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ROYAL GEOGRAPHICAL SOCIETY.

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The Geographical Journal.

No. 1. JULY, 1906. Vol. XXVIII.

ADDRESS TO THE ROYAL GEOGRAPHICAL SOCIETY, 1906.*

By the Rt. Hon. Sir GEORGE TAUBMAN GOLDIE, K.C.M.G., President.

At this Anniversary Meeting, the first over which I have presided, I propose to review briefly the work of our Society during the past year and its position to-day; but I must commence with one prefatory remark. In speaking of results achieved and of progress made, I cannot isolate the past year from its predecessors. In the Royal Geographical Society there are no revolutions. Successive presidents and councils take up the work which has been prepared by those who have gone before them; and, speaking for myself, I have been content to follow, as closely as circumstances have permitted, on the lines pursued by my distinguished and untiring predecessor, Sir Clements Markham, during the twelve years that he presided over us with such marked success.

So far as the general progress of the Society is concerned, we have reason to be satisfied. You will see in the Annual Report and the New Year-Book, which will appear this week, that during last year (as in the preceding years) a substantial addition was made to our members; but this is not the only, nor even the chief, sign that the Society is successfully holding its place amid the many and varied organizations through which the acquisition and diffusion of human knowledge are carried on. Personally, I am inclined to attach even more importance to the gradually increasing circulation of our *Journal* outside of the circle of the Society. You may remember that, about fourteen years ago, the scope of this publication was considerably extended so as to cover the whole field of exploration and geography. There had been previously no such permanent organ in the English tongue, and the success of the

* Delivered at the Anniversary Meeting, May 21, 1906.

experiment fully justified the step then taken by the Council. But scientific societies, like all other human institutions, can only prosper by continually adapting themselves to the changing conditions of their environment, and the Council, two years ago, wisely decided to place the *Journal* on public sale, and to exhibit the bills of its contents at the principal railway stations in the kingdom. The result has been a very large addition to the circulation of the *Journal*. I earnestly hope that this and similar steps may widely increase the spread of interest in geography amongst the general public. As testimony of the view taken by scientific men of the intrinsic value of the *Journal*, you may like to hear a few words from a letter recently received from Prof. Suess, when acknowledging his election as an Honorary Corresponding Member of our Society. Prof. Suess, as every one knows, is one of the greatest living exponents of geological and geographical science, and he writes, "The Society's *Journal* has for years been one of my richest sources of information, and I shall be happy to possess it in my library, and not to remain dependent upon public libraries."

You are aware that, in addition to our monthly journal, we issue at intervals extra publications of a character too lengthy or too technical to be suitable for our monthly number. During the past year we have published a volume of great interest and scientific value by Dr. Merzbacher, on his expedition to the Central Tien Shan mountains. The eighth edition of our 'Hints to Travellers,' which is used by explorers of all nationalities, has been exhausted for some months; but the ninth edition, under the editorship of our able map curator and instructor, Mr. Reeves, is now ready for publication. It has been entirely recast and greatly improved; the demand has been so great that we have had, most cheerfully, to print double the number that we printed of the previous editions.

In the instruction department under Mr. Reeves the work is constantly increasing. Officers and civil officials are sent every year by the Government departments to take the Society's diploma before entering upon their work. In other ways we continue to be on close relations with several departments of the Government, and even foreign governments have appealed to us to recommend competent men for carrying out the work of boundary delimitation.

Under the able and zealous care of Mr. Heawood, our library is constantly maintained at the level which you have the right to expect in a Society as energetic and abreast of the times as ours is.

Fortunately, we are not entirely dependent for this object on our own funds, often urgently required for other purposes, but are also assisted by the generosity of individual members. I must, on this occasion, specially refer to the magnificent donation made by one of our oldest Fellows, Dr. Alexander Peckover, Lord-Lieutenant of Cambridgeshire, who, from his early years, has been a diligent and discriminating collector of geographical classics and rare maps. Mr. Peckover has generously presented to our Society nearly the whole of this valuable collection, thus completing many gaps in the library and map-room collection. Quite recently, also, Colonel Feilden, who, during the greater part of his lifetime, devoted himself to forming an Arctic library, has been good enough to present this rare and large collection to our Society, of which he is so distinguished a Fellow. It will interest you to know that the general index to the first twenty volumes of the *Geographical Journal* is almost ready for publication. It will form a volume of about 600 pages in double columns, and will be invaluable for purposes of reference. The general index to the fourteen volumes of the earlier *Proceedings of the Royal Geographical Society* is also well advanced; while the supplement to the Library Catalogue, covering the last fourteen years, is proceeding.

To some of the Fellows, as also to the general public, the evening meetings of the Society, held fortnightly from November to June, may perhaps represent our principal activity; but I think that most of you here present know that they form only a small section of the totality of the Society's work. Nevertheless, those fortnightly meetings undoubtedly play a very considerable part in the diffusion of geographical knowledge, and the general character of the papers which have been read during the last year is an indication of the continuous progress which has been made in our time, in raising the standard and widening the field of our subject. From the nature of things the majority of those papers have been records of travels, but these have displayed unmistakable evidence of the increasingly scientific character of the work of geographical exploration. I would mention as typical cases the papers of Dr. Seligmann on British New Guinea, of Sir Henry McMahon on Seistan, and of Baron Nordenskjöld on his researches in Bolivia. Nor has such work been confined to remote continents and islands. Much has been done both at our meetings and in the *Journal* to extend our knowledge of Europe itself. For instance, Colonel Maunsell's paper on the Rhodope Balkans was a useful contribution to the geography of a very little known part on the Continent. Mr. Hogarth's able paper on the geographical conditions affecting population in the East Mediterranean lands, and Mr. Spotswood Green's most interesting paper on the Spanish Armada, are striking examples of the light which geography is able to throw upon history. The series of papers by Sir John Murray on the Scotch Lochs, which have been continued in the *Journal* during the last year, and the paper by Mr. Victor Gatty in the current number of the *Journal* on "The Glacial Aspects of Ben Nevis," are instances of recent contributions to geographical knowledge of our own country. We have had other papers of a purely scientific character, such as that by Mr. Scott Elliot on the action of water-plants in Chile in building up land; by Prof. Davis on "The

Geographical Cycle in an Arid Climate;" by Prof. Schwarz on "The Rivers of Cape Colony;" and by Mr. Mackintosh Bell on "The Great Tarawera Volcanic Rift." In another department of the wide field of geography—the field which has been designated "Applied Geography," that in which is worked out the bearings of Geographical conditions on human activity and human interests—we had an admirable paper by Prof. Gregory on "The Economic Geography of Australia."

You are aware that the increasingly scientific character of our geographical work led to the establishment, some three or four years ago, of a Research Department, mainly devoted to discussions on subjects of too technical a character to be suitable for our fortnightly meetings. These discussions are, of course, open to all Fellows of the Society, but not to visitors, except by invitation of the Research Committee. This department has been active during the past year. One interesting discussion was that on Mr. Randall MacIver's views as to the date and origin of the Zimbabwe ruins in South Africa, a subject intimately connected with the early history of African exploration. Another valuable discussion was that raised by Mr. Scott Elliot's advocacy of an inquiry into the resources of the Empire. Dr. Nansen's paper on "The Oscillation of Shore-lines" also led to a lively discussion by specialists, and I understand that the Research Department may soon expect another paper from Dr. Nansen on the same subject. Certain points connected with the Seistan lake-basin involving technical scientific considerations were also brought before this department by Sir Henry McMahon. A discussion on a paper by Sir Clements Markham dealt with problems still to be solved in the north polar area, and it is in the attempt to solve these problems that Mr. Einar Mikkelsen is now making his way through Behring straits to Prince Patrick Land. Part of the funds required for the work has been furnished by our Society. Captain Lyons of the Egyptian Survey brought before the Research Department the subject of the Nile flood, which he has now expanded into a book (entitled 'The Physiography of the River Nile and its Basin'), published by the Egyptian Government. This elaborate work contains a mass of valuable information on a most interesting and important subject. Through the Research Department we are initiating an investigation into the changes which have taken place in the North Sea coast region of England during the historical period. The inquiry is a complicated one, and will require the assistance of many workers, but it is worth carrying out, as the results can hardly fail to be of value both to pure geography and to history. In the same way we have arranged for a special investigation of a limited river area in the Thames basin, with a view to discover the rate at which the land is being worn away through influences of rainfall and other causes. We have every reason to hope that in the near future, as trained geographical students become more and more numerous, practical work of various kinds will go on increasing under the auspices of the Society.

I will say a few words on geographical work already completed, or in the course of completion, which has not yet been brought fully to the notice of our Society. Mr. Ellsworth Huntington, a young American explorer of a thorough scientific training, has just returned to this country from Central Asia with his companion, Mr. Barrett. I believe that Mr. Huntington has done much to solve some of the problems connected with the geography, the desiccation, and the archæology of Central Asia; but a full account from his pen will be published in the *Journal* very shortly. You all know that Dr. Sven Hedin has started on another of his great expeditions. He has already traversed Persia, and he believes that he has solved some of the more important geographical problems of the eastern provinces of that country. We understand that his next field will be Tibet. To us, as British geographers, it is somewhat tantalizing that the British Government has declined to grant permission to experienced British officers to enter Tibet or to explore the unknown reaches of its great rivers; but this is not the place for either approval or condemnation of the policy on which this decision is based. In the continent of Africa, the expedition under Captain Gosling and Lieut. Boyd Alexander has been at work in Nigeria, on Lake Chad, on the Shari, on the Mobangi, and in other regions for about two years. It is making its way to Lado, and may probably before long return down the Nile. Valuable results are expected from this expedition. Some of them have, indeed, already appeared in the *Journal*, including an excellent map of part of Nigeria by Mr. Talbot, one of the surveyors of the expedition. During the past year our Gold Medalist, Commander Peary, has made a fresh start for the purpose of reaching the pole. We wish him every success. Captain Amundsen, who, some three years ago, went out with two or three companions to carry out a series of observations around the north magnetic pole, has accomplished the North-West Passage. He has since returned to his companions, and will probably carry on the projected work for another year. Another interesting matter connected with the north pole region is the establishment of a Danish scientific station at Disco, on the west coast of Greenland, for the purpose of making continuous scientific observations. During the year Captain Scott's magnificent narrative of the National Antarctic Expedition has been given to the world, and we are now awaiting publication of the detailed scientific results. Meanwhile, the scientific results of the Swedish Antarctic Expedition have appeared in several large volumes, some of which are published in English. Strenuous efforts are being made by Lieut. Barne, R.N., to obtain funds for a small Antarctic expedition to supplement that in which he bore so admirable a part. In view of the heavy expenditure recently incurred by the Society in the National

Antarctic Expedition, your Council do not at present feel justified even in considering the question of a contribution to the new fund; but they fully recognize the importance of continuity in Antarctic exploration, and they have learned with satisfaction Captain Scott's emphatic opinion as to the qualifications of Lieut. Barne for conducting the proposed enterprise.

With regard to the ever-important subject of geographical education, we have every reason to be satisfied with the progress that has been made during the past year. We have excellent reports from Oxford, where, under the new reader, Dr. Herbertson, the school continues to flourish. The number of students during the present term has increased very largely over the past term, and not a few of them propose to devote themselves specially to obtain the full diploma of the school, which implies a very thorough mastery of the subject in all its departments. A special course of lectures by men of high standing in the different branches of the subject has been instituted there, and these promise to be completely successful. At Cambridge, also, we have reason to believe that steady progress is being made. There also a series of lectures has been initiated during the past year. Sir Clements Markham opened the series with a lecture on the Field of Geography. This has been followed by others by Sir Archibald Geikie, Mr. Hogarth, and Major Hills. Perhaps one of the most encouraging steps taken during the year was the issue by the Education Department of a syllabus for geographical teaching in secondary schools. It was hardly to be expected that, at the outset, this syllabus would be all that exacting geographers might wish; but on the whole it is satisfactory, and the mere fact that such a syllabus has been issued by the Education Department is highly significant of the important position which geography has assumed in education in this country, compared to what it was a generation ago. But this spread of geography in recent years, not only in secondary schools and in the universities, but in military and in other circles, is one which would demand an address by itself, and I have only been able to touch upon it here. I need not dwell on the increasingly important position which geography has been allotted in the examination of the University of London, largely due to the energy of Mr. Mackinder, who, as director of the London School of Economics, gives the subject a place of the first importance there.

The past year has in one respect been rather a sad one for the Society, as our obituary list contains the names of some of the most distinguished of our Fellows. Among our home list, I can only allude to the great loss which our Society and geography have sustained by the death of such men as Sir Mount Stuart Grant Duff, Sir Charles Wilson, Dr. Blanford, Sir John Farquharson, Sir William Wharton, Canon Tristram, Sir Coutts Trotter, Admiral Lindsey Brine, and Captain Wiggins. In Sir Augustus Gregory we have lost one of our oldest Fellows, and one of the great early pioneer explorers of Australia. Among our Honorary Corresponding Members we have to deplore the loss of such distinguished explorers and geographers as Baron Von Richthofen, Major Von Wissmann, M. de Brazza, and perhaps greatest of all Elisée Reclus.

I commenced my address with a tribute—necessarily brief and inadequate—to the work performed by my predecessor, Sir Clements Markham, during his twelve years' tenure of the Presidential chair. I wish to conclude the address with a similar tribute to the indispensable work performed by Dr. J. Scott Keltie during the first year of my presidency, as, indeed, during the fourteen years that he has filled the post of secretary to the Society, throughout all of which period I have been in a position, as a member of your Council, to follow and appreciate his invaluable services. I do not, of course, imagine that any words of mine can add materially to the firmly-rooted reputation of Dr. Keltie, either in our great Society or amongst geographers of all nationalities. He is too widely known to need commendation from me. But I claim, as one of my privileges, to remind you of the fact which must be patent to many of you, that by far the greater part of such work of the Society as appears to be performed by me—including even the more solid material of this address—is really the work of our untiring, our zealous, our deeply experienced secretary.

THE RHODOPE BALKANS.*

By Lieut.-Colonel F. R. MAUNSELL, C.M.G., R.A.

THE Rhodope Balkans is the name given to the series of ranges along the southern frontier of Bulgaria which shut off that country from access towards the Mediterranean. They form a part of European Turkey curiously little known, although the traveller in the Orient express to Constantinople skirts the foothills of the range on the north, and may admire its bold line of snowy summits, and also the coast to Salonica along the Ægean follows its southern slopes and traverses some of its gorges. Yet the actual country is seldom penetrated by travellers, and since the stirring times of the war of 1878, when some of the Turkish columns retreated through its passes, and its feudal beys organized a force to descend on the Russian line of communications, the country has remained forgotten.

The name "Balkan" in Turkish is a generic term referring to a range or mass of wooded hills with pasturage and meadowland on their slopes, rather than to a "dagh," or mountain, a name applied oftener

* Read at the Royal Geographical Society, March 12, 1906. Map, p. 9.

to the wild rocky ranges with inaccessible peaks and rugged slopes more common in Asiatic Turkey.

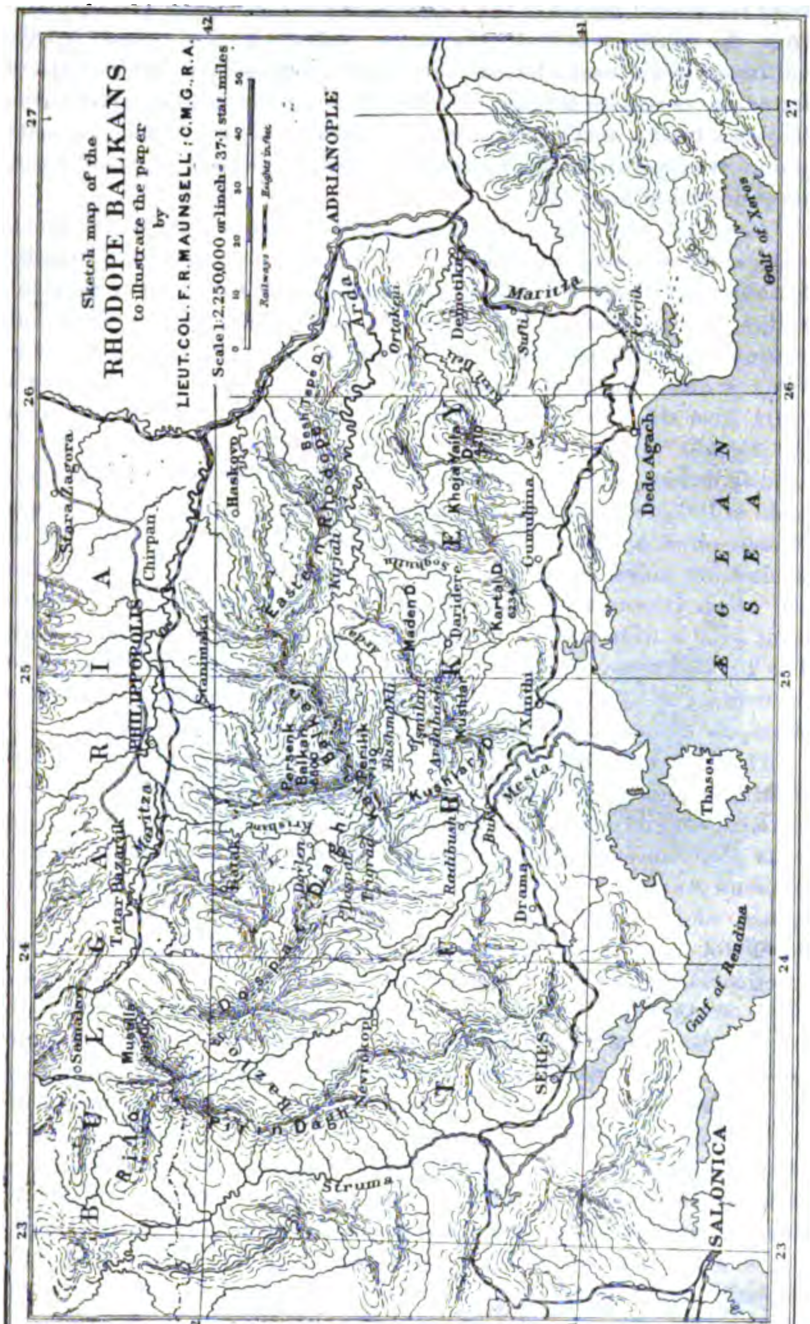
The main range of the Balkans which gives its name to the peninsula is known to the Turks as the Khoja Balkan, or "Father of Balkans;" the central mass of the Rhodope is known as the Kara, or Black Balkan, probably from the dark masses of pine forests along its summit ridges. The high mass of the Rilo mountains is the Altun, or Golden Balkan, while another very beautiful and picturesque range is the Stranja Balkan along the Black sea from the Bosphorus up to the Bulgarian frontier—hills of no great height, but with densely wooded slopes and deep winding glades, affording very delightful scenery of a kind somewhat rare in Turkey.

The Rhodope Balkans commence on the west as a continuation of the Rilo mountains, a fine mass of hills which form the southern buttress of the Sofia plateau, and rise in the Musalla peak to 9600 feet. A sharp dip with a rugged col separates the Dospat range, which forms the north-west end of the Rhodope Balkans, from it, after which the general trend of the range is to the south-east, though at an elevation very much lower, of about 5500 feet. The central part of the range, the Kara Balkan, is to be found along the Bulgarian frontier south of Philipopolis, where the principal peaks are the Persenk, rising to 6800 feet, and the Perilik, at the turning-point of the frontier, to 7130 feet. Eastward of this the range practically divides into two long offsets, which enclose the valley of the Arda, one following the line of the Bulgarian frontier, and gradually getting lower until its foothills approach the Maritsa near Adrianople, and another, a well-defined series of ridges which skirt the coast plain of the Ægean and trend to a central knot in the Khoja Yaila Dagh, which rises to 4210 feet, and sends out spurs to the coast at Dede Agach, as well as towards the Maritza on the east and the Arda on the north.

