Tables and Charts of the Commerce of the World. Compiled by William Harper. Philadelphia: Commercial Museum, 1899. Size 9 × 6, pp. 94. *Presented by the Philadelphia Commercial Museum.*

A series of statistical diagrams showing by coloured rectangles and sectors of circles the share taken in trade by the chief nations of the world grouped according to various divisions.

Commercial Geography—Sea Trade. ———
Merchant Marine of Foreign Countries. Special Consular Reports. Vol. xviii. Washington, 1900. Size 9 × 6, pp. xvi. and 182.

A collection of consular reports on the shipping of different countries, with statistics, but without any general discussion.

Commercial Geography—Tariffs. ———
Tariffs of Foreign Countries. Special Consular Reports. Vol. xvi. Part 1. Europe. Part 2. America. Washington, 1899. Size 9 × 6, pp. (part 1) 776, (part 2) 1304.

Historical. **Beazley.**
New Light on some Mediæval Maps. By C. Raymond Beazley, M.A. [From the *Geographical Journal* for December, 1899.] Size 10 × 6½, pp. 10.

Historical Maps. **Christy.**

The Silver Map of the World. A Contemporary Medallion commemorative of Drake's great Voyage (1577–80). A Geographical Essay. Including some Critical Remarks on the Zeno Narrative and Chart of 1558, and on the Curious Misconception as to the position of the Discoveries made by Martin Frobisher in 1576–7-8 which crept into the Cartography of the North Atlantic and of the North-Eastern Coast of America through the Errors of the Zeno Chart. By Miller Christy. Illustrated by facsimile reproductions of the Silver Map and seven other contemporary Charts referred to and by two diagrammatic Charts. London: H. Stevens, Son, & Stiles, 1900. Size 9 × 5½, pp. xii. and 72. *Price 12s. 6d. net. Presented by the Author and Publisher.*

This interesting sketch contains reproductions of the contemporary silver medallion commemorating Drake's voyage, and also of a number of old charts.

Historical—North Pacific. **Nachod.**

M. Deutsch. Ges. Natur- u. Völkerk. Ostasiens, Tokyo 7 (1899): 311–451.

Ein unentdecktes Goldland. Ein Beitrag zur Geschichte der Entdeckungen im nördlichen Grossen Oceau. Von Dr. O. Nachod.

Notes on the legend of an island rich in gold and silver lying to the east of Japan, and particulars of the voyages made in search of it by Portuguese, Spanish, Dutch, English, and Russian vessels.

History of Geography. **Nyström.**

Geografiens och de geografiska upptäckternas historia till början af 1800-talet. Af Dr. J. F. Nyström. Stockholm: C. E. Fritzes, 1899. Size 10 × 7, pp. viii. and 414. *Maps, etc. Price* 8.25*kr.*

Deals with the history of exploration and the development of geographical science in fine historical periods—Ancient, Early Mediæval (A.D. 400–1240), Later Mediæval (1250–1492), Maritime Discoveries (1492-1600), and Seventeenth and Eighteenth Centuries (1600–1800).

Rivers as Boundaries. **Junghans.**

Der Fluss in seiner Bedeutung als Grenze zwischen Kultur- und Natur- Völkern. Inaugural-Dissertation zur Erlangung der Doktorwürde der philosophischen Fakultät der Universität Leipzig vorgelegt von oak. Emil Junghans. Leipzig-Plagwitz: Emil Stephan, 1899. Size 9 × 5½, pp. vi. and 76. *Presented by Prof. Ratzel.*

This is referred to in the *Journal* for May, p. 541.

BIOGRAPHY.

Lichtenberg. *Abh. G. Ges. Wien.* 1 (1899): 119–135. **Günther.**

G. C. Lichtenberg und die Geophysik. Von Dr. Siegmund Günther.

Georg Christoph Lichtenberg was born at Oberramstadt, near Darmstadt, in 1744 or 1742, was professor of Nature Study (*Naturlehre*) in the University of Göttingen, and died in 1799. He made some important studies in physical geography.

Lothian. *Scottish G. Mag.* 16 (1900): 57–58. ———

The Late Marquess of Lothian, P.C., K.T., LL D. *With Portrait.*

Mitchell. **Mitchell.**

In Western India, Recollections of my early Missionary Life. By the Rev. J. Murray Mitchell, M.A., LL.D. Edinburgh: D. Douglas, 1899. Size 8 × 5½, pp. xii. and 406. *Map. Price 5s. Presented by the Publisher.*

These "Recollections" date from 1838 to 1863, and form a record of a life full of remarkable experiences of missionary enterprise, mainly in the west of India.