The many small streams on the northern slopes of the Rhodope emerge from their narrow valleys and gorges into the wide plain of southern Bulgaria, and there form tributaries of the Maritza, the great river of the principality most famous in national song and story, which leaves Bulgaria near Adrianople, and sweeps round the eastern end of the Rhodope to enter the sea near Dede Agach. The Arda is the chief river of the Rhodope, as it rises in the central part of the range, and flows between the two lines of hills forming the eastern end, receiving many tributaries on either bank, and finally escapes through a narrow gorge to join the Maritza just above Adrianople town.

The Kizil Deli Chai, or "mad red river," is a large mountain stream which drains into the Maritza from the eastern side of the Khoja Yailo Dagh, and is a rushing torrent throughout its course, which quite justifies its name.

On the south are no streams of any size flowing into the Ægean


Sketch map of the
RHODOPE BALKANS
to illustrate the paper
by
LIEUT. COL. F. R. MAUNSELL, C.M.G., R.A.
ADRIANOPLE
PHILIPPOPOLIS
SALONICA
SERES
Drama
Xanthi
Gumuljina
Dede Agach
Thasos
Gulf of Rendina
Gulf of Xeros
Haskovo
Chirpan
Tatar Bazarjik
Samakov
Strumma
Maritza
Arda
Mesta
Demotika
Ortakeui
Batak
Nevrokop

from the coastal ranges of the Rhodope, the largest being the Yardimlu from the southern side of the Khoja Yaila, which traverses a wide cultivated plain east of Gumuljina, with meadow-land and patches of forest, on its way to the sea. At Xanthi a stream emerges just above the town from a rocky gorge, but it scarcely exists in summer, as its waters are used up for the town and the belt of gardens surrounding it, its shingly bed being dry.

Along the west side of the Rutodope is the wide basin of the Mesta, a large stream rising in the Rilo, and formed of many affluents from its foothills and the Piriu and Dospat ranges. It passes in a deep-cut valley through Razlog, and enters the little plain of Nevrokop, but soon resumes its character of a mountain torrent, forcing its way along a deep tortuous channel through a V-shaped valley between spurs from the Rhodope and some high ranges about Drama, towards the Ægean. At the little station of Buk, the Salonica-Constantinople railway crosses the river and follows its bank, traversing a small open basin at Buk, and then winding along a picturesque rock gorge through tunnels or in a cutting closely overhanging the water. It is only in the last few miles, when it has left the gorge and turned towards the sea, which it enters opposite Thasos, that the river is able to spread itself over a wide sandy delta and escapes from its mountain gorges. The Turkish name of the river is Kara Su, but as this is also applied to the Struma and many other streams, it seems best to retain the name Mesta, its former Greek name, which is also known to the Turks.

The general outline of the Rhodope presents no prominent peaks of striking grandeur rising above the general chaos of wooded or brown summits, but its chief beauty, especially in the centre and west, lies in its pine-clad summits and slopes, enclosing pleasant valleys, upland meadows watered by many rills, along which are villages of log-built houses, whose wooden roofs and general outline would remind one of the Tyrol, were it not for a certain irregularity of shape that must be oriental, and for the wooden tower of the minaret above the trees. These pasture lands along the slopes and the forests constitute its principal source of riches of the country, and form a pleasing contrast to the bare cultivated plains of the Maritza and the Ægean coast, which are scorched in summer and have few trees. There are no lakes at all in the Rhodope, and in this it loses somewhat in picturesqueness compared with the fine lakes of Okhrida and Prespa among the Albania mountains, or even with those of the Pirin Dagh close by, which has several beautiful lakelets on its summit plateaux. The Dospat Dugh, at the north-west end of the Rhodope, sends out a long spur into Bulgaria, which circles round over Batak, the principal village on that side of the frontier.

All these summits are thickly covered with pine forest, occasional open glades being available as pasturage, while the streams soon disappear in deep narrow gorges choked with forest, or bordered by crags overhanging the stream tumbling over the boulders below, the district being extremely wild and picturesque, with few habitations outside Batak itself. The spurs to the north terminate abruptly over the plain of the upper Maritza, and the streams as they emerge are used to irrigate the rice and maize fields of the lower levels.

On the Turkish side the chief centre is Dospat, a large village of some three hundred houses, close round which approach the dense pine forests, although these probably will disappear in a few years if the present reckless system of cutting is continued. The place is still, however, famous for its sawmills, picturesque wooden buildings along the borders of the stream, which winds along below the town and supplies the necessary water-power to work the primitive machinery. The

SUMMIT OF KARA BALKAN, SHABANITZA UPLANDS.

southern slopes overlooking the Mesta valley are almost bare of trees. The Central Rhodope is the most picturesque part of the range, and is known at its western end as the Chadir Kaya, and at the east as Shabanitza, forming part of the Kara Balkan, and running up to the Perilik peak. The frontier of Turkey at this point projects forward as a long triangular tongue which reaches to Tumrush, only six hours from Philipopolis, and from the hills round which the Maritza plain can easily be overlooked. This is the Rupchuz "kaza," or district, and has its centre of government at Dovlen, a scattered place of some three hundred wooden houses at the bottom of a deep valley.

The Krishim stream drains this district towards the Maritza, being made up of a large tributary from Trigrad, and another from the hills over Batak, which emerges just above Dovlen from a splendid gorge bordered with towering crags, and filled with a dark thicket of forest growth. If the track along the broad ridge of Shabanitza is followed, a succession of fine panoramas unfold themselves northward over Rupchuz, eastward over all the valley of the upper Arda, and westward towards the gorges of the Mesta and Nevrokop. Far away to the north in the shadowy haze is the long line of the main Balkan chain, with the Shipka pass and other historic features of the 1878 war. Below it is the fertile plain of the Maritza, with the corn and rice fields watered by the streams which struggle over the plain after leaving these hills. The middle distance is a tumbled mass of peaks, some bare and craggy, and some thickly forested, the black pine-clad peak of Persenk rising higher than the others; while many deep gorges trend down to join the Krishim stream, which can just be traced winding northward at the foot of a narrow V-shaped valley. Along the several heights can be traced the double line of huts and posts forming the frontier of Turkey and Bulgaria.

At our feet are dense masses of pine and beech forest, severed by open grassy uplands and glades, through which flow many small streams, which unite lower down to form the river of Trigrad. A glimpse of the wooden roofs and minarets of the village can be obtained, as well as its outlying farms and sheepfolds, which are occupied for the summer pasturage, and are dotted about the slopes in little clusters where the best grazing can be found. Just beyond Trigrad the stream enters a deep narrow gorge some 6 miles long, bordered by limestone crags and cliffs several hundred feet high, clothed with patches of beech and pine forest—a very striking bit of scenery in the middle distance. Winding along the slope near the top, and overlooking the gorge, is the narrow path which leads out of Trigrad towards the villages to the north. The more distant hills have almost lost their forests, and appear bare and brown; and the reckless way in which the trees are cut tends very rapidly to destroy their principal beauty.

Turning eastward, a splendid panorama of mountain scenery open out over the succession of wooded ridges and pleasant valleys down which flow the streams forming the headwaters of the Arda, and some of the roofs and minarets of Ardabashi ("the head of the Arda"), where are the principal springs which give rise to the stream, can be seen in the deep valley below. Farther north is the long line of the frontier ridge, with the valley of Bashmakli just below us, dotted with many small villages and mills along its stream. Immediately below us the slope of Shabanitza falls away very rapidly in a number of craggy spurs thickly clothed with beech and pine forest and a tangle of brushwood. About midway down open glades and meadowland appear, with the roofs of detached farms and sheepfolds, occupied in summer by people from villages out of sight in the deeper valleys beyond. Several sharply defined ridges, also well wooded, run out eastward as spurs, enclosing the many small valleys which trend down to the Arda. Water-meadows extend along the streams, little clusters of pretty wooden-roofed houses, and here and there a water-mill, easily recognizable by the long wooden trough or shoot which carries the water from the upper channel down to the rim of the wheel.

Beyond these, in the middle distance, the forests almost cease, and bare shaly spurs with patches of red and yellow earth dip steeply from the brown summit of the Maden Dagh towards the Arda, and enclose the district of Egridere, or the "crooked valley." In the far distance the frontier ridges can be traced above Kirjali, with the bare rocky mass of the Khoja Yaila which overlooks the mouth of the Maritza, and also of the Karlik Dagh along the edge of the coastal plain.

Looking southward towards the Ægean, a belt of shimmering haze indicates the sea, and the high mass of Thasos island stands out boldly, with a mass of minor ranges on the mainland near it. A high wooded ridge runs out as a spur towards Xanthi, and rises again to the Kushlar Dagh and other ranges which trend eastward. The narrow gorge of the Mesta can be traced by a dip in the hills, but the stream is not visible. The scenery of this slope differs greatly from the others, as the grassy uplands give way to sharp stony spurs, with a forest of Scotch fir on the upper levels, but only scattered stunted oaks and brushwood lower down. Here the streams tumble over rocks and boulders or thread through narrow rifts and gorges on their hurried

CENTRAL RHODOPE UPLANDS NEAR TRIGRAD.

way towards the Mesta. Paths narrow and tortuous lead down these valleys, and are scarcely traceable among the stones except here and there. The stream is crossed by a picturesque stone bridge of one high pointed arch with a very narrow slippery roadway, and no side walls to prevent the unwary traveller from falling into the torrent below. These tracks trend towards the station of Buk, on the Salonica railway, which has become the principal trade centre for this district since the line was opened. Looking westward along the summit of

CENTRAL RHODOPE: TRIGRAD VALLEY.

the range is the Chadir Kaya plateau, once well wooded, but now with only some scattered patches of trees. Its undulating slopes have a few patches of rye and barley cultivated by men from the hamlets far down the valley, and many of the detached summits are crowned by huge granite boulders, while on the slopes are scattered pines stunted and gnarled by being lopped for firewood.

Beyond Chadir Kaya a magnificent distant view opens across the Mesta valley, the horizon being filled in by the long sharply defined range of the Pirin Dagh with its rugged forest-clad slopes, while away to the north is the Rilo Dagh and Musalla peak, the highest summit in this country, just touched in October with the first snow. The actual stream of the Mesta is still invisible in its deep narrow gorge, but in the Nevrokop a few reaches glimmer in the sun, and the white houses of Nevrokop show up in a belt of gardens against the hills on the far side of the plain.

The population of the Rhodope is almost entirely Moslem, the Eastern Rhodope exclusively so, except for a few Christian Bulgarian villages in the Bashmakli valley, while the long tongue of Turkish territory forming the Rupchuz district is also all Moslem; indeed, at one time it formed part of Bulgaria, but owing to the strenuous resistance of its inhabitants to Christian rule, the frontier was readjusted and the country restored to Turkey. On the Bulgarian side of the frontier, with the exception of a few scattered Moslem villages, the inhabitants are Christians. The most interesting section of the population are the

Pomaks, or Moslem Bulgarians, people who became Moslem at the time of the Turkish conquest in the fourteenth century, and who form the principal part of the inhabitants of the Central Rhodope, and numbering some 100,000 throughout European Turkey, where they occupy districts along the Vardar as well as these hills. It is among the mountains that the people can best be studied, as in other districts in the Vardar valley they have become more merged in the general Moslem population. Here they inhabit all the Ahi Chelebi district, all the central range and the Rupchuz district, as well as the Dospat ridge to the west. In Ahi Chelebi there still remain some of the Pomak "derebeys," or feudal leaders, such as at Ismilan lives Salih Pasha, a celebrated hero of the 1878 war, who, when the Russians were moving past Philipopolis, raised an irregular corps from his retainers, and carried on a guerilla warfare against the Russian communications. Another of the same family is Hassan Pasha, who received me in quite the ancient style. His servants and retainers lined the avenue of approach to his house, picturesquely situated among meadows by a stream; he himself stood in the gateway to receive the guest, and his sons pressed round to wait. But, as in other parts of Turkey, independence among these "derebeys" is discouraged, few now remain with any power, and the ordinary civil government generally obtains. The Pomaks wear no distinctive dress, except that the women of particular districts in the mountains have special fashions in clothes, like in most of the

CENTRAL RHODOPE: VALLEY OF KRISHIM RIVER.

districts in Bulgaria over the frontier. Those of the Rupchuz generally dress in red, with a black cloak edged round with yellow braid, and a white kerchief on their head. Their language is a dialect of Bulgarian which they call Pomakje, or, better still, Airanje for choice, although the derivation of the latter term is rather obscure.

There are several dialects in the hills, and those in the Central Rhodope say they cannot understand the Bulgarian of those of Nevrokop, and so on. In the valley just below Bashmakli, on a tributary of the

CENTRAL RHODOPE: CHADIR KAYA RIDGE.

Arda, is a compact group of villages of Christian Bulgarians, comprising Raikovo, Chatak, Vlahova, and others, a very thriving settlement, interested in manufacturing woollen cloth of all kinds in small primitive mills worked by the water-power of their stream. It is woven in their homes on hand-looms from native wool, dyed various colours by natural dyes; it is then taken to mill, steeped in water, and submitted to a kind of hammering process which improves the texture, making it closer. The machinery of the mill is almost entirely of wooden beams; an overshot waterwheel supplies the power which drives a wood axle, projections on which make rise and fall, through a distance of about 18 inches, heavy beams fixed nearly vertically, and which hammer and press together the lengths of cloth placed in a wooden trough beneath them. The heavy throbbing sound of these hammers makes a strange noise as one passes up the valley to Raikovo and Bashmakli, and in the secluded valleys of the Central Rhodope. The Christians of Raikovo manage to turn out quite excellent tweed and woollen cloths of all kinds by these mills. Many of the inhabitants are tailors, who carry the goods to various towns on the Ægean coast, and even the Greek islands, and make up suits from it. Others of the inhabitants are builders and carpenters, who monopolize this kind of work in Gumuljuia, Xanthi, and other coastal towns, so that the little settlement gets on well.

The Moslem Pomaks in other parts of the district make their cloth in these mills, but only of the coarser kind for cloaks ("abbas"), which find a market in Constantinople. In the Dospat Dagh and the Central

Rhodope, and in the village of Dospat especially, are many small saw-mills, with primitive machinery worked by water-power for sawing logs into planks. The logs are only some 6 feet long and 2 feet diameter, and are cut into planks, which are transported on mules to the coast ports, caravans of these being frequently met with winding along the mountain tracks. A curious feature is the semi-nomad population of usually called Kutzo-Vlachs, locally known as "Karakachans," who spend the summer on these hills of the Central Rhodope, and winter in the plain country about the mouth of the Maritza and near Gumuljina. They are said to have come about one hundred years ago from the Southern Pindus, when they formed one of the tribes or parties during the great struggle of the famous Ali Pasha of Yanina against the Turks in the beginning of the last century; and when that old chieftain was being brought to bay in his fortress of Yanina, these people betrayed him and went over to the enemy. On a settlement being effected they found it impossible to remain, and had to fly to the Rhodope, where they remain in a kind of permanent exile ever since. They own large flocks of sheep, ponies, and cattle, speak Greek, and belong to the orthodox Church. They form parties or tribes of a combination of fifteen to twenty families under a recognized leader, and build themselves in summer a sort of log hut or wigwam out of boughs and branches, lengths of pine bark being used as a carpet on the floor. They number altogether about 5000 in Central Rhodope, and parties were met on their migration to the plain about the middle of October. Their dress is that of the Greek peasants. Other parties are found in the Kirjali district further east, where they can also obtain grazing. These mountains produce little for export, except it be some timber, wool, and cloth of local manufacture. The logs are either sawn in short lengths for mule transport, or are thrown into the Krishim stream, down which they drift until they reach the Philipopolis plain, where they are collected by men employed by Bulgarian contractors. The finest timber, in large logs 20 to 30 feet long and 20 inches or more in diameter, is obtained from the forests round the headwaters of the Mesta, and these are also thrown into the river to float down until opposite the Buk railway-station, where they are caught by grapnels as they pass and brought to bank.

The Scotch firs on the south slope of the central range are cut for railway sleepers, and floated down a stream to Buk also. The forests along the actual summit are of larch chiefly, and some beech with thick undergrowth, while lower down the Trigrad stream more oak and beech appear. On the Chadir Kaya are some thick low patches of dwarf juniper—some of the large juniper—birch, wild pear, and apple trees. There are some fine walnut trees in the lower valleys. Resin, or "katran," is boiled out from the pine wood in large pans, where it is burnt with charcoal, the resin running out of a hole at the bottom. Rye, oats, and barley are grown on the higher slopes, and maize in the lower valleys, while round Trigrad is a large production of potatoes (called "kompir" by the Pomaks), which form the principal food of these, and are also exported. The districts of Xanthi (Eskeje) and Drama on the coast plains are celebrated for the fine quality of cigarette tobacco produced, and it is also grown in the minor valleys on the southern slope of the Rhodope, but the quality of leaf deteriorates rapidly as higher levels are reached.

No minerals are actually worked, and the hills have never thoroughly been explored, although traces of gold and silver lead are said to exist near Trigrad, and also at Radibush on the southern slope is said to be copper or zinc. In the island of Thasos, in the Ægean, close by is one of the richest zinc-mines in the world, worked by a German company. The general formation of the summit range of the Central Rhodope is of granite, much disintegrated, leaving rounded slopes, with an occasional boulder showing; while on the lower spurs both to the north and south sandstone and limestone appear. Some big game is to be found, but is extremely difficult to dislodge from the dense forests, and an army of beaters has to be employed to drive them across the open glades. As each arrives armed with some ancient weapon of his own and determined to have his share in the sport too, uncertain and dangerous elements are introduced. Grey bears (*Ursus syriacus*) and the brown variety are to be found, also the red deer of Anatolia, but they are scarce and difficult to obtain. Wolves are numerous, and pig also. The badger, the fox, and the tree marten are also to be found, but the last named is becoming rare now, owing to the price obtained for its fur. Excellent trout-fishing is obtained in the upper Arda, the Trigrad, and other small streams at the higher elevations.

VALLEY NEAR BUK, SOUTHERN SLOPE OF KARA BALKAN.

Of minor animals may be remarked some huge black lizards with bright yellow spots, which appeared in some numbers after a heavy shower, and waddled about the path, their legs seeming too short to allow them to run. The zeptieh's story regarding them, which he repeated with solemn assurance, was that they had just then dropped from the clouds; in reality, the rain coming after a long spell of dry weather had apparently attracted them from their holes and hiding-places.

There is, I think, no trace of ancient remains of cities or settlements in this part of the Rhodope, but on the road from Trigrad over the pass leading south to the railway in the Mesta valley, known as the Meshatli Gedik, is the tradition, which seems general, of a great battle which took place over a thousand years ago, but the names of the combatants are now forgotten.

The country of the Eastern Rhodope is less picturesque than the central range which I have just described, as the forest has largely disappeared, the summits are bare or nearly so, and the slopes are so steep as to afford no room for the pleasant meadows and pasture-land of the higher ranges. As all the streams flow inwards towards the Arda, and this flows eastward to the Maritza at Adrianople, it follows that the country remains quite isolated and shut in by high ranges both north and south. Only a few minor streams drain into the Ægean, and no convenient valleys exist which would afford access from southern Bulgaria towards the Ægean, and thus that country has to find access to the southern sea by the railway along the Maritza valley to the port of Dede Agach.

The wall of coast ranges continues in spurs of the Central Rhodope to the Kushlar Dagh over Xanthi, which is apparently one mass of rock with only a few patches of vegetation, owing to deforesting

CENTRAL RHODOPE: GROUP OF POMAKS OF MIKHALOVO.

but one result is that most of the earth has washed down to the lower foothills, and on these are the most valuable fields for growing tobacco.

A very picturesque track winds up the valley north of the Xanthi, and soon enters the wooded country, crossing two high ridges among oak, ash, and beech forest, on its way Ahi Chelebi and Bashmakli, the seat of the kaimakam, or local governor. This is the best way to reach these districts from the railway, and affords comparatively easy access. Farther east, along the line of hills which appears as a continuous wall of grey rocks from the coast, is the prominent peak of the Karlik Dagh, which rises nearly sheer out of the plain, and is 6200 feet at the summit.

The road from Gumuljina, the local capital of all the Eastern Rhodope, passes over a wooded col at the east end of the Karlik Dagh after a long ascent, passing the ruins of an old stone castle which once barred this route, which is the principal way into the Arda basin from the south. Farther along, the mountains curve northwards to the Khoja Yaila mount, whose rocky summit forms the last principal outlier of the Rhodope to the east, overlooking the valley of the Maritza. Rugged spurs covered with oaks radiate in all directions from it, and run down towards the sea at Dede Agach, the whole of this part of the Eastern Rhodope forming a very wild and impracticable tract draining by the Kizil Deli stream into the Maritza.

The Arda is the great river of the Eastern Rhodope, rising, as we have seen, in the Kara Balkan at the springs of Ardabashi, flowing at first through pleasant meadows and past pine-clad slopes, and turning many primitive mills, until it reaches the end of the Maden Dagh, and there it enters a narrow difficult gorge with steep slopes of loose shale and rock, nearly bare, except for a few scattered trees and brushwood, and along which rough paths gain only a difficult foothold, until the basin of Kirjali is reached and the valley widens. Here the stream is usually rapid over a wide bed of shingle and stones, subject to violent freshets, which have several times carried away the wood trestle bridges by which the road crosses to Kirjali, the principal centre of the northern part of the district.

Just here two large tributaries join from the south, besides many small streams from the frontier hills. One is the Soghutlu, which rises in an intricate wooded district on the east slope of the Kushlar Dagh and enters Daridere, or the "narrow valley," a very appropriate name, as very steep slopes of shale and earth rise on either hand, and the habitations and strips of cultivation occupy a very narrow strip alongside the rushing stream. The Soghutlu sweeps round the bare mass of the Maden Dagh and enters the long valley of Mastanli, spreading out over a wide bed of shingle like the parent stream, but having a considerable extent of maize cultivation, orchards, and gardens dotted with homesteads now on either bank.

The other southern tributary is the Burgas Chai, which is formed from many streams of the Karlik Dagh and hills east of it, the slopes here being wooded along the summit, but bare lower down and enclosing very deep narrow valleys, the narrow strip of green orchards and cultivation, with an occasional small village, showing the course of the stream far down below. The stream rapidly increases and enters the district of Sultan Yeri, a very fertile area, the shingly bed of the stream being now bordered by trees and cultivation in a wide belt.

As it leaves the Kirjali basin the Arda enters a long winding gorge between wooded hills before it finally reaches Adrianople plain. The slopes are so narrow and steep that foothold is only obtainable for the merest tracks, and this district is very wild and impracticable. The frontier ridge, here known as the Besh Tepe, or Five Hill range, is densely wooded, and game abounds in it, but is, as usual, difficult to obtain without organizing a large drive.

AHI CHELEBI DISTRICT: VILLAGE NEAR BASHMAKLI.

On the steep slopes and spurs cultivation is generally in terraces, with some patches of woodland; maize and tobacco of inferior leaf being grown. There are no regular villages, but isolated houses or hamlets of stone with a roof of rough slates are dotted about in the most accessible places on the steep hillsides.

The most fertile part of the country lies in the wider parts of the valleys as they approach the Arda in the districts of Mastanli or Sultan Yeri, or the "Sultan's Place," so-called because of its fertility. Here the cultivation, trees, and orchards completely fill the valley, except for the wide strip of shingle of the stream-bed, and the mass of dense dark green foliage, relieved occasionally by the walls of a little white hamlet or a slender minaret towering over the trees, forms a pleasant contrast to bare steep border-slopes of the valley. The hamlets are very scattered up the valleys, and there are few villages of any size; but Kirjali, on the Arda, is the principal seat of government. The district exports very little surplus produce, except, perhaps, a little corn and maize and an excellent kind of apples for which its orchards are famous, and little from the outside world disturbs its peaceful valleys. One useful product is the very fine breed of mules obtained in this district, and which are disposed of at the annual fairs held at Gumuljina and other places in the hills, usually in the spring. The only part of this country which has thick forests is along the deep valley or gorge of the lower Arda on the Bulgarian side, where is a wooded district, with many scattered farms along the Besh Tepe Dagh. The population of the Eastern Rhodope is exclusively of Turkish origin, and few, if any, of the Pomaks, or Moslem Bulgarians, are to be found.

The Eastern Rhodope was settled by immigrants from Asia Minor at the time of the first Turkish invasion in the fourteenth century under Sultan Murad I., when Adrianople was their capital, and the Greek emperors still reigned in Constantinople. They retain many of the qualities of the hardy races of Anatolia, and are quiet and peaceable, cultivating their little terraces of rye or wheat along the hill slopes, or tending their maize-fields and orchards in the valleys. A general exodus of the men takes place in the early summer towards the plains of Adrianople or Gumuljina, to be employed as labourers to gather the harvest just ripening there, and when that is done they troop back to reap their own harvest, which is some weeks later at the higher elevations. There is no Christian population in the actual basin of the Arda, but in the hilly country extending down to the sea at Dede Agach are many villages of Bulgarians. In the coast towns and in Xanthi and Gumuljina are a considerable number of Greeks, generally engaged in shipping or in the trade of the coastal plain, but very few penetrate into the mountain districts.

The eastern slopes of the range overlooking the lower Maritza valley has a belt of fertile foothills, although the slopes are generally rough and steep, and covered with patches of sparse forest and brushwood. Ferejik, Sufli, and Demotika are small towns at the base of the hills along the railway. Sufli, or Sofali, contains four thousand inhabitants, mostly Greeks, and is surrounded by a wide belt of mulberry gardens, for the place joins with Adrianople as a silk-producing centre, while on the near slopes are extensive vineyards which produce a rough red wine. Demotika is a place of eight thousand inhabitants, mostly Moslems, very picturesquely situated at the mouth of the valley through which the Kizil Deli river emerges from the hills, and is built like an amphitheatre at the foot of a cliff, on the summit of which are the ruins of an old castle, probably of Byzantine origin, but chiefly famous as having been used in 1709 as a prison for Charles XII. of Sweden, who fled to Turkey after the battle of Poltawa, and was detained here about a year by Sultan Ahmed III. Another very pleasant little town at the foot of these hills is Ortakeui, connected with Adrianople by a good driving road, and used as a summer resort by the people of that place, while the hot sulphur baths at Ilije close by are also found beneficial.

The wooded spurs and foothills, which rise above the town to the east and over the gorge of the Arda as it emerges into the plain, form a very effective background to the little town built halfway up their sides, surrounded with mulberry gardens and orchards on the lower slopes, and with vineyards planted in the rich red earth of the higher levels. On the summit of a prominent conical hill a few miles west of the town are the ruins of an old castle of Hissarlik, just traceable, probably of Byzantine or even earlier origin, as the summit offers an ideal site for a watch-tower over all the country towards the Maritza,

THRESHING SCENE IN THE KARA BALKAN.

with the great plain of the Ergene river extending almost to the horizon. It guarded also the principal entrance into the Eastern Rhodope country from this side.

Through Ortakeui a good path now leads into Sultan Yeri and Kirjali, and is a picturesque road to follow, as the road, after ascending through the vineyards of Ortakeui, which cling to the steep slopes for some way above the town, follows for several miles the nearly level ridge of a spur which affords an extensive view for several miles over most of the Eastern Rhodope country. Along the ridge is a fair amount of cultivation and many small villages, generally a very scattered collection of small slate-roofed houses surrounded by a few trees.

To the south a succession of very fine panoramas unfold themselves. The principal object is the long stony ridge summit of the Khoja Yaila, which has abundant pasture land midway up its slopes, as the name "Father of Pasturages" would imply. In front is an extensive view over the many ridges which fill up the country along the Arda, apparently a tumbled mass of brown hills, although a closer approach affords a view into the fine valley of Sultan Yeri with its mass of dark green orchards; in the distance is the Maden Dagh, and beyond the higher summits of the Kara Balkan.

The view towards the north, over the Arda gorge into Bulgarian territory beyond, is over a mass of dark wooded hills, rising sharply to a line of comparatively low summits which form the frontier ranges. Here and in the district round Kirjali on some of the higher ridges, is some good pasturage in woodland glades between the forest like the Central Rhodope.

As regards minerals, these districts of the Eastern Rhodope have never been thoroughly explored for that purpose; but probably, from the name Maden Dagh, or Mine mountain, some old workings must have existed there—in fact, there are traditions to that effect—while in recent years it is known that there are several places where petroleum may be found in the southern spurs of the Khoja Yaila Dagh leading down towards Ferejik, but no workings have yet commenced. The winter climate of all the elevated districts is necessarily severe, and the snow remains from the end of November to the beginning of April as a rule, but in summer the hills are a pleasant refuge from the malaria and heat of the coast plains along the Ægean, although in some of the deep narrow valleys along the Arda considerable heat is felt too.

The whole district of the Rhodope Balkans, from the fact that it is naturally so shut in and without easy avenues of approach, remains a country quite apart, and it is subject to no disturbance to the even tenour of the life of its inhabitants, who are generally peaceable and supply some of the best soldiers that the Sultan has in his European battalions. Neither has it a history, either ancient or modern, as its mountains afford no passage from north to south, and it has always lain apart from the track of invading and conquering armies on their way towards Constantinople or along the Ægean, and its mountains have acted as a shelter to various races who have drifted aside from the general tide. Yet its pine forests, pleasant uplands, and meadows by its streams, with its little alpine villages of wooden chalets, have a picturesque charm rather rare among the wild mountain scenery of the rest of the peninsula, and would well repay the traveller a visit.

Before the paper, the PRESIDENT: Colonel Maunsell is an artillery officer, who twelve or fourteen years ago travelled in Kurdistan and gave us a valuable address, the more valuable owing to his excellent map. Some years afterwards he filled a consular position in Turkey in Asia for about two years, during which time he travelled extensively. He gave us a second address upon southern Kurdistan, also illustrated by a map based on his own surveys. He also contributed to our

Journal a paper upon the Mesopotamian petroleum fields. In 1901 he was appointed military attaché to the British Embassy at Constantinople, and, active as usual, and following out that fine motto of his regiment to go "Ubique, quo fas et gloria ducunt," he gave much attention to the less-known parts of the Balkan peninsula. I may mention, also, that there will shortly appear in our *Journal* a very valuable map of the greater part of Turkey in Asia, which has been furnished to us by Colonel Maunsell, by permission of the War Office, and which obtained for him the Gill Memorial in 1905. I now call upon Colonel Maunsell to read his paper.

After the paper, the PRESIDENT: We have with us to-night the Right Hon. James Bryce, who has come here from more exciting scenes to spend an hour in the calmer discussion of geography. Mr. Bryce is, as we all know, a world-wide traveller, and as he was in the Balkans last year, I feel sure you will be glad if he will open the discussion.

The Right Hon. JAMES BRYCE: I did not come here with the intention of saying anything, but to have the pleasure of listening to Colonel Maunsell's paper, which I have done with the greatest interest. I am sure he deserves our thanks for having given us a very lucid and detailed account of a region which, although not very far distant from us, has been up to now very little known to geographers. Indeed, it is remarkable, considering how much attention has been called to that region by political circumstances, that a country which is surrounded by civilization and which is environed by two railways, one on the south and the other on the north and east, should have remained so little known. Scarcely any travellers seem to have, during the last hundred years, penetrated into the recesses of those valleys which Colonel Maunsell's paper has dealt with. The region which he has so well described is to me almost entirely unknown—that is to say, I have seen most of it only from a distance in traversing the plains and crossing the ridges which lie to the south of it. The part of the Rhodope which I do know is a little further to the west, and what I should like to say, if it is of any interest to you, is with regard rather to that western region. Let me remark, however, that one part of the south-eastern Rhodope, the part which lies between Drama and Dedeugutch, or, speaking more strictly, between Xanthi and Drama, contains one of the most beautiful pieces of scenery I have ever seen. It is a valley something like 30 miles long, traversed by a river where the railroad has been run along the very edge of the stream. Mountains rise from 2000 to 3000 feet above the stream; they are in part richly wooded, and break in splendid crags down into an excessively narrow valley, along which there is no passage except the railway. The winding gorge, with these limestone crags towering above it, is wonderfully picturesque. Colonel Maunsell will, I think, agree with me there is hardly a more beautiful piece of railway scenery in Europe, or perhaps in America either, and it can be seen in perfect comfort in travelling along the line. The part which I know better is in the extreme north-west, and includes the peak of Musalla mountains, lying to the south and south-south-east of the town of Sumokov. That is the highest point of the Rhodope group, and higher than any part of the Balkan range proper, the range, that is to say, which runs along the north bank of the Maritza. It may be easier for those whose knowledge of ancient geography, acquired at school years ago, is perhaps still more exact than their familiarity with modern names, if I remind you that the Rhodope may be said shortly to lie between the valley of the Strymon or Struma on the west, and the valley of the Hebrus or Maritza on the east—that Hebrus which is famous in mythology as the stream on the banks of which Orpheus was killed by the Bacchants, and whose waters carried his head down to the Ægean sea, according to Milton's line—

"Down the swift Hebrus to the Lesbian shore."

The Hebrus on the east and Struma on the west include the whole of the group of Rhodope mountains, and I think I am right in saying there is no road and no pass over the mountains between those two points. There is a very rough road leading from Serres on the Turkish side, which passes by an easy ascent into western Bulgaria, and descends into Sofia past the town of Radomir. Colonel Maunsell has told us there are few historical references to (and few traces of ancient works) this region, either in ancient or modern records. The reason doubtless is that the country was too impassable to be a road for the passage of armies. The mountain group to the south-east of Sofia, due south of Samokov, is the most picturesque and most striking of any part of the Rhodope. The chain attains its maximum level in the peak of Musalla, whose height is something over 9000 feet. Immediately to the west of it there is a range of very bold and striking mountains, across which Prince Ferdinand, the ruler of Bulgaria, has lately begun to construct a very good carriage road, which crosses over a pass at a height of nearly 8000 feet. Here there is a group of exceedingly picturesque mountains, some of which approach 9000 feet, and which are composed of old crystalline rocks, granite, and gneiss. North and south of this granite nucleus there is a band of slate rocks. I visited it in the end of September, when, though there were small patches of snow left, the summer and autumn flowers had almost entirely disappeared, but I was able to find a few flowers and seeds still left, which enabled one to say that the mountain flora is, broadly speaking, similar to the flora of the highest Alps, and not altogether unlike the flora of the highest mountains of England and Scotland. One finds the same genera, and a few even of the same species, appearing. The monastery of Rilo, which is the most famous of all Bulgarian shrines, lies in a deep valley south of this mountain group. It is a place of pilgrimage which has been frequented for many centuries. It is a very large and striking building enclosing a church, some parts of which are very ancient. The valley, buried in the hills, is surrounded by the most beautiful woods of beech and oak. Higher up are pines, and higher still pastures and savage crags. A more beautiful and striking scene is hardly to be found in all Europe than the glen of Rilo; and if any of you should find yourselves at Sofia, I would strongly recommend you to spend three days in making an excursion to a place so full of historical interest, as well as of picturesque charm. It is a remarkable thing that this great mountain range is not a race boundary. The Bulgarian population exists on both the north and the south of it. You do not get the Greek-speaking population until you come much further south—in fact, pretty near to the coast. The Pomaks are an interesting people. I see Colonel Maunsell adopts the view, which has been generally received, that they are Bulgarians by race, who were long ago converted to Islam, but I believe some other views have been entertained. The Kutzo Vlachs are also a remarkable race. They speak a language very nearly the same as the Russian of Wallachia and Moldavia and Transylvania. They have been hitherto classed as adherents to the Orthodox Eastern (or, as we call it, Greek) Church, but of late years they have taken to assert an ecclesiastical independence for themselves, and have thereby incurred the hostility of the Greek population, whose armed bands now make frequent raids upon them. Much trouble has thereby arisen between the Government of Rumania and that of Greece. I have observed that this great mountain mass of Rhodope, difficult of passage as it is, has nevertheless not been a political boundary. Apparently when the Bulgarians, a Finnish race from the Volga, came into the country, which is now called by their name, in the eighth or ninth century, they met with comparatively little opposition, and soon spread themselves over both sides of the chain, till they got in some places to within 40 or 50 miles of Constantinople. It is a momentous feature in the present political situation that the Bulgarian population, being the same on both sides of the chain, is in close relationship each part with the other. The Bulgarians north of Rhodope sympathize with those who live south of it under the Turkish sceptre, and that is, of course, one of the causes that makes the existing situation full of peril, because the Bulgarians who enjoy freedom cannot but sympathize with their brethren who live to the south of the mountains under those deplorable conditions which are known to all of us. There is very little more that my limited knowledge enables me to say, except that the scenery of these western Rhodope mountains is exceedingly noble. Their highest summit is, I think, the loftiest summit in the whole Balkan peninsula, *i.e.* between the Adriatic and the Euxine, with the exception probably of Olympus, whose majestic peak very nearly touches 10,000 feet. There may, in northern Albania, be summits equally lofty—very few have been accurately measured—but with that exception Musalla probably overtops everything except Olympus.

Mr. Hogarth: I am afraid I have not much claim to make remarks upon the singularly interesting and careful paper which Colonel Maunsell has read. It is curious that it should supply almost the only detailed authority we have upon a group of mountains which is so accessible, and which a great many of us have seen more than once in travelling by train. I cannot, however, echo the famous remark of the Oxford don, "I know nothing about this subject, I have not even written a book about it," as I have, much against my will, dealt with these mountains in a general account of the country. The only thing I shall do to-night is to take measures to learn a little more, if Colonel Maunsell will answer one or two questions I should like to ask him. First of all, is it a fact that Dospat Dagh is a genuine native name? and is the name, Despóto Dagh, which the Greeks give the mountain, merely a corruption of that? The mountain may have been so called from the proximity of the great Rilo monastery. The other question I should like to ask is with regard to the Pomaks. As Mr. Bryce has said, there is an alternative view to that expressed by Colonel Maunsell, that they are Bulgarians by race. That view is that they are a remnant of the original Thracians driven up into the mountains. A good deal depends on the language they speak. But the types which Colonel Maunsell put upon the screen do not recall to my mind Bulgarian types, still less do they recall Turkish types or Greek types. That fact seems to me to lend some weight to the theory that these Pomaks are a remnant of a more or less aboriginal Thracian race driven up into the mountains by the Greek incursion from the south, and by the Bulgarian incursion from the north. It is very interesting to find these people in the Dere Bey stage. That is a stage through which most of Turkey has passed. I do not know whether Colonel Maunsell learnt anything as to the origin of the power which these Dere Beys exercised. In Asia Minor they generally seem to have had two sources of power. In certain cases it rested on a tribal basis, for it so happens that the heads of the two greatest Anatolian families were both Turkoman Beys. But in other cases they got their power by contracting to collect the taxes of a certain region. As time went on, their sense of their obligation in collecting the taxes very often ceased with the collection. I should like to know whether there is any evidence to show how these Dere Beys of the Rhodope came by their power—that is to say, whether they are comparatively modern, or are feudal chiefs dependent upon ancient family and tribal connections. As to the nomad people, I am afraid I do not know what the Kachan part of their name, Kara Kachan, means; but, judging by the place from which they are said to have come, they would seem to be the same as the "Karagounis" of the S. Pindus, who are not properly Kutzovlachs at all. The latter might, indeed, call themselves so now, but they speak a quite recognizable dialect of Greek, and not a Rouman dialect. They are a curious nomadic people whose time is entirely taken up in conveying goods for other people, and very often stealing them. They became well known to people who were about in Greece in 1897, as they were among those who fled most freely from the Turks to Athens. "Karagouni" means, in their language, "black cloak." I do not know whether Kara Kachan may have the same sense. I think Mr. Bryce was wrong about the Pindus summits. So far as I know, there is no summit in the Pindus which exceeds 8000 feet, if there are any which touch it. But I am perfectly certain that Rhodope is higher by a good thousand feet than Pindus. If Musalla is actually the highest peak, I do not know.