Moffat. **Moffat.**

The Lives of Robert and Mary Moffat. By their son, John Moffat. Eleventh Edition. London: T. Fisher Unwin, [1900]. Size 8 × 5½, pp. xii. and 314. *Portrait and Illustrations. Price 6s. Presented by the Publisher.*

A cheap edition of the life of the pioneer missionary in South Africa.

Napier of Merchiston. **Gravelaar.**

Verh. K.A. Wetens. Amsterdam 6 (1 Sec.) 1899: 1–160.

John Napier's Werken. Door N. L. W. A. Gravelaar. *With Portrait and Plates.*

A biographical account of John Napier of Merchiston, with a discussion of his system of logarithms and other mathematical works.

Radde. ——

Dr. G. Radde—List of Published works with Portraits. Tiflis, 1899. Size $9\frac{1}{2} \times 6\frac{1}{2}$. *Presented by the Author.*

Tillo. **Artamonoff.**

Obituary Notice of General A. A. Tillo. By L. K. Artamonoff. [In Russian.] St. Petersburg, 1900. Size 10×6, pp. 26.

Varenius. **Schwerdfeger.**

Bernhard Varenius und die Morphologischen Capitel seiner "Geographia Generalis" (Amsterdam, 1650). Ein Beitrag zur Geschichte der Geographie von Dr. Josef Schwerdfeger. (Separatabdruck aus dem Jahresberichte des K. K. Staatsgymnasiums in Troppau. 1897–8, 1898–9.) Size $10 \times 6\frac{1}{2}$, pp. 48. *Presented by the Author.*

On the life and work of the father of modern physical geography.

GENERAL.

Bibliography. ——

Catalogue of Books in the Library of the Alpine Club. Edinburgh: T. & A. Constable, 1899. Size 9×6, pp. 224. *Presented by the Alpine Club.*

This catalogue is arranged under authors' names in the first part, and according to subjects (alphabetically arranged) in the second.

British Empire. ——

Statistical Abstract for the several Colonial and other possessions of the United Kingdom, in each year from 1884 to 1898. London: Eyre & Spottiswoode, 1899. Size $10 \times 6\frac{1}{2}$, pp. 306. *Price* 1*s.* 3*d.*

Educational—Instrument. *J. School G.* 4 (1900): 10–20. **Surface.**

The Helior: an Instrument for Observational Work in Mathematical Geography. By H. A. Surface.

Description of a rough wooden quadrant designed for school demonstrations of the altitude of the sun, and of very inexpensive construction.

Foreign Missions. ——

The Eighty-ninth Annual Report of the American Board of Commissioners for Foreign Missions. Presented at the meeting held at Providence, R.I., October 3–6, 1899. Boston: Published by the Board. Size $9\frac{1}{2} \times 6\frac{1}{2}$, pp. xviii. and 198. *Maps.*

Geographical Congress. *Petermanns M.* 45 (1899): 238–240, 268–269, 288–290. **Supan.**

Der VII. Internationale Geographenkongress zu Berlin, 28 September bis 4 Oktober 1899. Von Prof. Dr. A. Supan.

German Colonies. ——

Kolonial-Handels-Adressbuch 1900. (4 Jahrgang.) Herausgegeben von dem Kolonial-Wirtschaftlichen Komitee. Berlin: E. S. Mittler & Sohn. Size $10\frac{1}{2} \times 7\frac{1}{2}$, pp. 114. *Maps.*

This directory, in addition to the names of business firms in the various German colonies, gives a good deal of practical information about the colonies, and maps showing the various concessions.

German Naval Observatory. ——

Einundzwanzigster Jahresbericht über die Thätigkeit der Deutschen Seewarte für das Jahr 1898. Erstattet von der Direktion. Beiheft II. zu den "Annalen der Hydrographie und Maritimen Meteorologie," 1899. Hamburg, 1899. Size $10\frac{1}{2} \times 7\frac{1}{2}$, pp. iv. and 100.

Report on the work, nautical and scientific, of the German naval observatory at Hamburg, which, under the leadership of Dr. Neumayer, produces every year much oceanographical work of scientific value to the world, as well as of practical importance to German shipmasters.

Historical Charts. *P.R. Artillery I.* 26 (1899): 467–484. **Ward.**

Synoptical Charts applied to military subjects. By Captain B. R. Ward. *With Chart.*

These charts are diagrams intended to show the chronological order of movements in the course of a campaign.

International Relations. *B.A.R. Belgique* 35 (1898): 629–728, 925–993. **Descamps.**

L'évolution de la neutralité en droit international. Par M. le chevalier Descamps.