Mr. Bryce: Musalla is the highest.

Mr. Hogarth: The only other point on which I should like information is whether Colonel Maunsell asked any questions about religious survivals in the Rhodope; that is to say, whether there is any trace, if this is a Bulgarian population, of those curious dualistic faiths which seem to have flourished both in the plain immediately north of the Rhodope, and also further west about Philippopolis. In the latter district they were apparently due to Armenians imported from the upper Euphrates. But, at the same time, dualism seems to be too widely spread in Bulgaria to be due simply to immigrants.

Mr. Noel Buxton: I feel it rather difficult to keep the admirable rule of this Society that nothing must be said which has any reference to politics, because even Colonel Maunsell's paper, which has so strictly kept the rule, alludes to the habits of the people, and the habits of the people are hardly separable in this case from the peculiar governments which have led to those habits. Now, he spoke more than once of the denuded state of these mountains, and what has struck me very much is that you find on one side of the mountains under one Government the forest mostly gone, on the other side you find the forests carefully managed. You find, again, with regard to the housing of the people, that on the Bulgarian side, so far from some degree of civilized methods having made the villages less picturesque, the greater security that prevails there has made them much more picturesque. You find quite a different stamp of house. You find the tiles, for instance, better; you find the eaves wider; and, strangely enough, contrary to our usual experience, greater civilization makes things much more picturesque than before. Then there is rather a curious thing with regard to the fauna. A European who lives in the middle of Macedonia was telling me the other day that one curious result of the disturbances in that country was the great increase of big game. The farms having been inaccessible during recent summers, there has been a great increase, he told me, of red deer and also of bears. Colonel Maunsell was saying it was a difficult thing to organize these hunts. I took part myself in one very picturesque bear hunt in another range, and, as he said, it required a great army of beaters. The beaters were armed with old kerosene-tins, and certainly the noise they made was enough to move any beast. My host gave orders that if any beater had not set out for the forest by four o'clock in the morning, he should be flogged. I am not able to speak of any part of the Rhodope range except a little further east than Mr. Bryce spoke of—on the north of the range, on the Bulgarian side. I think the world will some day wonder why this country was not earlier discovered as a tourist country. Mr. Bryce spoke of the extreme beauty of some parts of the country on the other side. That on the north side has another beauty, and a very remarkable one. I am quite sure I have not seen autumn colours of such extraordinary vividness as they are there. The whole of the hillside is often made up of the most brilliant wild cherry, and again of the wild pear, and you have now and again a pear tree covered with a wild vine in different shades of blazing scarlet, and certainly the effect is very wonderful. Then you get the most extraordinary variety of country in that part of the world. There is a place where the Prince of Bulgaria established a summer villa, and I find I made a note that one of the views gave me an impression of a sort of magnified Hindhead, and a great deal of the country round about there reminded me strongly of the Haslemere district of Surrey, only on a grander scale. Then, again, you get Scotch scenery, and these extraordinary varieties not very far apart. At Cham Kuria there is a fish hatchery and an experimental farm, and a good many pines have been introduced. The Macedonian pine is extremely fine on the north side of the Rhodope, but on the south it has been very largely destroyed. That again brings you inevitably in touch with the Government of the country, because it was very largely destroyed in some of the districts only two years ago in order to make it impossible for refugees to hide on the mountain-side, and I remember that Prince Ferdinand appeared to be deeply moved by the loss of these forests of *Pinus Macedonica*, which is limited to a rather small area, and was destroyed in enormous quantities at that time. As to the people, I speak very much as an amateur, but I would like to throw out one piece of information which may possibly throw light on the difficult questions raised by Mr. Hogarth. It struck me as a very astonishing thing, when I first went among the Pomaks, to see the Mohammedan cast of countenance and their peculiar aggressive expression combined with blue eyes, but I did not see the same blue eyes among the Bulgarians proper, and I do not know whether that indicates any sort of difference such as Mr. Hogarth seems to lean to. The Pomaks are very remarkable, because they appear to me to be on the north side a great deal more prosperous than those in Turkey. They also seem to me to have a more jovial nature than the Christian Bulgarians, and I do not know that that is likely to be introduced by their religion. It occurred to me that they are of a different stamp from the Christian Bulgarians. I do not wish to take up more time, but I cannot help saying that I think this part of the world has been marvellously neglected as a country for travel. You have a country where practically you may be quite certain you will not meet another tourist, and you have a country of great natural beauty within two or three days' journey of London. You get right away from the railway in three days, and in the very limits of an ordinary holiday you can get a full month in an extremely interesting and unknown part of the world. You can get valleys undefiled by the motor, and mountains unvulgarized by the modern hotel.

The PRESIDENT: I rise to propose a vote of thanks to Colonel Maunsell. I have no doubt you will join in the vote very heartily.

Colonel MAUNSELL: As regards the height of the various ranges, the Rilo Dagh is undoubtedly the highest mountain, and the Musalla peak at its south-eastern end its loftiest summit. I think Mount Olympus rises to nearly 10,000 feet, and some of the northern Albanian mountains reach to about 9000 feet; but they have never been thoroughly explored or measured. The name of Dospat Dagh comes, apparently, from the village, and there is no trace of a monastery near by, while the village is Mohammedan. As regards the origin of the Pomaks, I am afraid I cannot agree that they are separate from the Bulgarian race. So far as I could see, comparing them with the Christian Bulgarians in the same valley, the type looked precisely the same, and I think one may say that they are the same race. As regards the "Derebeys," I do not think there ever was any tribal organization in that country; no trace exists now, and I do not think they derive that power from tribal power. Probably the country was divided into natural valleys, and each valley had a leader of its own, as the name "Derebey," which means "lord of the valley," suggests. There may have been tax-farmers in later days, but I think they are simply the biggest men in the valley. As regards the name Kara Kachan, I asked the Turks what was the derivation, and they told me that Kara Kachan meant really "Kir Kachan," or people who have fled into the mountains. They were regarded as traitors in Albania, and fled to the mountains, hence the name "the flyers into the open," which has now become corrupted into Kara Kachan. In origin I should think they are southern Albanians who became detached after the death of Ali Pasha owing to their treachery, and they are wrongly called Kutzo Vlachs. As regards old religious survivals or rites, I could not trace anything such as can be found among the Kizilbash of Asia Minor, who are Moslems outwardly, but practising in secret many ancient ceremonies derived from paganism.

RECENT CHANGE OF LEVEL IN ALASKA.*

By RALPH S. TARR and LAWRENCE MARTIN.

WHILE it is well known that mountains are formed by uplift, involving folding and faulting, and while evidences of past movement are numerous, and uplifts have been actually observed, it is rare that the evidence of the growth of mountains is capable of clear demonstration upon the basis of observation. It is from this standpoint, as well as from the standpoint of the remarkable changes recorded below, that this article is believed to present points of interest to the geographer as well as to the geologist. In this Alaskan instance the formation of one of the grandest features of the Earth is seen to be in progress to-day—a geographical development under our very eyes.

The Mount St. Elias chain extends along the boundary-line between Canada and Alaska, rearing its snow-clad peaks to elevations of 10,000 to 15,000 feet, and culminating in Mount St. Elias (18,024 feet) on the International boundary, and Mount Logan (19,539 feet) in Canada, the second and third highest peaks on the North American continent. This mountain range, like others in Western America, is young, and, as was shown by Prof. I. C. Russell, bears distinct evidence of recent growth and uplift. Its peaks are high and rugged; the mountain spurs show an alignment suggestive of fault origin; and some of the individual mountains, including Mount St. Elias, have the appearance of tilted fault-blocks. From the higher mountain peaks and mountain valleys great glaciers descend, some of them reaching the sea. Several of the

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* The observations recorded in this paper were made in the summer of 1905, in connection with a general geological survey of the Yakutat bay region by a U.S. Geological Survey party under the direction of the senior author. A grant of money from the American Geographical Society made it possible to add the junior author to the party as special assistant in glacial geology and physiography. Acknowledgments are due to B. S. Butler, the other member of the scientific corps, for assistance in this work. A more detailed statement of our observations on this change of level will appear in vol. 17 of the *Bulletin of the Geological Society of America*, and our complete final report in a Professional Paper of the United States Geological Survey.

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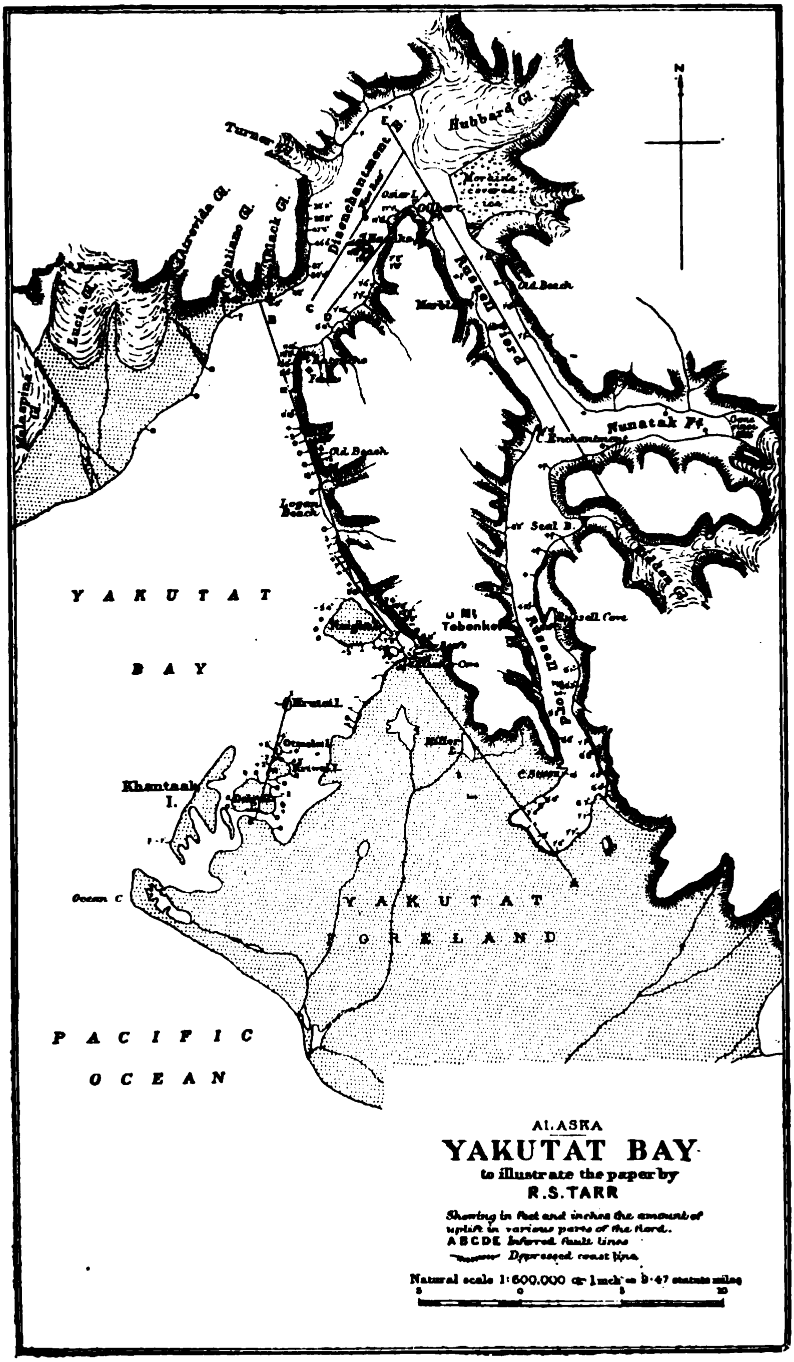

N
Hubbard Gl.
Turner Gl.
Disenchantment
Atrevida Gl.
Galiano Gl.
Black Gl.
Lucia Gl.
Malaspina Gl.
Old Beach
Nunatak Fd.
C. Enchantment
Seal B.
Logan Beach
Mt. Tebenkof
Russell Cove
Russell Fiord
Khantaak I.
Ocean C
YAKUTAT BAY
YAKUTAT FORELAND
PACIFIC OCEAN
ALASKA
YAKUTAT BAY
to illustrate the paper by
R.S.TARR
Showing in feet and inches the amount of uplift in various parts of the fiord.
ABCDE Inferred fault lines
Depressed coast line

FIG. 1.

largest of these glaciers coalesce near the base of Mount St. Elias to form the great Piedmont ice-plateau to which the name Malaspina glacier is given. At an earlier period of greater ice expansion other large glaciers coalesced at the mountain base south-east of the Malaspina glacier, and by their moraines and outwash gravel deposits built up an extensive coastal plain, or foreland, which now fringes the mountain base (Fig. 1).

The straight mountain front and its fringing foreland have given to this part of the Alaskan coast a remarkably smooth outline, quite in contrast to the fiorded coast-line both to the south-east and north-west. This straight stretch of coast, which extends for a distance of

FIG. 2.—WAVE-CUT BENCH, 18 FEET ABOVE PRESENT HIGH TIDE, ON DISENCHANTMENT BAY, NEAR HAENKE ISLAND. BARNACLES AND MUSSELS OCCUR IN PLACES ON THIS BENCH AMID THE SCATTERED ANNUAL PLANTS AND YOUNG BUSHES. THE OLDER GROWTH OF ALDERS IS SEEN IN THE UPPER RIGHT-HAND CORNER.

about 300 miles, is broken by only one inlet of notable size. At its mouth, where it is broad and V-shaped, this inlet is called Yakutat bay. Here it is bordered on the eastern side for half its length by the low foreland, and on the western side by the Malaspina glacier and its fringe of outwash deposits. Narrowing toward the head of the bay, the inlet penetrates the St. Elias chain, then turns abruptly back toward the ocean, reaching beyond the mountain front at its head, and terminating in the low foreland. The entire inlet has the form of a bent arm, with the shoulder at the ocean and the fist at its head. Where the inlet enters the mountains the name is changed to Disenchantment bay up to the bend, and beyond this it is called Russell fiord (Fig. 1). The mountain-walled portion of the inlet is a true fiord with mountains rising abruptly from 3000 to 5000 feet, and at the elbow to elevations of 10,000 to 16,000 feet. The total length of the Yakutat bay inlet from the sea to the head of Russell fiord is from 70 to 75 miles.

The geological formations differ from place to place. Both the mouth of the inlet and its head beyond the mountain front are bordered by recent deposits of glacial origin. The mountains which the inlet cuts are mostly made of a very complexly folded and faulted system of shales, volcanic tuff, and other rocks of undetermined age, to which the name Yakutat Series has been applied. Crystalline rocks, also of undetermined age, form the core of the Mount St. Elias range, and border the northern shore of the north-western arm of Russell fiord, the two series being separated by a fault-line (Fig. 1).

In the summer of 1905 our United States Geological Survey party spent somewhat more than two months in this inlet studying the general geology and physical geography of the region. Our studies extended along a coast of about 150 miles in extent, on which there was clear evidence of a recent and remarkable change of level. This evidence is of three classes—physiographic, biological, and human testimony.

The most pronounced physiographical evidence of change of level is that presented by well-defined rock benches and associated sea-

FIG. 3.—ELEVATED BENCH, 35 FEET ABOVE PRESENT HIGH TIDE, NORTH OF POINT FUNSTON.

FIG. 4.—BARNACLES CLINGING TO SLATE ROCK (NEAR KNIFE AND CARTRIDGES), 7 FEET ABOVE PRESENT HIGH TIDE. YOUNG ALDERS HAVE THEIR ROOTS IN CREVICES AT SAME ELEVATION. PHOTOGRAPH TAKEN OPPOSITE MARBLE POINT.

caves and chasms elevated well above the level of the present reach of the highest waves. So pronounced are these uplifted strands that it was possible to photograph them at numerous points (Fig. 2), and in places they furnished excellent highways for travel along the coast at points where the steeply rising shore presented no foothold at the present wave-line. The strength of development of the benches cut in the rock and of the connecting beaches (Fig. 3) proves conclusively that the land had remained at the lower level for some time before the uplift. Wave-work in the narrow fiord is not at present very rapid, but the effect of iceberg waves during a period of recent ice advance, of which there is abundant evidence, no doubt in part accounts for the strength of development of the uplifted beaches and wave-cut benches.

Associated with the elevated beaches are numerous uplifted alluvial fans into which the streams have now cut small gorges, and on the front of which the fiord waves have cut low cliffs. Besides these physiographic evidences of change of level, new reefs have appeared at two points in the inlet (Fig. 1).

The biological evidence of uplift is striking. All around those parts of the inlet where the land has been raised, remains of marine animals are abundant up to the level of the elevated strand. Most of these forms of life are loose, and by themselves might not be

FIG. 5.—BRYOZOAN REMAINS (WHITE) ON THE ELEVATED STRAND. ALONG THE CREVICES OF THE ROCK MUSSEL SHELLS ARE CLINGING, AND YOUNG ALDER BUSHES HAVE TAKEN ROOT AMONG THEM. PHOTOGRAPH TAKEN ON COAST NORTH OF POINT FUNSTON.

FIG. 6.—DEPRESSED COAST ON THE SOUTHERN SHORE OF KNIGHT ISLAND, SHOWING ENCROACHMENT OF BEACH IN THE FOREST.

considered proof of recent change of level; but several species were commonly found in place. Of these the most abundant were the barnacles (*Ballanus cariosus* and *Ballanus porcatus*), which were found throughout the fiord, clinging to the uplifted ledges and benches where they grew (Fig. 4). Shells of the common mussel (*Mytilus edulis*) were also found on the abandoned strands, and in such abundance as to present the appearance of patches of blue flowers when viewed from a short distance. Most commonly these shells were unattached, but at numerous points they were found still adhering by their byssus to the ledges (Fig. 5). A bryozoan, which grows below low-tide line, was also found clinging to the rocks well above the reach of the present waves, forming a whitened coating, which gave to the rock-surface a whitewashed appearance when viewed from a distance (Fig. 5). Still another evidence of uplift was presented by the parallel lines of drift-wood, one line at present high-water mark, another at the crest of the abandoned strand.

While uplift is recorded throughout most of the inlet, there is clear evidence of depression in some sections, notably on the foreland just outside the mountain front (Fig. 1). This evidence is less complex than that of the uplift, but is no less convincing. It consists of the presence of salt water in the forest which borders portions of the depressed coast-line, and into which sand and beach gravel are now being thrown by the waves (Fig. 6). Where the waves have reached most effectively the trees have been killed and often thrown down; but back of this is a zone in which the destruction of the land plants has not yet been completed.