Maps. **Mehedinţi.**

Ueber die kartographische Induktion. Inaugural-Dissertation zur Erlangung der Doktorwürde bei der hohen philosophischen Fakultät der Universität Leipzig eingereicht von S. Mehedinţi. Leipzig: Sellmann & Henne, 1899. Size 9 × 6, pp. 52. *Presented by Prof. Ratzel.*

On the study of maps, showing how, in the logical discussion of geographical questions, the map supplies information which no description in words can convey.

Medical Geography—Scurvy. *P.R.S.* 66 (1900): 250–265. **Jackson and Harley.**

An Experimental Inquiry into Scurvy. By Frederick G. Jackson and Vaughan Harley, M.D.

The authors produce evidence to demonstrate that the cause of scurvy is ptomaine poisoning, due to eating tainted meat. This idea, suggested by experience in the arctic regions, was tested experimentally by feeding monkeys in three groups on a diet including fresh tinned meat, slightly tainted tinned meat, and slightly tainted meat with the addition of fresh fruit. The result of the experiments confirmed the theory, and helps to prove that the use of fresh vegetables or lime-juice is not sufficient either to prevent or cure scurvy.

Melbourne Geographical Society. **Madden.**

T.R.G.S. Australasia (Victoria) 17 (1899): 5–29.

Inaugural Address by the President (Sir John Madden).

This address on the progress of geography, and the discussion which followed it, show that geography is being forwarded in an enlightened manner by the Royal Geographical Society of Australasia in Melbourne.

Military Geography. *Scottish G. Mag.* 16 (1900): 138–160. ——

Military Geography: a Review.

Mountaineering. *Annuaire Club Alpin Français* 25 (1898): 34–82. **Bregeault.**

Les chasseurs alpins. Par M. Julien Bregeault. *With Illustrations.*

On military mountaineering, with special reference to the French alpine regiment.

Mountaineering. **Javelle.**

Alpine Memories. By Émile Javelle. With a Biographical and Literary Notice by Eugène Rambert. Translated and with an Introduction by W. H. Chesson. London: T. Fisher Unwin, 1899. Size 8½ × 6, pp. vi. and 444. *Portraits and Illustrations. Price 7s. 6d. Presented by the Publisher.*

The late M. Javelle was an enthusiastic mountaineer, whose eloquent descriptions and profound appreciation of mountain beauty are presented with wonderful effect in the translation.

Paradox. **Unger.**

Die Ursache der Umdrehung der Erde und aller Planeten um ihre Achse. Das Wesen der Monde, der Saturn-Ringe und der Meteorsteine. Ferner drei damit zusammenhängende physikalische Probleme entdeckt, bewiesen und erläutert in drei Gesprächen mit Prof. Ed. Süss, Prof. Edm. Weiss, N. N., vom Verfasser Joachim Unger. Wien-Leipzig. Size 8½ × 5½, pp. 80. *Presented by the Author.*

This little book, which seeks to explain terrestrial rotation through the action of solar warmth on the atmosphere, is interesting in showing the extreme consideration and kindness of Austrian professors to all students however uninstructed.

Photography. *La France de Demain*, No. 13 (1899): 47–63. **Radiot.**

Les Voyageurs et les Images. L'Illustration intensive par la Photographie repérée. Par Paul Radiot.

Scenery. *Annuaire Club Alpin Français* 25 (1898): 556–577. **Schrader.**

A quoi tient la beauté des montagnes. Par M. Franz Schrader.

Telephotography. **Dallmeyer.**

Telephotography, an Elementary Treatise on the Construction and Application of the Telephotographic Lens. By Thomas R. Dallmeyer. London: Heinemann, 1899. Size 10 × 7½, pp. xvi. and 148. *Illustrations. Price 15s. Presented by the Publisher.*

This gives full particulars of the theory of the Telephotographic lens, and instructions for its use. A number of illustrations are given showing the advantage of using these lenses in photographing distant objects. The method has already produced extremely interesting results with regard to geography.

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

England and Wales. **Bartholomew.**

Bartholomew's Cyclists' Touring Map of England and Wales, showing the best touring roads. Scale 1 : 823,680 or 13 stat. miles to an inch. J. Bartholomew & Co., Edinburgh. *Price 2s. mounted on cloth. Presented by the Publishers.*

The scale of this map, 13 stat. miles to an inch, is rather small for cycling purposes. However, the roads are clearly shown in colour, and the principal touring routes distinguished from cross-roads. The map embraces the whole of England and Wales, the Isle of Man, and the southern part of Scotland: and the elevations from sea-level to above 3000 feet are indicated by seven different tints of colour.