One of the most important features connected with these changes of level is the clear evidence of their recency. As has just been stated, the depression is so recent that destruction of those trees which only the highest waves reach is not yet complete. Where the change of level is one of uplift there are numerous evidences of its recency. Along the present wave-zone the work of the waves has not only been unable to cut a new bench, even in the weaker rocks, but in places where the rocks are fairly resistant fresh glacial grooves, striæ, and polishing still remain in the zone of wave attack. Furthermore, in a number of places the uplift has brought till deposits into the wave zone, and the erosion has not yet succeeded in removing the clay and concentrating the pebbles. In consequence of this we have the anomaly of a clay shore against which the waves are breaking, giving rise to a strip of muddy water along the coast. That the uplift is of recent date is also proved by the fact that marine animals still cling to the rock on which they were adhering during their life. Even the byssus of the mussel is still preserved, and in many places the organic tissue of the barnacles causes their valves to remain in position.

Even more striking than this evidence is the barrenness of the

FIG. 7.—WAVE-SWEPT AREA, SHOWING DEVASTATION CAUSED BY EARTHQUAKE WATER-WAVE UP TO LEVEL OF 40 FEET. COAST NORTH OF LOGAN BEACH.

FIG. 8.—SOME OF THE PARALLEL MINOR FAULT-LINES ON GANNETT NUNATAK.

elevated zone (Figs. 2 and 3). While mature willow and alder bushes grow above the abandoned strand, the elevated beaches and benches support only scattered annual plants and occasional young alders and willows (Figs. 4 and 5). Many of these bushes were cut down and the rings of annual growth counted; but in no case was one found on the raised shore-line with more than five rings, while most of them had but three or four. This fact points quite clearly to the season of 1899 as the time of uplift.

Bearing upon this point of the exact period of change of level is the human testimony. In the first place, Prof. I. C. Russell spent some time in this fiord in 1890 and 1891, and he reports no change of level. Dr. G. K. Gilbert spent several days in the Yakutat bay inlet in June, 1899, landing at several points in the fiord; in one place on a coast where the uplift amounts to 18 feet. Moreover, the ship in which he travelled sailed twice close by one of the new uncharted reefs, which could hardly have escaped the attention of sailors. Both Prof. Russell and Dr. Gilbert have made a special study of abandoned shore-lines, and it is inconceivable that these geographers could have failed to observe the uplift if it had existed during their visit. A photograph taken by a United States Fish Commission expedition in July, 1901, shows clearly the presence at that time of an uplifted bench at one point (Haenke island) in the inlet.

The testimony of natives is definite as to the time of occurrence of the change of level. Every spring they spend two months or more in the inlet hunting the hair seal, so that they are familiar with the region in detail. They assert positively that the uplift occurred in September, 1899, during a series of earthquake shocks which lasted for seventeen days.

Of the occurrence of this earthquake there is unquestioned proof. Entirely aside from the testimony of the natives, there were three prospectors encamped on the shores of the inlet during the heaviest of the shocks; and at the village of Yakutat, at the mouth of the bay, there are a number of white men whose account tallies with that of the natives and of the prospectors. The shocks began on September 3 and ceased on the 20th, reaching greatest intensity September 10 and 15. On September 10, between 9.20 a.m. and 3 p.m., there were fifty-two notable shocks, culminating in one of great violence. The prospectors report a great water-wave in the fiord during the most vigorous shocks; and the inhabitants of Yakutat, 15 or 20 miles away from the centre of greatest disturbance, were so alarmed by the shaking that they abandoned their houses and retreated to tents on the neighbouring hills.

Signs of the earthquake are still visible at various points in the inlet. In the first place, the mountain slopes are scarred with great avalanches, far more numerous than in other fiords on the Alaskan coast. In the second place, there are wave-swept areas (Fig. 7), in two sections reaching to an elevation of 40 feet above sea-level, throughout which the forest is completely destroyed. Here trees are overturned, twisted, broken, and uprooted, giving rise to such a scene of devastation as only rushing water could produce.

In this sparsely settled region it is natural that the extent of the earthquake should not be exactly known. That it was not confined to this limited area is probable; and in this connection it is noteworthy that in September, 1899, an earthquake of great violence occurred in Glacier bay, 135 miles from Yakutat bay. This earthquake was so

FIG. 9.—ONE OF THE MINOR FAULT SCARPS ON GANNETT NUNATAK.

violent that it shattered the front of the Muir glacier to such an extent that for several years the tourist steamer was not able to penetrate the bay to the Muir glacier. In all probability the uplift which accompanied this shock affected the entire region between Yakutat and Glacier bays, and doubtless for a considerable distance beyond this area. As yet, however, no evidence of change of level has been reported outside of Yakutat bay.

In connection with our other studies, we made measurements of the amount of change of level at various points along the 150 miles of coast-line which we visited, making in all over one hundred careful measurements, besides numerous observations for checking these. The numerical results of these observations are plotted on the accompanying map (Fig. 1). From this map it will be seen that the amount of uplift varies greatly from place to place. One of the most noteworthy features on the map is that there is a zone just outside the mountain front, on one side of which there is uplift, and on the other side, in general, either no change of level or else a depression. This is true at the head of the inlet and on both shores of Yakutat bay. From this and other facts it is inferred that a fault-line extends here as indicated by the line A. The very variable amount of change of level along this line is believed to be the result of a drag along the fault. It should be stated that the straight mountain front which rises above the foreland close by this inferred fault was interpreted by Russell as a fault scarp in 1890 on the basis of its form alone. We reached the same conclusion when we first saw this mountain front, and before we knew of the recent change of level.

The complex condition of change of level in the archipelago of islands north of Yakutat Cannery and Mission may in part be due to a shaking of the gravels of which these islands are made; but this would not account for the uplifted sections. We have, therefore, inferred a minor fault along the axis of these islands; but the evidence of this fault-line is less definite than that of the others.

On the basis of its form, Prof. Russell also classed the straight mountain front along the eastern shore of Yakutat bay as a fault scarp; and here again our evidence tends to verify his interpretation. The evidence of faulting along this line, which we have indicated by the letter B, is of several kinds. In the first place, the straight, steep, truncated mountain spurs are suggestive of fault origin. In the second place, there is an unusual abundance of avalanches along this mountain front. In the third place, the change of level along this line varies greatly, as would be expected along a line of faulting with updragging of the strata on the downthrow side. In the fourth place, at one point (marked Old Beach) there is a still earlier uplifted strand on which a mature forest is now growing, with trees over seventy-five years old, proving a former period of uplift.

Along the shores of Disenchantment bay there are great differences in the amount of uplift. Throughout the greater part of the eastern shore the uplift is between 7 and 9 feet. On Haenke island and on the peninsula just north-east of it, the uplift ranges from 17 feet to 19 feet 3 inches. On the western shore of Disenchantment bay the uplift varies from 33 feet 11 inches to 47 feet 4 inches, the latter being the greatest change of level in the inlet, and, in fact, the greatest uplift ever recorded as having occurred at a single period of time. To account for the difference in level of the upraised strand in Disenchantment bay, we have inferred two fault-lines (C and D), as indicated on the map.

Along the north-west arm of Russell fiord the south-west shore shows very slight uplift, while the north-east shore is raised from

7 feet 6 inches to 9 feet. Moreover, along the north-east shore there is an older beach covered by a growth of mature alders. This shore of the fiord is made of crystalline rocks, while the younger Yakutat series forms the south-west shore. Geological evidence proves the presence of a fault-line between the Nunatak fiord and the valley of Hidden glacier, which, extended, would pass along the axis of the north-west arm of Russell fiord, where, from the evidence of the upraised shore-lines, we have inferred fault E.

From the region of slight uplift in lower Russell fiord there is a gradual rise of the abandoned strand toward the mountain front, where it reaches a maximum of 9 to 10 feet.

In inferring our fault-lines we have endeavoured to be conservative, and to postulate no more than the evidence definitely calls for. Our studies, however, prove conclusively that there was pronounced dislocation in other parts of the region. At several points we found small recent faults. These were best shown on the Gannett Nunatak, at the head of Nunatak fiord, and a description of these may serve for the rest. This nunatak is a glaciated rock hill rising about 1450 feet above the fiord, and composed of steeply dipping gneisses and schists, striking approximately parallel to the major axis of the St. Elias chain—that is, north-westward. In its southern half it is crossed by scores of small faults extending from a few feet to over 100 yards, and with throws varying from an inch to 3 feet, but usually of less than a foot (Figs. 8 and 9). They generally extend along the strike of the rock, but in some instances diverge from it, and a few short faults strike at right angles to the main series. The hade is nearly vertical, and in almost all cases the south-western side of the fault is the upthrow side. There are also some fissures, and a few instances of small graben blocks (from 3 to 30 feet wide) between parallel faults.

While it cannot be demonstrated that these minor faults were formed at the same period as the uplifted strands, this inference is nevertheless apparently warranted, for the faults are evidently very recent, and no other notable earthquakes have recently occurred here. The fault scarps are steep, and in many instances have striæ extending up to their very edges. Their recency is proved by the sharp angle formed where the fault-plane intersects the surface, and by the absence of notable talus slopes at the base of most of the tiny fault-scarps, even though the rocks are friable, thin-bedded schists. It seems incredible that these fault-scarps can have been exposed to the sharp frost-action of this climate longer than six years.

From our observations we draw the conclusion that this part of the St. Elias chain is still actively growing, and that this growth is being accomplished by movements along a series of fault-lines by which several mountain blocks are being differentially uplifted, as first suggested by Prof. Russell. At least one period of earlier uplift is demonstrated by the presence of the older forest-covered beaches; but a much more notable mountain growth occurred in September, 1899. This uplift involved the entire mountain region inside of the Yakutat foreland as far as the bay reaches, and to an unknown distance beyond. It consisted of a general uplift along the mountain front, and of a differential uplift along several secondary lines of faulting: in other words, the mountains are tilted in a series of fault blocks. In addition to these major lines of faulting there was a minor fracturing, apparently due to local adjustments in the tilted blocks.

This recent change of level is noteworthy from three standpoints: Its age can be definitely determined; it is the greatest uplift so far recorded as having occurred at a given time; it contains a lesson of importance as to the mode of formation of mountains, representing as it does a step in the development of the loftiest range on the American continent.

ADDENDUM.—The San Francisco Earthquake of April 18.

Since this article was written, and just as it is being made ready for mailing (April 19), news comes of the terribly destructive earthquake which has caused such devastation in California. While as yet the meagre dispatches give us little information of scientific value regarding this most recent of vigorous earthquakes, enough is known, both from the past history of California and from the newspaper accounts of the present shock, to make it certain that the conditions described above are distinctly applicable to the San Francisco earthquake. American geologists have long been familiar with the fact that the Coast Ranges of California, like the mountains of Alaska, are still in the process of evolution. The frequent earthquakes which have been felt in California, numbering from one to three score a year, are proof of this. Geological study demonstrates that the rocks of the Coast Ranges are crossed by many fault-lines; and physiographic investigations have shown that recent earth-movements have upraised parts of the Californian coast and depressed others, including the bay of San Francisco, which is the drowned mouth of the Sacramento river, into which the sea has been admitted by local subsidence.

Where the fault-lines along which the slipping occurred to cause the San Francisco earthquake are located, whether there is but one line of slipping or several—as in Yakutat bay—and whether the movements have produced visible signs of uplift or depression, as in Alaska, are questions which future investigation must answer. It seems evident, however, that the shock is the result of a normal process of mountain-building here as in Alaska. The strains to which the mountain rocks are subjected have locally become too great, and relief has been gained by a slipping of the rocks over one another —probably on one or more planes of older faulting, along which previous movements have occurred. San Francisco is situated on a danger-line in the Earth's crust, and it will remain in danger so long as the growth of the Coast Ranges continues. Many years may elapse before the strain again reaches the condition necessitating vigorous movement and consequent destructive earth-shaking. It is to be hoped that the interval will be a long one in this place, where other geographical conditions have determined that a large city must develop.

THE SNOW-PEAKS OF RUWENZORI.

Their Probable Positions and Heights.

By Lieut. T. T. BEHRENS, R.E.

In the following note an attempt has been made to combine the available data from all sources, and to obtain the best and most probable positions and heights for the main snow-peaks of Ruwenzori. It is a pity that in cases of this kind, where each traveller's observations are necessarily insufficient to give a definite result, few give their observations in published form in such a manner that others who come after them can combine them with their own work. The mere publication of a map is, of course, of no use to the cartographer unless he knows on what kind of observations the positions of the points depend.

I say that a single traveller's observations were "necessarily insufficient;" and when I say that, though in a neighbourhood for nine months from which, on most days, Ruwenzori might have been visible from my tent, I only saw it seven times, and then only for a few moments just after sunrise, the difficulty of observing the mountain will be apparent. So fleeting were the chances of observing, between the time when it was light enough to see and when the clouds covered the peaks in rising mist, that I only once had time to sketch the range, and once again to observe all the five peaks visible. On the other five occasions there was only time to observe the two highest points, while many a time, when the instrument had been placed in position and the telescope directed to the mountain, it was only to see the first cloud covering the coveted pinnacles. And all this, in spite of a daily watch being kept at dawn to apprise me of even the possibility of seeing the mountain.

In the present instance the data available are the following, in the order of accuracy:—

1. Two tops of a summit fixed trigonometrically.
2. Trigonometrical rays to four other summits.
3. Eight perspective views from sketches or photographs, with some magnetic bearings and variation of the compass determinations.
4. A map compiled from all available sources up to 1901, chiefly

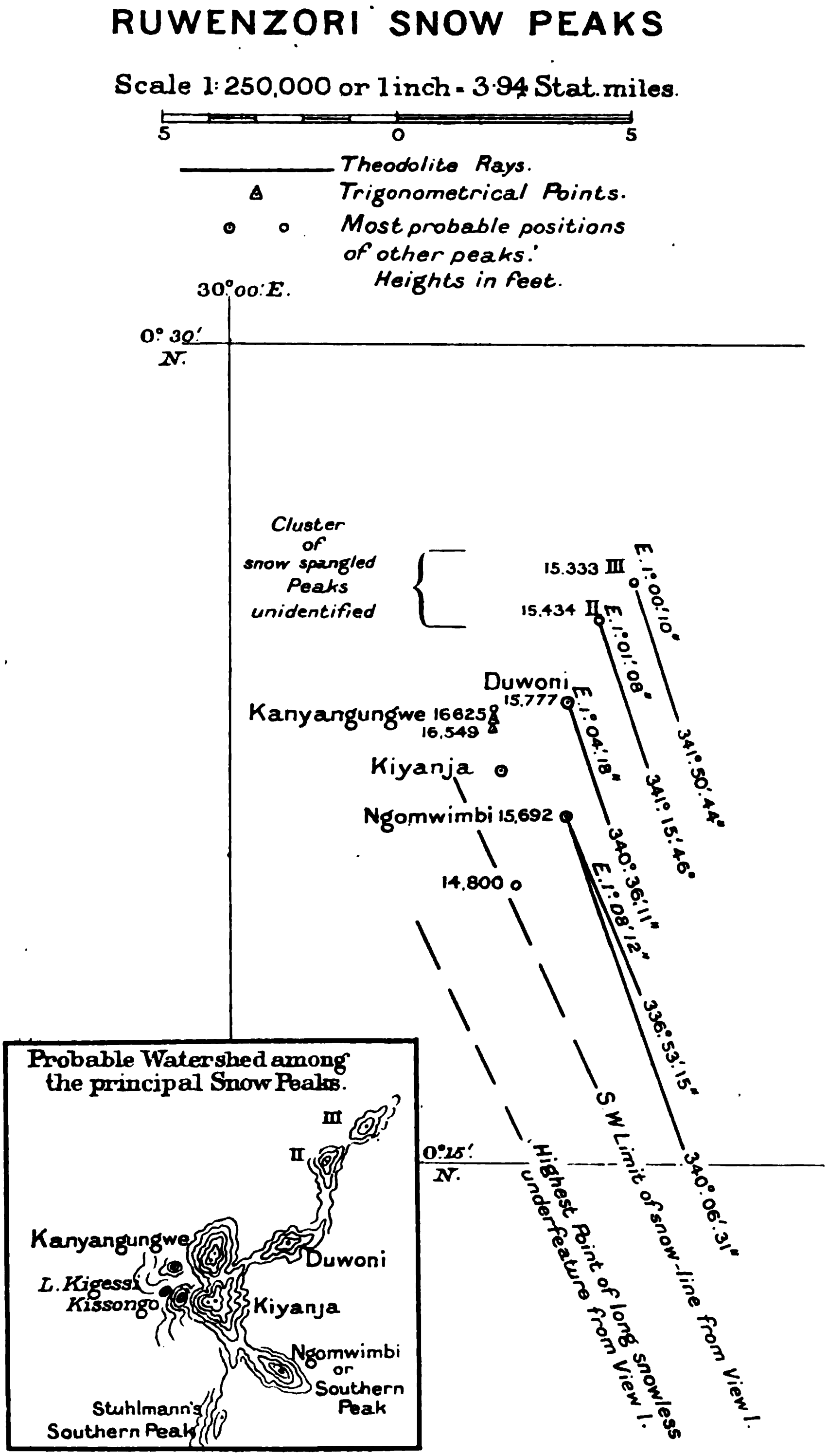

RUWENZORI SNOW PEAKS
Scale 1: 250,000 or 1 inch = 3·94 Stat. miles.
5
0
5
Theodolite Rays.
Trigonometrical Points.
Most probable positions of other peaks.'
Heights in feet.
30°00' E.
0° 30' N.
Cluster of snow spangled Peaks unidentified
15.333 III
15.434 II
E. 1° 00' 10"
E. 1° 01' 08"
Duwoni 15.777
E. 1° 04' 18"
Kanyangungwe 16625
16.549
Kiyanja
Ngomwimbi 15.692
14.800
341° 50' 44"
341° 15' 46"
340° 36' 11"
E. 1° 08' 12"
336° 53' 15"
340° 06' 31"
0° 15' N.
S.W. Limit of snow-line from View I.
Highest Point of long snowless underfeature from View I.
Probable Watershed among the principal Snow Peaks.
III
II
Kanyangungwe
Duwoni
L. Kigessi
Kissongo
Kiyanja
Ngomwimbi or Southern Peak
Stuhlmann's Southern Peak

FIG. I.

based on Dr. Stuhlmann's route traverses and astronomical observations.

5. Information received this week from Mr. A. F. R. Wollaston, and kindly put at my disposal by Mr. Douglas Freshfield, which materially helped in arriving at a conjecture of the probable shape of the watershed between the peaks. Mr. Wollaston had been up Duwoni and Kiyanja, besides climbing to a point on the watershed between them. The outline given of the ridges tallies very well with all the best data, although it does not satisfy some of the less reliable. Mr. Freshfield very kindly helped me by his personal knowledge of the mountain.

It was very satisfactory to find that the result also coincides with Dr. Stuhlmann's careful description of the ridges seen from his highest camp 13,330 feet on the western slopes. The positions of the peaks satisfy his compass bearings from Kirima and Lungwe, while Mr. Wollaston's height for Duwoni agrees very well with the 15,777 feet given by the Boundary Commission calculations, which make Lake Albert Edward 3010 feet. It is noteworthy that neither Dr. Stuhlmann on the west and north-west, nor Mr. Douglas Freshfield on the east and north-east, of the mountain saw

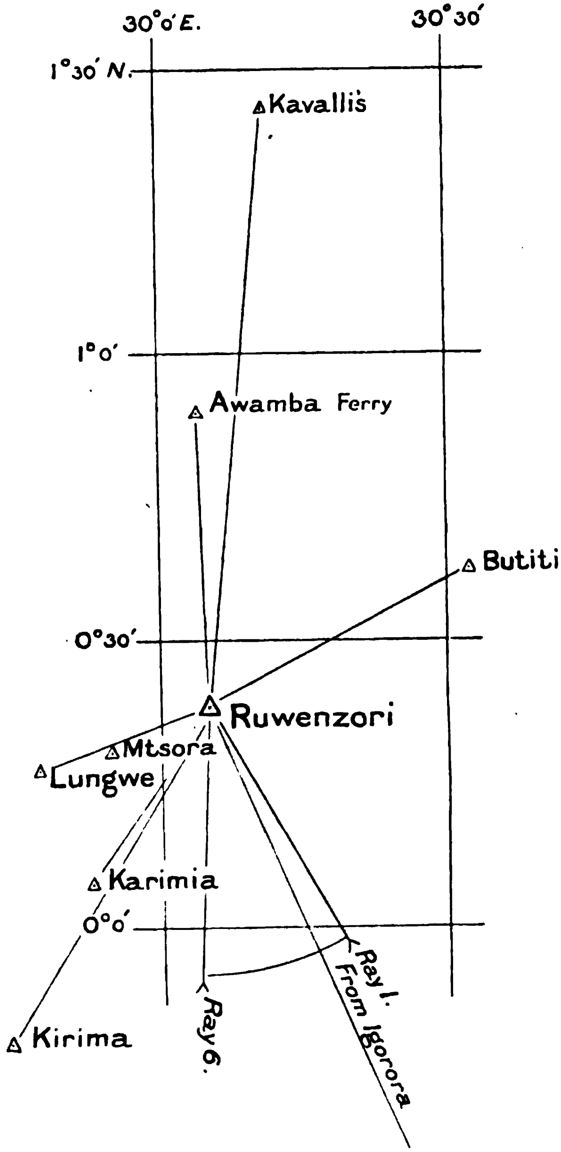


FIG. 2.

any snow-peak away to the north of this group of peaks, though Mr. Wollaston now speaks of having seen what he believes will prove to be the highest peak "a good many miles due north of Kiyanja," on which he was standing.

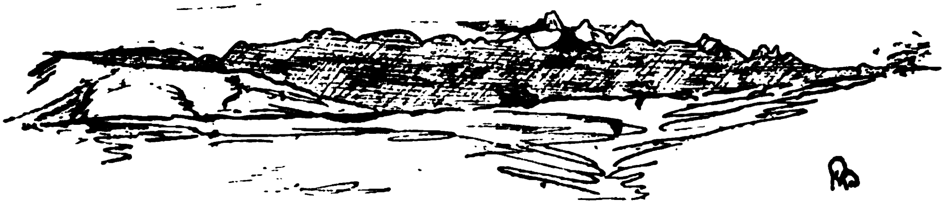
1. Two peaks, close together, fixed by six and five rays each from the main trigonometrical stations of the Anglo-German Boundary Survey, 1903. The six rays to the main peak all passed through a circle of radius 9 feet, and those to the lower point through one of radius 12 feet. The six height determinations for each had a range of 72 feet. The coefficient of refraction used was one determined at the same time of day as the observations to Ruwenzori (early morning) by a large number of simultaneous observations, between two distant hills, on several different days. A more probable value for the refraction was got in this way than by taking an arbitrary value, found for the time of day when the vertical angles for the ordinary work were usually observed. The heights given for these summits may be considered correct within ±30 feet at the most.

2. Two rays observed to a third point, and three single rays, one to each of three other snow-capped peaks. The rays to these four subsidiary points have been drawn in their correct places in Fig. 1, and against each has been written the correct reverse azimuth at the point. The two well-fixed points have been shown in the same figure in their calculated positions. The lower point is 655 feet south of, 256 feet to the west of, and 76 feet lower than, the main and more northern summit. The longitude is the same as that in the Hamburg Society's map.

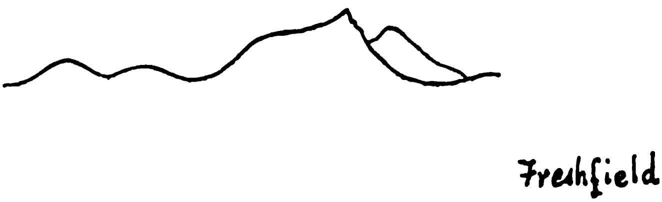
It is to be hoped that any other traveller's unpublished observations may now be made accessible, so that the true positions of the other peaks may be more certainly fixed. The word "probable" positions is advisedly used, as it is with great diffidence that an attempt is put forward to solve the problem with such insufficient data.

3. Eight views, from the sketches and photos of various travellers, have been collected as a basis on which to judge of the probability of the positions assigned to the several summits. These were all that could be used, as only those taken from points whose positions with reference to the mountain were more accurately known would be of any use. Fig. 2 shows the points from which these views were taken, and the sector between ray 1 and ray 6 is that within which the rays determining the main point lie.

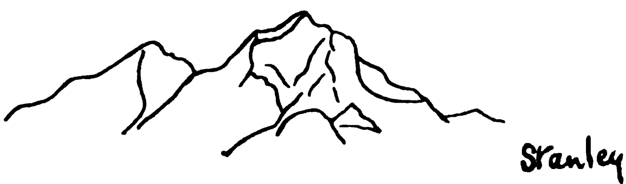
Referring again to the sketches (Fig. 3), No. 1 was sketched at a point 80 miles off whose altitude was about 6000 feet. It will be seen that Nos. 3 and 4 are alike; No. 4 being taken from the heights at Kavalli's, and No. 3 from the valley of the Semliki, would account for the slight change in outline. The views 5 and 6 confirm each other, and the relative positions given to the two southernmost peaks, as do also



1. View from Igorora



2. View from Butiti



3. View from Awamba

4. View from Kavalli's.

FIG. 3.—SKETCHES OF RUWENZORI FROM VARIOUS POINTS.

Nos. 7 and 8. If all the sketches had bearings attached, or even the approximate focal length of the camera employed noted on them, a far better result would be obtained.

As far as the heights are concerned, the subtended angles S of each peak, in the positions plotted, are given as calculated from their observed elevations. The heights given by the data on No. 5, and those given by my own observations, further confirm the positions of the main and southern peaks. The nature of the positions of peaks II. and III. (Fig. 1), behind the spurs of the main peak, makes their identification from Lungue very doubtful. The heights given are those determined by the A.G.B. Commission calculations, to which, however, a small correction still remains to be made.

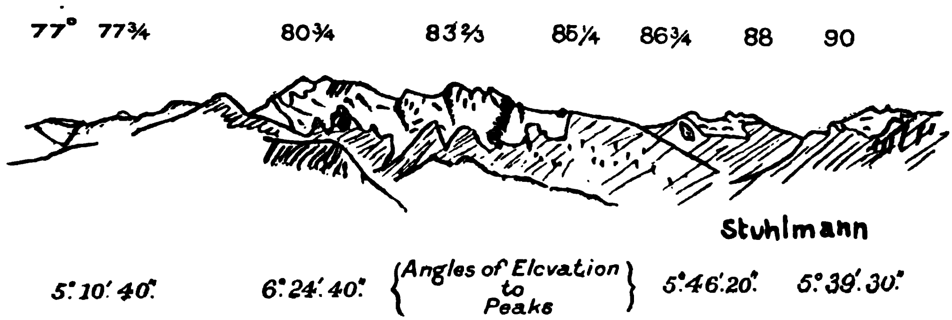
4. The positions used for the points of view are those taken from Herr Max Moisel's map in vol. 17 of the *Mittheilungen* of the Hamburg Geographical Society. The written notes accompanying the two maps explain fully the data on which the map was constructed, and enabled the relative value of the observations to be estimated.

There must, however, have been other observations to the snow-peaks, which I have not been able to use, and I hope these may also be incorporated in a later result obtained from more conclusive data.

A curious thing about the longitude of this map is that the absolute determination on which it was based, Watson's at Rejaf, was confirmed by two others at Magungo and Homia, which gave greater values respectively of 73″ and 58″ of arc, and in spite of this close agreement the longitude appears to be in error more than 10′ (minutes of arc).

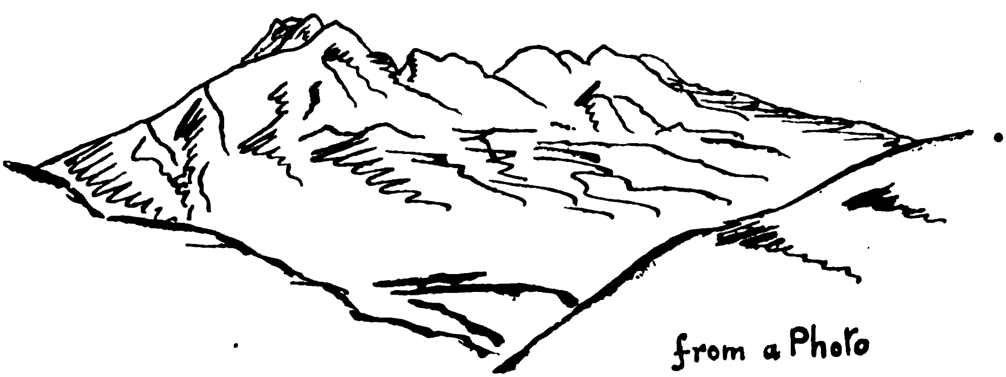
As this map was based on a considerable number of observed latitudes, it was the latitude which gave the most important argument in favour of the A.G.B. Commission's peak being the highest, and not one of the lower peaks. Indeed, its latitude is more northerly than the most northerly edge of Kanyangungwe on Herr Moisel's map. The only peak which might have obscured the view of the highest summit would be the southern peak of Kanyangungwe, namely Kiyanja, and to do this it would have to be not less than 188 feet below Kanyangungwe's apex. As I cannot recollect ever having been perplexed during any of the observations to the peak, varying over an arc of 31°, by other peaks close to it of like elevation, relatively altering their position as I shifted my place of observation, I think this is unlikely to be the case. It is, on the other hand, far more probable that Kiyanja peak was hidden, or almost hidden, over this arc by the mass and width of the higher peak behind it.

On the question of the names of the main peaks, the two most prominent peaks seen from the east are now generally known as Duwoni and Kiyanja, about whose identity there is no longer any question. On the western side Dr. Stuhlmann was given the names of Kanyangungwe by the natives for the most imposing summit



5. View from Lungwe.

6. View from Mtsora



7 View from Karimia

8. View from Kirima

he saw (shown in Fig. 1 as 16,625 feet), and Ngomwimbi for what is evidently Mr. Freshfield's "Southern peak." Dr. Stuhlmann gives no native name for his most southern snow-cap, shown as 14,800 feet (about) in Fig. 1.

The following note has been sent us from the Natural History Museum :—

"Three members of the Zoological Expedition sent out under the auspices of the Natural History Museum, South Kensington—Messrs. R. B. Woosnam, D. Carruthers, and A. F. R. Wollaston (a member of the Alpine Club)—have made the following ascents in this range. On April 1 they ascended Duwoni, the peak rising to the north-east of the Mubuku glacier. This peak has two tops of apparently equal altitude; the southern top, which was reached, was found to be 15,893 feet. On April 3 they ascended Kiyanja, the peak at the western end of the Mubuku group of peaks. The altitude * was found to be 16,379 feet. Each of these peaks has been thought by different explorers to be the highest point in the Ruwenzori range, but from the summit of Kiyanja a still higher peak with two tops, on a spur on the Semliki side of the watershed, was seen in a north-north-westerly direction. The weather at this season of the year proved very unfavourable, the mountains being almost constantly buried in clouds with frequent snowstorms, which prevented the party from making further explorations."

With reference to the above, Mr. D. Freshfield writes that he suggested that the loftiest peak seen by the party was identical with the double peak seen and sketched by him from Butiti, whence it would be almost in the same line as Sir H. Johnston's Duwoni, and overtop it. In his paper read to the Alpine Club in March last, he pointed out that he had had some difficulty in reconciling the outline of the peak seen from Butiti with that of the Duwoni of the Mubuku valley, and suggested that from the valley the former summit might be connected by "an intervening range." The case may be compared to the appearance of the Ortaler over the Alpine watershed from the south or west.

THE PHYSICAL FEATURES OF THE TRANSVAAL.†

By TUDOR G. TREVOR, F.G.S., A.R.S.M.

To a traveller arriving in Johannesburg by the Cape route it appears that the Transvaal consists merely of an extension of the great South African plateau, and that to describe the physical features of the whole country one has only to describe the physical features of one farm, so great does the similarity of one portion of the tableland to any other appear.

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* These altitudes were taken by aneroid, and by the boiling-point thermometer.

† Read before the British Association (Geographical Section E) at Johannesburg, Transvaal, August, 1905. Map, p. 104.

Should, however, the traveller elect to continue his journey either north to Rhodesia, *viâ* Pietersburg, or east to the Indian ocean at Delagoa bay, he finds, usually to his great surprise, that the Transvaal does not consist merely of rolling, treeless downs, but that by far the larger proportion is of an entirely different nature, part being mountainous, with open park-like valleys, and again part flat and lowlying, but densely covered with trees and bush of all description. He then begins to realize that the Transvaal is not the tableland which it is usually represented, but only a small portion of the top, with a great deal of the supports of the table, and also of the floor on which it stands thrown in.

Journeying from Christiana in the extreme west to Komati Poort on the eastern border of the colony, one finds that for 350 miles to Machadodorp one travels on a tableland level in appearance, but gradually rising as one proceeds. At Machadodorp one reaches the escarpment of the plateau, and from thence falls rapidly through broken and much eroded country to Kaapmuiden, a distance of 93 miles; from whence on to Komati Poort, a distance of 43 miles, one travels over a flat floor some 4000 feet below the tableland.

On a journey from Volksrust in the extreme south to Tuli on the Rhodesian border a similar section is observed, but on this journey the section is reduplicated owing to the depression known as the Transvaal Bush Veld, which, cutting across the colony from east to west, separates the outliers of Waterberg and Zoutpansberg from the main plateau.

Entering the Transvaal at an altitude of 5400 feet at Volksrust, one practically remains at that altitude for 150 miles till one reaches Johannesburg, on the Witwaters Rand, which here forms the northern edge of the plateau. Thence one falls rapidly through country that descends in step-like ridges past Pretoria to Hamans Kraal in a distance of about 60 miles. At Hamans Kraal one has come down to an altitude of about 3700 feet, and into a flat country well covered with trees, at about which altitude, and in which country, one remains till reaching Piet Potgieters Rust, a distance of 100 miles, where the Magalaquane river divides the highlands of Waterberg from those of Zoutpansberg. From Piet Potgieters Rust one rises rapidly through the granite hills of Magapan on to the Zoutpansberg plateau, arriving at Pietersburg in the centre of the plateau at an altitude of 4400 feet in a distance of 34 miles. From Pietersburg the plateau extends some 60 miles north, where it is terminated by a sharp ridge of hills known either as Magato's mountains, or the Zoutpansberg, on the north slope of which the ground falls rapidly to the Limpopo flats, the lowest point of which on this section is reached at Rhodes Drift, 150 miles from Pietersburg, where the height above sea-level is only some 1200 feet.

On both the above journeys, or on any other long excursions that one makes in the country, one notices that the characteristics of the ground force one to classify it under one or other of three heads, these heads being—

A. *Plateau country*, known locally as High Veld.

B. *Slopes of the Plateau*, often known locally as "Banken."

C. *Basement country*, locally known as "Low" or "Bush Veld."

As this classification is extremely practical, I propose to describe the peculiar physical features of each of the divisions in turn; for if these are once properly understood, and to them is added a simple knowledge of the river systems of the country, the general physical conditions of the whole colony are at once comprehensible, and most of the secondary phenomena can be accounted for.

As most of my hearers have come from Durban, I may here state that in Natal, on the journey by rail from Durban to Volksrust, the three divisions mentioned are not well apparent, for, the main escarpment of the Drakensberg approaching very nearly to the coast, the low veld is not well developed. The railway practically leaves what corresponds to the low veld in Natal at Pinetown, and, mounting over the Ichanga range, runs along the slopes country parallel to the main escarpment till it mounts the final rise at Langs Nek, and comes out on the true plateau at Charlestown.

A. The Plateau.

The plateau consists of the Transvaal extension of the great South African tableland and two outliers. The boundaries of the Transvaal from near Mafeking south to Christiana, thence east along the line of the Orange River Colony and Natal to the town of Wakkerstroom, lie on this plateau, so that the Transvaal may be said to contain the north-east extremity of the tableland. The tableland slopes very gradually upward from where it enters the Transvaal on the western border at an altitude of about 4000 feet to its eastern edge in the neighbourhood of Lydenburg, Belfast, and Wakkerstroom, where it reaches an extreme altitude of over 6000 feet.

The northern edge of the plateau enters the Transvaal between Pitsani and Lobatsi, slightly to the north of Mafeking, thence runs east just to the north of Ottoshoop, Krügersdorp, and Johannesburg. Bending to the north after passing the latter town, it becomes strongly defined as it passes Middelburg and Belfast. From Belfast it stretches north, causing the plateau to make an arm, which forms the Lydenburg district. Slightly to the north of Pilgrims Rest this escarpment meets the main eastern escarpment, which runs south in a most abrupt edge to Wakkerstroom, where it enters the colony of Natal. The highlands of Waterberg and Zoutpansberg consist of outliers from this main plateau, separated from it by the great depression known as the Transvaal Bush Veld, and from each other by the valley of the Magalaquane river.

Though Europeans call all the plateau country high veld, the Transvaal Afrikanders are accustomed to use the term in a more restricted sense, and to apply it only to the very highest part of the tableland that lies to the east of the Natal railway line and south of the Delagoa Bay line. A line drawn south from Elandsriver station on the latter line past Greylingstad to the Orange River Colony border would fairly accurately show the western limit of what the Boers call "high veld;" on the other sides it is bounded by the edge of the plateau. Curiously enough, the boundaries of this high veld are almost identical with those of the main coal-measures of the country. As this Boer division has a great deal to recommend it, I shall follow it, and for purposes of description divide the plateau country into—

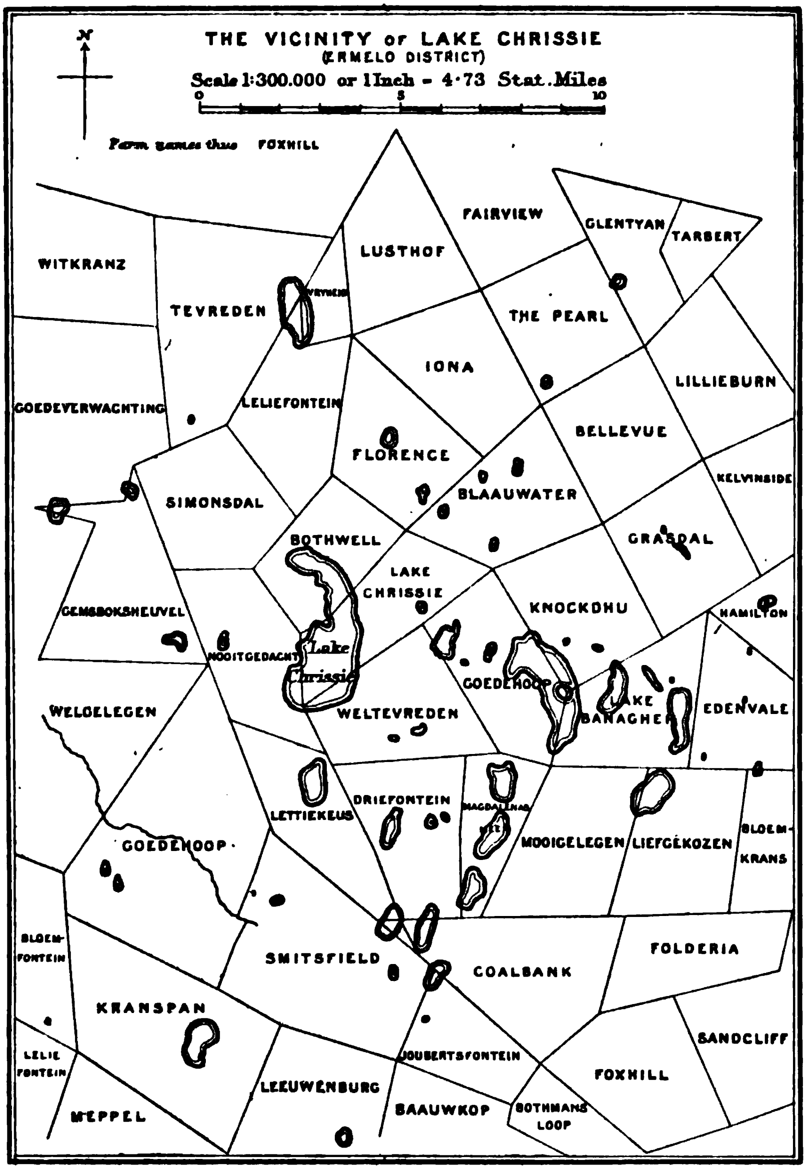
1. True High Veld.
2. Middle Veld.