England and Wales. **Ordnance Survey.**

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Italy. **Instituto Cartografico Italiano.**

Carte delle Strade Ferrate Italiane. Scale 1 : 1,500,000 or 23 6 stat. miles to an inch. Roma: Instituto Cartografico Italiano, 1900. *Price 2 lire.*

This map shows the railways of Italy, and their connections with those of other countries, up to March 1, 1900. The physical features are lightly printed so as to give due prominence to the railway lines, which are very clearly indicated in colours. By the lettering and signs employed, the relative importance of towns, as regards population, is indicated. The map will doubtless prove useful to tourists and others visiting Italy.

Rome. **Instituto Cartografico Italiano.**

Carta Topografica della Provincia di Roma e Regioni Limitrofe, con Cartina Speciale del Colli Albani. Scale 1 : 250,000 or 3·9 stat. miles to an inch. Roma : Instituto Cartografico Italiano, 1900. *Price* 1.50 *lire.*

In addition to hill shading, elevations from sea-level to above 500 metres are shown on this map by four tints of colour. The altitudes of important peaks are also given in figures, but it is to be regretted that no attempt has been made to indicate the depths of the sea. The map is based on the recent government surveys.

Vienna. **Hartleben.**

Plan der Reichshaupt u. Residenzstadt Wien. Scale 1 : 20,000 or 0·3 stat mile to an inch. Mit Angabe der neuen Bezirkseintheilung und der früheren Gemeindegrenzen. Wien : A. Hartleben's Verlag. 1900. 8th edition. *Price* 2 *kronen.*

ASIA.

China. **Chevalier.**

Atlas du Haut Yang-Tse de I-Tchang Fou à P'ing-Chan Hien. Par le R. P. S. Chevalier, S.J. Observatoire de Zi-Ka-Wei, Shanghai.

With the publication of this, the second part of the 'Atlas du Haut Yang-tse,' Father Chevalier's large-scale chart of the river from I-chang Fu to Phing-Chan Hien is completed. The first part appeared some months ago, and gave, on thirty-eight sheets, the course of the river from I-chang Fu to Chung-King Fu; that now issued consists of twenty-nine sheets, including index and explanatory letterpress, and shows the river from just above Chung-King Fu to Phing-Chan Hien.

The basis of the survey is a series of latitudes and longitudes, astronomically determined, at fifty-one different places along the course of the river, a table of which is given, together with a statement of the methods employed. This should be specially useful to future travellers, as it will furnish them with fairly reliable fixed starting-points for their route surveys in the interior. Between these astronomically determined positions a compass-survey was carried out, every bend in the river being carefully observed, and the distances ascertained as nearly as possible by noting the time the junk took to pass from one place to another, making allowance for the speed of the current of the river. Soundings were taken continually, and these are recorded on the charts. As the whole of this section of the Yang-tse was passed over twice, opportunity was afforded for checking the survey, and altogether the work seems to have been carefully performed. A note is given explaining the system employed in the transliteration of names of places, which are also given in Chinese characters.

AFRICA.

Madagascar. **Locamus.**

Carte de Madagascar. Scale 1 : 500,000, or 7·8 stat. miles to an inch. Dressée par P. Locamus. Sheets: 2, Diego Suarez; 5, Maintirano. Paris: Maison Andriveau-Goujon.—H. Barrére.

All available information appears to have been utilized in the compilation of this map, which is now in course of publication, including the charts of the French Hydrographic Department, the geodetic work of the topographical service of the French army of occupation, the surveys of Pères Roblet and Colin, the route-surveys of explorers, and the documents published by the military administration under the authority of General Gallieni. The map is clearly drawn, and printed in four colours—sea, blue; hill-shading, brown; forests, green; and rivers, roads, and lettering, black. Altitudes, where they have been ascertained, are given in metres. When complete, the map will consist of twelve sheets, and its scale, 1 : 500,000, is sufficiently large to admit of considerable detail being shown.

Rhodesia. **Stanford.**

Map of Mashonaland, Matabeleland, etc. Scale 1 : 1,000,000 or 15·8 stat. miles to an inch. London: Stanford's Geographical Establishment, 1900. 2 sheets. Revised. *Price* 8*s.*

These two sheets form portion of Stanford's six-sheet map of Rhodesia, and embrace the region between the Zambezi and the Shire highlands on the north, the northern part of the Transvaal on the south, Portuguese East Africa on the east, and Bechuanaland on the west. The map contains a fair amount of detailed information, including notes on the character of the country, navigability of rivers, etc., but no attempt has been made to show the relief, only the tops of isolated hills being indicated, and some heights given in figures. Boundaries are clearly shown, and railways have been brought up to date.

AMERICA.

New Brunswick. **Ganong.**

Map of Nictor Lake and Upper Nepisiguit River, New Brunswick. Compiled by W. F. Ganong, 1899. Reprinted from *Bulletin of the Natural History Society of New Brunswick*, No. xviii., 1899. *Presented by the Natural History Society of New Brunswick.*

AUSTRALIA.

New South Wales. **Department of Lands, Sydney.**

Map of New South Wales, including Lord Howe Island. Scale 1 : 506,880 or 8 stat. miles to an inch. Department of Lands, Sydney, N.S.W., 1898. 9 sheets. *Presented by the Department of Lands.*

This large nine-sheet map of New South Wales has been constructed at the Department of Lands, Sydney, under the direction of Mr. E. Twynam, Chief Surveyor, from the latest surveys and topographical information up to the date of its publication. It has been photolithographed from the original drawing, but it cannot be said that the method of reproduction has proved very satisfactory. Many of the names are so small that it is impossible to read them without a glass, and in places where they appear over hill-shading, which is itself very confused, they are almost illegible. However, as the map has evidently been compiled with care, and contains a great deal of information, it will be of service to all who are interested in the colony.

CHARTS.

United States Charts. **U.S. Hydrographic Office.**

Pilot Chart of the North Atlantic Ocean for April, 1900. U.S. Hydrographic Office, Washington, D.C. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Balearic Islands. **Sternberg.**

Seventy-seven Photographs of the Balearic Islands, by F. Sternberg, Esq. *Presented by F. Sternberg, Esq.*

This is an interesting set of "quarter-plate" photographs of the scenery and inhabitants of the Balearic islands. The following is a list of their titles :—

Majorca.—(1) General view of the city of Palma ; (2) The cathedral, Palma ; (3) Residence of the Captain-General, Palma ; (4) British Vice-Consulate, Palma ; (5) El Consulado, Palma ; (6) La Lonja, Palma ; (7) Interior of La Lonja, Palma ; (8) El Ayuntamiento, Palma ; (9) Cloister of San Francisco church, Palma ; (10) Patio of the Casa Caleza, Palma ; (11) Calle de la Almudaina, Palma ; (12) A typical street, Palma ; (13) Valdemosa ; (14) Old woman at Valdemosa ; (15) School children, Valdemosa ; (16) Miramar ; (17) Interior of museum, Miramar ; (18) Old bedstead, museum, Miramar ; (19) Hospederia, Miramar ; (20) Monk, Miramar ; (21) Majorcan conveyance ; (22) Village of Deya and surrounding country ; (23) Soller ; (24) River and bridge, Soller ; (25) Ayuntamiento, Soller ; (26) Country and road near Soller ; (27) Fornalutx ; (28) Entrance to Fornalutx ; (29, 30) Groups at Fornalutx ; (31) Washerwomen, Soller ; (32) Typical dress, Pollensa ; (33) Roman bridge, Rollensa ; (34) Curious-shaped fountain, Pollensa ; (35) Calvario, Pollensa ; (36) Majorcan windmill ; (37) Old olive trees ; (38) Majorcan peasant, with sheepskin covering.

Minorca.—(39) Entrance to harbour, Port Mahon ; (40) Quay, Port Mahon ; (41) Church, Port Mahon ; (42) Market-place, Port Mahon ; (43, 44) Streets showing windmills, Port Mahon ; (45) Street fish-seller, Port Mahon ; (46) Street, Port Mahon ; (47) Group, Port Mahon ; (48) Monument erected during governorship of Sir Richard Kane ; (49) Megalithic stone ; (50) Talayot ; (51) View from top of Talayot ; (52) Church built during French occupation ; (53) View from top of church.

Ivica.—(54) Town of Ivica from opposite side of harbour ; (55) Cathedral, Ivica ; (56) Door of cathedral, Ivica ; (57) A choice window, Ivica ; (58) Town of Ivica, from near cathedral ; (59) Town of Ivica and harbour from cathedral ; (60) Principal entrance to old town, Ivica ; (61) Main gate, Ivica ; (62) Interior of Ayuntamiento, Ivica ; (63) Archives of Ayuntamiento, Ivica ; (64) Roman statue, Ivica ; (65) Market-place, Ivica ; (66) A potter, Ivica ; (67) Water-cart, Ivica ; (68) A typical street,

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