1. *True High Veld.*

The true high veld lies at an altitude of from 5000 to 6400 feet, and is the extreme eastern summit of the great South African tableland. It has an east-to-west length of 120 miles, and a north-to-south extent of 100 miles. Approximately, I estimate it to contain 14,900 square miles. As its boundaries are practically coincident with the horizontal coal-measures, it has an extremely uniform character, and consists of rolling downs, absolutely treeless, but covered with shore-growing sweet grasses. Hills and valleys are both rare, save on the edges of the escarpment. Wide waves or rises, known as "builts," separated by broad hollows called "laagtes," or "vleys," form the bulk of the country.

Running water is rare, save in a few rivers, but every laagte carries water either in a succession of disconnected water-holes known as "reitkuilen," or in the black sloughs here called "vleys." Small springs of good water are also frequent.

Ranges of hills, except on the escarpment, are absent from this portion of the plateau, but there are occasional isolated hills known as "kopjies"—mostly either



as "spitz kopjies" or "tafel kopjies." The former, as the name implies, are pointed hills, and are usually formed by denuded igneous necks. The latter are miniature table-mountains, usually caused by a horizontal igneous sheet having protected a small portion of the general plateau from denudation. None of these kopjes are particularly high, an altitude of 100 feet above the general level making a notable hill.

Scattered frequently over the surface of the country are the depressions known as "pans." These are shallow lakes having horizontal beds and no outlet. The largest pan in the country, Lake Chrissie, has a length of about 5 miles, and is nearly a mile broad. Its catchment area extends at least 3 miles around its water-level, and the height of its watershed must be about 150 feet. The greatest depth of water in it is, however, not more than 10 feet. Many of the pans hold water all the year round, but some, again, are always dry, and even Lake Chrissie seems to be steadily getting smaller, the water at the north end having receded permanently more than 200 yards in my own recollection.

In nearly all the pans the water is brackish, and most of the beds of those that are dry are encrusted with saline deposits. Some contain enough common salt to repay working, and were regularly worked till the railway, by introducing Liverpool

HIGH VELD NEAR EDGE OF PLATEAU AT WATERVAL BOREN.

salt at a lower price, rendered the local trade unremunerative. At present I only know of one pan in the country that produces salt for sale, and that is the one at the point of the Zoutpansberg north of Pietersburg. These pans form a remarkable feature of South African scenery, especially in the high veld. Though most common in the horizontal Karroo and Carboniferous formations, they occur in geological strata of all ages. It is difficult to conceive by what agency they were formed, and why they have not long since filled up by the denudation of their catchment areas. In most pans the sides slope gradually down to the bed, but in some abrupt cliffs form the margin, while I know of one that has a precipitous island in its centre. No geologist has, so far as I am aware, worked at the solution of the difficulties presented by the formation and continued existence of these pans.

The true high veld forms the cream of the Transvaal from a farming point of view. The grasses are all of excellent quality; endemic diseases amongst stock are unknown, and epidemic plagues are less severe than in other parts. The soil is not rich, but is easily worked over large areas, and is not too poor to repay working. The climate is absolutely healthy for man and beast, and is one of the most invigorating in the world. The temperature varies from an extreme summer heat of 90° in the shade to several degrees of frost in the cold winter's nights.

The rainfall is at its greatest on the edge of the eastern escarpment, where over 50 inches fall in the year, but diminishes to about 30 inches at Boksburg on the west. A fair proportion of this rain falls steadily on cloudy days, but heavy tropical thunderstorms are frequent. The occurrence of the rain falling as it does in the autumn months is one of the greatest drawbacks to the country. In spring, when rain is earnestly needed to bring on the young crops and grass, it is often entirely wanting; and in autumn, when dry weather is required to mature the grain, useless rains frequently destroy it. The whole Transvaal suffers from this disadvantage, and as it is a most important one, I have attached to this paper a table giving the average rainfall registered at the different observing-stations in the Transvaal in the season 1904–05.

2. *Middle Veld.*

The remainder of the plateau, after the true high veld has been divided off, is often known as middle veld. It consists of that portion of the tableland lying west of the Natal railway line. Though some portions of it, such as the Rand, rise to over 5000 feet, it may be said to lie at an altitude of from 4000 to 5000 feet above the sea. The western portions, consisting of districts of Lichtenburg and Bloemhof, lying for the most part on horizontal Ecca shales, approximate very closely in appearance to the true high veld. The main portion, however, consisting of upturned older rocks, differs considerably from the country just described. Though builts and vleys alternating still take up most of the country, long low stony ridges and lines of hills known as rands make their appearance. Pans become less frequent, and watercourses, either dry or running, are of common occurrence. The rands and kopjes are usually covered with protea scrub, and though the builts and laagtes are still bare of trees, the lower river-valleys are often pleasantly sprinkled with mimosa.

The grasses of the middle veld are not nearly so good as those of the true high veld, neither is it so healthy for stock. Horned cattle do well, but sheep poorly; while in the summer the disease known as horse-sickness takes its toll of all grazing horses. For agriculture, the soil, being derived from the older rocks, is richer than in the true high veld, but, being more broken up by rock bars and more stony, is not so conveniently worked. The rainfall is about 30 inches on the east, but gets smaller toward the Bechuanaland border. Toward the west, also, steady rains appear to me to get rarer, and tropical storms more frequent.

The characteristics of the plateaus of Zoutpansberg and Waterberg are similar to the above, but, lying farther to the north, the climate is much hotter, and malarial fever makes its appearance even on the plateau. Endemic diseases are very severe amongst all kinds of cattle, and practically the only stock that will live are the native breeds of cattle, goats, and thick-tailed sheep, and of these the horned cattle have been almost exterminated in the last few years by epidemic plagues.

The approximate total area of the whole plateau ground in the Transvaal is, according to my calculations, roughly as follows:—

	Square miles.
True high veld	14,900
Middle veld	18,800
Zoutpansberg plateau } Waterberg " }	4,400
Total	38,100

B. Slopes of the Plateau.

The slopes or descent from the plateau vary considerably in height and extent, being in some places precipitous and abrupt, as in the Lydenburg escarpment; or gradual, as in the section taken by the railway from Johannesburg to Pretoria and the north; or, again, very much broken and cut up into outlying hills, as in North Lydenburg and Barberton. From Mafeking to Johannesburg the breadth of the

slopes is usually about 40 miles, and the ground falls in a succession of steps, each step being as it were held up by a range of hills that, being of harder rock, has resisted denudation and protected the ground on its upper side.

The three main ridges are the Witwatersrand, the Witwatersberg, and the Magalies Berg, and an excellent view of them and of this description of country can be got from the higher suburbs of Johannesburg, such as Parktown. The highest of these ridges—the Witwaters Rand—makes the watershed between the Indian and

WATERFALL OVER EDGE OF PLATEAU AT SABI, LYDENBERG.

Atlantic oceans. Beyond Johannesburg, at Elandsfontein, the defined edge between the plateau and the slopes dies away, but makes again 30 miles to the north in the neighbourhood of Witfontein station, and, again running east, becomes more and more sharply defined as it goes. From Middelburg to Olifantspoort, where the eastern and northern escarpments meet, the slopes are very much cut up into outlying hills, and the mountains which have resulted from the denudation of the plateau form the most romantic scenery. On the east from Olifantspoort to Wakkerstroom the main slope is very precipitous and abrupt, but at its foot foothills and valleys, stretching for some miles, correspond closely with the rest of the slopes country. The rock at the base of the slopes is in every case granite, and their upper escarpment of sedimentary rocks.

From the sedimentary rocks, or from their junction with the granite, all the rivers that run to the Indian ocean take their rise and obtain by far the greater part of their water. The whole extent of the slopes country is beautifully watered with clear running brooks and streams, which, breaking their way through the ranges that make the steps of the plateau, give rise to those poorts which form such a characteristic feature of South African scenery.

The valley bottoms are well wooded with open-growing mimosa and other trees, the sides park-like with scattered timber, and the hills covered with protea, euphorbia, aloe, and other picturesque and peculiar growths. High up on the sea faces of the eastern slopes fine patches of heavy timber fill the dingles and gorges. These patches are known as "woodbushes" in contradistinction to "bush," which is the term used for the scrub mimosa forests of the low veld. These woodbushes are not often of great extent, but they contain huge timber trees, many carrying over 100 cubic feet of timber. All the hardwood trees of the Cape Colony are represented in them, and formerly all the waggon wood used in the country, and most of the farm and household timber, were cut from them. The largest of these woodbushes or timber forests are those of the Pongola on the extreme south, and of Haenertsburg and the Woodbush mountain on the north of the eastern escarpment. These forests are very local, and begin like plantations, with little or no loose timber outside their edges. The trees in them are either peculiar to them, or grow only in a dwarf form outside their margins. The bushcutters say that the forest grows only where the sea-mist strikes and hangs on the mountain. One has but to observe the mountain for some time to notice the connection, for the mist appears first on the forests, and often hangs there for days when the rest of the hills are clear; but whether in reality the forests cause the mists to settle, or whether the mists cause the forests to grow, I am not prepared to state.

Another peculiarity of these woodbushes is that even in the smallest of them the flora and fauna are entirely different to those a few yards outside their boundaries. The woodbushes have their own animals, birds, flowers, and even butterflies, which are peculiar to the actual limits of the forest itself, and I do not know of one antelope or other animal that frequents both the woodbush and the surrounding open country according to its humour, in the way that our European animals use both the woods and the fields.

Though the slopes country is infinitely the most attractive in the Transvaal, it suffers from many disadvantages. It is deadly for horses in the summer, neither do sheep do well. It appears excellent country for Angora goats, but poison in the verdure and a disease known as blue tongue have always rendered them unprofitable. For horned cattle the country is excellent for grown stock, but the mortality amongst young stock is so great that I have never known a man commercially successful in breeding cattle in this region. Most of the slope country is perfectly healthy for man, but in the lower valleys malarial fever makes its appearance, and

EDGE OF PLATEAU AS SEEN FROM BELOW, KANTOOR BARBERTON in some, such as Ohrigstad and Elandsriver, has been known to drive out the population.

For agriculture the actual ground that can be cultivated is small, consisting only of the narrow bottoms of the valleys, but such as there is of it is of excellent quality. Everything can be grown at one altitude or another in the slopes country, from the apples and wheat of England to the tobacco and bamboos of the tropics, and for citrus fruits I should say that it was certainly unrivalled in Africa, if not in the World. Unfortunately, owing to the configuration of the country, all agriculture has to be on such a petty scale that one has to doubt if this can ever become an exporting district.

The slopes surrounding the Waterberg and Zoutpansberg plateaus are so similar that no special description of them is necessary, but, being farther north, all the disadvantages of the southern slopes are accentuated considerably. As to the area of the slopes, only the roughest approximation can be arrived at, as their lower limit is so indefinite. The portion of the attached map on which I have marked them represents, however, 27,100 square miles, and that, I think, can be taken as fairly accurate.

C. Basement Country, or Low Veld.

All the remainder of the Transvaal, not previously described either as plateau or slopes, consists of basement country, or low veld. On the northern side of the plateau the typical low veld begins at an altitude of about 4000 feet, but below the eastern escarpment the abrupt slopes continue down to 3000 feet, and it is only at that line that the characteristic appearance of the low veld begins. The lowest portion of the low veld lies along the Portuguese border at less than 1000 feet of altitude, but so great is the similarity of this country that it is quite impossible to recognize from a low-veld landscape whether one is on the Portuguese border at an altitude of only 800 feet or on the Bechuanaland line at 4000 feet. Exactly similar country stretches far away to the north and west beyond the borders of the Transvaal.

The whole low veld is flat and covered with scrub bush, mostly of mimosa and thorn-bearing trees. Most of this bush is gnarled and crooked, and useless for all purposes. A few varieties of the bush trees, however, grow big enough and straight enough to make fencing posts and furniture woods; but, except in the river courses of the lower parts of the country, there is nothing that one can call timber.

Low stony ridges and kopjes, mostly of the spitz variety, occur sparsely over the low veld, and in places peculiar granite kopjes, consisting either of one huge bare rock or of a pile of enormous loose blocks of granite, appear. Granite, in fact, is the main country rock of the whole low veld.

Water in this country is very scarce. Rain-water stands in small pans for some weeks after it has fallen, but otherwise practically the only water is in the rivers, which, rising in the plateau or slopes, pass through the low country on their way to the sea. With the exception of a few mineral springs, most of which are thermal, I cannot call to mind a single permanent perennial spring of any magnitude in the whole low country. Small soakage springs are occasionally met with, but these are often brackish and are not perennial.

The rivers also diminish very considerably in volume, or even dry up as they cross this country. At Rhodes's drift, near Tuli, the Limpopo is often quite dry at the end of the winter, though where it enters the bush veld it is a considerable river at the same period. The Selati, which, when it falls from the slopes, is

AN AFRICAN "POORT"—JOHANNISPOORT, PIETERSBERG.

A GRANITE KOPJE, ZOUTPANSBERG, MUTITZIES.

a fine perennial stream resembling our English trout streams, dries up completely before it reaches its junction with the Olifants river, and numerous other instances might be quoted. So marked and well known is this peculiarity, that any "old hand" looking for water in the foothills at the edge of the low veld will always follow the watercourses upward into the hills, and not downward into the flats, as he would probably do elsewhere.

Sand rivers and dry rivers also form a feature of the low veld, especially in the north. The former of these are dry beds of sand, often over 100 yards wide, in which water can sometimes be got by digging a foot or two below the surface, but in which water seldom or never flows on the surface. The dry rivers are torrent-courses, which often extend for miles, and occasionally contain holes full of stagnant water. At the present time no torrents ever seem to fill these courses; a local storm may set them running for a mile or two, but the water is quickly absorbed by the ground and stored in the inequalities of the bed. The Malatie river, near Leydsdorp, is a good example of such a dry river. Its course stretches some 40 miles, but it has never been known to run its entire length, and, judging by the timber that encumbers it and the absence of drift at its lower end, it never has done so in recent times.

It is worth mentioning here that the H.E. Proprietary Company recently put down two bore-holes in a belt of schist included in the granite near Leydsdorp, and that neither bore-hole could be proceeded with to any great depth, because at about 300 feet they had not only not struck any water, but they actually lost the water they were pumping down the rods to keep the hole clean—this notwithstanding that at that depth they were far below the lowest depression of the country.

Another feature of the low veld, which is particularly noticeable when looking over any part of it from an altitude, is the long strips of treeless spaces which meander through the bush like rivers. The soil in these is usually black organic turf, which suggests the presence of water, but I have never found water in them, nor are they in any obvious way associated at the present time with water. A peculiar feature of that part of the bush veld north of Pretoria is a strip some 20 miles wide and 150 miles long, known as the Springbuck flats. This consists of an almost treeless and waterless belt of deep black turf, and appears to owe its origin to a sheet of a peculiar amygdaloidal rock that underlies it.

The climate of the low veld is, as might be expected, more tropical than that of the other divisions. The summer maximum shade temperature rises to 113° Fahr., but the nights are almost invariably cool and pleasant. Frost occasionally is known down to the 2000-feet level, but there are spots as high as 3000 feet where it has never been observed.

As to the rainfall, it is impossible to give any figures, as there is nowhere in the low country where a continuous record has been kept. Where the low veld approaches closely to the main escarpment, the rainfall appears to be about 30 inches, and steady rains occur, but the farther one gets from the mountain the less and more erratic does it become. I lived once near a native kraal where no rain fell for twenty months. It was not a particularly dry season elsewhere, but no thunderstorm happened to strike that spot.

The soil in the low veld, being usually derived from granite, is poor, but certain portions, where schistose or igneous rock occurs, form notable exceptions. For instance, the Springbuck flats are exceptionally fertile, and, could water be obtained, would probably support a larger population than any similar area in the Transvaal. For various reasons, however, practically no cultivation has ever been attempted by white men in the low veld, though at present several attempts to do so are being commenced.

The pasture in the low veld is uniformly excellent, and I should imagine that an acre there had a greater feeding value than in any other of the divisions of the country. Unfortunately, all stock suffers in the summer from many endemic diseases, and epidemic plagues are most destructive. At the present time it may be said that, with the exception of a few herds of miserable native goats, with an occasional thick-tailed native sheep, the whole low country is devoid of stock. Nor, unless something can be done to get at the root of the endemic diseases that decimate all introduced and all young stock, do I think that it can ever become any use as a pastoral country.

Malarial fever is rife from one end of the low country to the other, but varies in intensity, not only with the altitude, but locally. Above 3000 feet I do not think that the malaria is more severe than in the south of Spain, and it should not interfere seriously with the population of the country; but below that level the fever takes a virulent form, and blackwater fever makes its appearance. It may, I think, therefore, be regarded as certain that below that level the country will never carry a European population.

A LOW-COUNTRY LANDSCAPE, WITH TYPICAL ANTHILL IN FOREGROUND.

The area that I have marked on the attached map as basement country, or low veld, works out at 52,500 square miles. We have therefore seen that, according to my approximations, the Transvaal consists of—

32·4 %	plateau country,	or	38,100	square miles.
23·0 %	slopes	„	27,100	„
44·6 %	basement	„	52,500	„
100·0 %			117,700	„

The foregoing completes my description of the physical features of the Transvaal as they have impressed themselves on my mind during eighteen years spent in almost constant travelling in the country; but before closing this paper I should like to touch on the water system of the country, and on two points of great interest connected with it.

The Water Systems.

The drainage system of the Transvaal is extremely simple, all the rivers of the country uniting into five before reaching the sea. They are—

The Vaal,
The Limpopo,
The Komati,
The Umbelusi,
The Pongola.

The Vaal drains the greater part of the main plateau westwards into the Atlantic ocean. The Limpopo and its great tributary, the Olifants river, carry off the waters of the whole northern escarpment and slopes of the main tableland, and of the outliers of Waterberg and Zoupansberg as well, into the Indian ocean. The Komati, Umbelusi, and Pongola drain the eastern slopes of the plateau also direct into the Indian ocean.

Both the Limpopo and Vaal have similar characteristics—carrying a huge volume of water in their summer floods, they almost or quite cease to flow in the winter. This, coupled with the fact that both in the main courses run deep between high banks, has rendered them useless in the past for either irrigation or industrial purposes. The same causes have also rendered the eastern rivers very unsatisfactory as power-producers. To a certain extent the tributaries of the Komati have been used for power purposes in the Barberton district, but with uniformly unsatisfactory results. None of the Transvaal rivers are navigable while they run in the Transvaal territory, even for native canoes.

Alluvial Soil.

The absence of alluvial deposits of any extent is one of the most remarkable features common to all the rivers of the country. It would be difficult, if possible, to find a continuous alluvial flat of say 1000 acres in extent in any of the valleys of the country, and flats of alluvium even of more than 50 acres are most uncommon. Everywhere the soil seems made of rock decomposed *in situ.* All the rivers, even in the low country, run on rock bottoms, and the country rock outcrops everywhere.

Geologists have noted that the main features of the Transvaal landscapes were eroded in precarboniferous days before the laying down of the South African boulder clay or Dwyka conglomerate. I think that contention can easily be proved, and, moreover, this absence of alluvium and other evidence incline me to believe that very little of the denudation that we see has been done in recent geological times. Over the whole eastern low veld a recent gravel wash is spread over the tops of the rises. In the Western Transvaal, the Orange River Colony, and Bechuanaland, similar gravel beds occur high up on the rises and kopjes. In the bushveld north of Pretoria is a long line of deposits of calcareous tufa over 100 miles long.

These facts would appear to indicate that this country had been submerged in recent geological times, and if so, the absence of alluvium and the fact that the pans have not yet been filled up by the denudation of their sides, might be accounted for. This absence of alluvium has two important results. In the first place, there are no great alluvial flats where irrigation on a large scale might encourage an agricultural population to settle. In the second place, though the gold mines of Barberton and the low country were probably as rich on the surface as any in the World, no considerable alluvial goldfields have been found attached to them. Nor is it probable that any will be found, for there are no great deposits of derived alluvium where only large quantities of alluvial gold could be expected. The surface soil often contains nuggets and gold dust, but this appears due to the decomposition *in situ* of gold-bearing schists.

Springs.

The last feature of the Transvaal to which I wish to attract attention is one of vital interest to the very existence of the country. I allude to the water-springs and fountains, and to the evidence that one constantly hears and sees that the supply from these has steadily diminished since the white man first settled in the country, and appears to be still diminishing.

In a country such as the Transvaal, where systematic scientific observations have only just begun to be recorded, it is impossible to prove this drying-up of the country by figures. But there is abundant evidence, both human and natural, that some such change is in progress, and my own experience bears out the evidence From Tuli to Volkrust, and from Mafeking to Komati Poort, every old inhabitant of the rural districts can point out springs that have dried up, creeks that have ceased to run, and pans where the water has either receded considerably or entirely disappeared.

The common belief to which I incline is, not that the rainfall has diminished, but that, owing to the universal practice introduced by the white man of burning off all the old grass every winter, the ground becomes hard-baked, and that the rain-water, instead of soaking in and strengthening the springs, runs directly off the surface and away down to the rivers.

In a general paper such as this it is, of course, impossible to go thoroughly into any such subject as this, however important it may be; but I mention it in the hopes that attention and inquiry may be directed to an apparent natural change which, if true, threatens the whole existence of the country and its inhabitants.

ADMIRALTY SURVEYS DURING THE YEAR 1905.

By Rear-Admiral A. MOSTYN FIELD, F.R.S., Hydrographer.

Under the orders of the Lords Commissioners of the Admiralty, eight of His Majesty's vessels, with three small hired vessels, manned by an aggregate of 80 officers and 747 men, have been employed on hydrographical surveys on various stations at home and abroad.

A naval officer, assisted by officers of the Royal Naval Marine, has also been employed, with the sanction of the Admiralty, under the Indian Government, in charge of the surveys in Indian waters.

A detailed report of the labours performed by each surveying ship has been prepared, and, in accordance with custom, has been presented to Parliament. The following is a brief summary:—

Notwithstanding the progress of hydrography, and the constant employment of our own and foreign surveying vessels in many parts of the world, the requirements of navigation increase more rapidly than the advance of surveys. During the year 1905 no less than 522 rocks and shoals which were dangerous to navigation were reported and notified to the public through Notices to Mariners; 1129 miles of coast-line have been charted, and an area of 4295 square miles has been sounded.

On the *East Coast of England*, various re-examinations of the Thames estuary were carried out. Considerable changes were found to have taken place. Some work was also done at Harwich and Lowestoft.

On the *South Coast of England*, at Portsmouth, the outer bar was resounded, and areas used for spoil deposit by dredgers were examined. The resurvey of Tor bay was completed. At Plymouth, the dredged area above the Royal Albert bridge was resounded, and Asia pass was examined.

On the *West Coast of England*, Fishguard bay was resurveyed.

On the *West Coast of Scotland*, the resurvey of the Sound of Mull was resumed and completed from a mile east of Lismore lighthouse to Ru Pennygown. The north-western portion of the sound and Tobermory harbour were triangulated and plotted ready for sounding next season.

Loch Kishorn with its approaches to Loch Carron, Broadford bay, and Loch Dunvegan were resurveyed.

In the *Orkney islands*, Pierowall road in Westray and Hoy sound were resurveyed.

On the *Newfoundland coast*, a further search was made for the reported bank off the Burgeo islands, but no indications of shoal water were found. The survey of the Bay of Exploits was resumed. An investigation was made of a reported magnetic disturbance off Flowers ledge in the Straits of Belleisle; no evidence of such disturbance was found, but the Flowers lighthouse was found to be wrongly charted.

On the *West Coast of Africa*, the Liberian coast from Manna river to Monrovia bay was resurveyed, plans being made of Cape Mount and Monrovia bays.

A reported shoal of 6 fathoms, 27 miles north of Cape Barbas, was unsuccessfully searched for, 75 square miles being sounded over without any indication. A further attempt is being made to determine with more certainty than on the previous examination in 1871 the relative volumes of water pouring in and out of the Straits of Gibraltar at any one time and also at different depths. With this in view, the *Goldfinch* spent a month sounding in the straits and selecting the most suitable spots for making observations. The work is not yet complete.

In *British Columbian* waters, the work for the season was arranged in such a manner as to connect together all previous surveys of the *Egeria* in the archipelago lying between the east coast of Vancouver island and the Strait of Georgia, the special area for work being that lying between Gabriola island and the boundary-line between the United States and British Columbia in the vicinity of Pender and Stuart islands.

In *China*, a survey of the east coast of Lantau island, in the neighbourhood of Hong Kong, was commenced.

Port Shelter, with the adjacent Rocky harbour at the entrance to Mirs bay, was completed, and a survey of the coast from Lama islands to the Brothers commenced.

In *Borneo*, Kimanis bay was surveyed. The coast survey was carried from Labuan northward to Dukan point. On the east coast of Borneo, a reported shoal in Sibuku bay was successfully searched for and charted.

In *New Zealand*, a portion of Hauraki gulf was resurveyed.

In *Australia*, the survey of the inner route on the Queensland coast was carried from Pickersgill reef to Snapper island. Several fresh offlying dangers on the inner edge of the Barrier reef were found, but none near the usual track of vessels.

In the *Red sea*, the approaches to Mersa Sheikh el Barghut (Port Sudan) were surveyed. This place is the terminus of the recently opened Atbara-Red sea railway.

In the *Indian ocean*, Messrs. J. Stanley Gardiner and C. Forster Cooper were embarked in H.M.S. *Sealark*, on May 9, for the purpose of making a scientific exploration of various coral islands and submarine banks included in the area between the Chagos archipelago, Mauritius, Madagascar, and the Seychelles group. The voyage lasted nearly six months, during which time dredging, sounding, magnetic observations, and other scientific and hydrographical work, were carried on uninterruptedly. Messrs. Stanley Gardiner and Forster Cooper disembarked at the Seychelles on October 21.

On the *Ceylon coast*, a survey of the approaches to Colombo was commenced.

The Indian Government conducted surveys of Koweit in the Persian gulf, and in the Andaman islands of Stewart sound; also the west coast of Middle Andaman island, lying between North Passage island and Rougat bay.

During the year the Hydrographic Department has published 110 new charts and plans, and 36 plates have been improved by the addition of 43 new plans, while 5320 corrections have been made to the chart plates. The number of charts printed for the requirements of the Royal Navy, for Government Departments, and to meet the demand of the general public, has, during the year, amounted to 689,930.

REVIEWS.

ASIA.

THE FAR EAST IN 1905.

"The Re-shaping of the Far East." By B. L. Putnam Weale. London: Macmillan, 1905. Two vols., pp. xv., 548; x., 535. *With a Map.*

HIS previous book, 'Manchu and Muscovite,' compels the reader to defer to Mr. Putnam Weale as an authority on Far Eastern questions. The present large work is of peculiar interest as containing a very close study of political situations and questions written with a mind unaffected by the actual signature of peace between Japan and Russia, for it dates from the period of the war itself. As a consequence, in the political chapters which occupy part of the first and the whole of the second volume, one obtains such interesting analyses as the probable course of events if the war should be carried to the point of exhaustion, based on developments up to a certain point in the war itself. It is unnecessary to go more deeply here into these chapters; it is sufficient to remark that the book, from this point of view, is valuable, not only as an expert expression of opinion, but as a history of events which preceded the war, for there are both an introductory historical chapter and a number of appendices giving texts of treaties, conventions, and so forth, of the decade before the publication of the book. The outstanding chapters of the first volume furnish a description of some of the author's journeys in the Far East. It is a matter of opinion whether the association between these two sections of the work is entirely happy. The introduction of the reader into the proper atmosphere of the subject is the purpose of this narrative, which is perhaps, however, barely sufficient in itself. Nevertheless, the journeys described are extensive, and the narrative full of interest. A voyage up the Yangtse, journeys on the unfinished Hankow-Peking railway, the German Tsingtao railway, and the Japanese line between Fusan and Seoul, with a glimpse of Japan itself, are found in these chapters of travel, which are not wanting, so far as they go, in the presentation of the geographical environment of political problems in these lands. We who read are fully impressed with the vast wealth of China that awaits development by the opening of communications; we learn such geographical lessons as that the Hwang-ho sets a natural boundary between two lands, as it were, of different characteristics, and we meet, incidentally, with such curious details as the author's observations on the little isolated family of Chinese Jews in Kaifengfu. As compared, however, with the historical introduction and the political chapters, the travel-narratives may appear to some in the nature of a makeshift for a fuller geographical treatment of the subject, but to those who find this section sufficient, the entire work cannot fail to be deeply interesting. A large and good map satisfactorily illustrates the whole.

AFRICA.

The Rhodesia Ruins.

'Mediæval Rhodesia.' By David Randall-MacIver, M.A., D.SC., F.R.G.S., Laycock Student of Egyptology at Worcester College, Oxford. London: Macmillan & Co. 1906. 4to, pp. xvi., 106. *With Frontispiece and 36 Plates.*

We have here the results of an inquiry, undertaken at the suggestion of Sir Lewis Michell, and in connection with the African visit of the British Association in 1905, into the age and purpose of those stone-built ruins of Rhodesia, of which the "Great Zimbabwe" has been hitherto the best-known example. From the first regular examination of these ruins, by the late Mr. Theodore Bent, in 1891, down to the year 1905, there has been, as is well known, intermittent controversy, accentuated by very imperfect knowledge of the ruins on the part of the more cautious theorists, and by great boldness of imagination on the part of those who knew the sites most thoroughly. South African opinion for the most part followed the lead of Mr. Bent, and attributed the ruins to Sabæan Arabians, or more specifically to the Queen of Sheba; a few reserved judgment until a trained excavator should have explored the rubbish-heaps and sub-soil; others, and among them some who were well qualified to judge of this point, regarded the modern Kaffir, with his peculiarly autocratic chieftaincy, as competent to organize both the building of a Zimbabwe and the working of "King Solomon's mines."

Dr. Randall-MacIver went out with considerable experience of the methods of modern excavation; he had every possible help from the Rhodesian authorities; he covered—considering that he was necessarily only in the field for about three months—a great extent of ground; and his results are presented in a form which is admirably clear, and well set out with plans, views, and photographs of characteristic objects. The substance of his argument has been stated already in his paper before the Research Committee of the R.G.S. in the last volume of this *Journal* (p. 325 ff.); and the principal considerations which have been urged on the other side reappear in due order in the discussion which followed that paper. For his evidence, however, and for detailed descriptions of the sites and the objects found on them, we are referred to the book under review; and it is one which certainly marks a turning-point in South African archæology. It will be indispensable to students of Kaffir history and culture, and no less to African ethnographers generally, and to investigators of Arab and other Semitic enterprise on the shores of the Indian Ocean.

On the main question, of the age and character of these ruins, Dr. MacIver has proved his point. Questions of this kind are decided, not by the quantity, but by the quality of the evidence. To argue from the style of the architecture, the sculpture, or the ornament in these ruins is to argue in a circle, and this is equally the case whether the comparison be with ancient Egyptian or modern Kaffir art. It assumes exactly that which is to be proved; namely, that there is anything more than an accidental likeness between the two styles which are compared. To argue from the assumption that this or that people could (or could not) desire gold, or get it from the ground, or lay their heads together to build stone forts, is equally to argue from the conclusion backwards; and so also is it to argue from the depth or thickness of a deposit, unless we know the rate of deposition. It is only on the occurrence, at a particular level, of imported objects of known style and date, as Dr. MacIver realized at the outset, that a valid chronological argument can be based; and he is therefore greatly to be congratulated on having secured, in so brief a tour, good evidence on this particular point. This evidence comes from no less than three distinct sites, and covers a period extending from the end of the thirteenth to the seventeenth century A.D. It exists in the shape of fragments of Nankin china and other well-known Oriental fabrics, and the evidence is preserved in the Buluwayo Museum.

This discovery gives the death-blow, as the evidence stands at present, to all theories, based on observation of the layers of *débris* from which these fragments came, which refer those layers to an earlier date than that of the fragments themselves. It supersedes all *à priori* arguments from the appearance of soapstone beams, carved birds, and other works of art; and in the event of any one wishing hereafter to revive any theory of an earlier date for these ruins, it puts the *onus probandi* on him.

In three points, however—and one of these is crucial—Dr. MacIver's argument does not yet seem quite flawless, and if, as we may hope, he finds some later opportunity of revisiting South Africa, he will, no doubt, not be long in setting them right.

In examining the great kitchen-midden at Dhlo-Dhlo, one could wish that he had—to use his own words—"observed the excavator's primary axiom, and dug to bed-rock." His inference that "as no distinction whatsoever could be observed in the character of the deposits found in the several levels down to that point, and only a very slight depth remained below it, there can be little doubt that the results are representative," was a very natural one, and no doubt he did all that was possible in the time which he allowed himself at Dhlo-Dhlo. But it is open to the critic to reply that it is precisely the existence, at Zimbabwe, of a thin layer of a different character, at the bottom of a long sequence of uniform strata which makes him qualify his conclusions on that site as he does. "I must frankly confess," he says (p. 64), "that I am unable to decide whether this layer is older than the hut foundation or contemporary with it. On the one hand, it might have been deliberately placed there as a bed for the foundation; on the other, it might have been the kitchen midden of an earlier settlement." But, in the latter event, to which settlement do the stone walls belong? There is no evidence that Dr. MacIver followed either stratum further than *up against* these walls. What if the lower layer were subsequently found to be of the "kitchen-midden" type, and yet banked up against the walls, which he attributes to the later stratum? The only possible conclusion would be that the walls existed already when the earlier stratum was being formed.

The same critic might add that the stress which Dr. MacIver lays on the practical identity of modern Kaffir pottery with the pottery from the lowest layers both at Zimbabwe (p. 63), and apparently also at Dhlo-Dhlo (p. 45), might easily have led him to the conclusion that culture here had been practically stagnant; and that, this being so, the depth of the deposits affords practically no evidence as to the age of its lowest layer, unless the rate of deposition can be determined somehow independently. And as it happens that he has omitted to mention the depth (either absolute or relative) at which he found his fragments of sixteenth-century Nankin china in this kitchen-midden, we are for the moment confronted with an "unknown."

Fortunately, however, the date of Dhlo-Dhlo does not depend primarily on the contents of this kitchen-midden, but upon Nankin china of the seventeenth century, from below the cement foundations of a hut which is, in Dr. MacIver's opinion (p. 48), "beyond all question contemporary with the first stones which were ever laid at Dhlo-Dhlo." As this is a point upon which criticism will certainly be directed, it is a pity that he has not given some indication, in detail, of the evidence on which he bases this assumption. It is a pity, also, that Mr. C. H. Read, though he dates these fragments of china "to the seventeenth century without doubt" (p. 52), has to add, "but I have not seen the original." Surely this should have been arranged.

The third point on which formal doubt might arise is in the case of "enclosure 15" at Zimbabwe, where the "mediæval Arab glass and Nankin china" (p. 63) were not found by Dr. MacIver himself, but by a previous excavator, Mr. R. N. Hall. Exactly *where* it was found is not stated; but in any case it was apparently not, as at Dhlo-Dhlo, *below* the cement floor, but *in* the cement mass which stands upon that floor. It is quite true that the kind of pottery which Mr. Hall "calls Makalanga, and which is, in fact, exactly like modern Kaffir pottery," was found below the cement floor, in the lowest layer which contained any artefacts at all. But (1) the likeness of "Makalanga" to "Kaffir" pottery only proves anything as to relative age, if we know the rate at which culture was changing in the interval; (2) at Zimbabwe, *ex hypothesi*, culture was not changing, for the fabrics are "exactly like;" and (3) even supposing slight changes were discernible, the objects in question occur lower down in the series than the lowest possible level of the Nankin china, and consequently are not dateable by it. Once realize these three qualifications, and the value of the Zimbabwe evidence becomes appreciably less.

These, however, are merely formal defects in an argument which is practically conclusive. There can be very little doubt, after Dr. MacIver's work, that the Rhodesian ruins are of latish mediæval date; and that conseqnently the Portuguese records are good evidence as to their probable makers, as they are in any case for some of their earlier (if not for their first) inhabitants. This granted, the Portuguese records tell their own story of gold-working Kaffirs living in walled towns and trading with the Europeans from the coast, but otherwise undifferentiated from other South African peoples.

It is probably only a slip of the pen which makes Dr. MacIver say on p. 64 that "it was the same *race* which deposited the rubbish and which built the hut above it, for precisely the same objects are found within both." If this were so, the similarity between these objects and modern Kaffir objects would prove identity of *race* between the modern Kaffir and the builders of Zimbabwe; yet part of Dr. MacIver's theory is (p. 58) that some one of those "terrible waves of devastating conquerors which have swept over South Africa periodically, as long as we have any knowledge of its history, may have blotted the inhabitants off the face of the earth and left the city to fall into ruins;" and he gives historical instances of such raids in 1570 and 1602 (pp. 102–3). Clearly, what he means is not "the same *race*," but "a people of identical *culture*."

One final cavil. The descriptions of the excavations would have been easier to follow if the exact sites and extent of the trenches had been shown on the plans.

J. L. M.

HISTORICAL GEOGRAPHY.

History of Cartography.

'Die Reformation der Kartographie um 1700.' Von Christian Sandler. With Atlas of facsimile Maps. Munich and Berlin: R. Oldenbourg. 1905.

No period could be named more important for the history of cartography than that which formed the borderland between the seventeenth and eighteenth centuries. Prior to the elaboration of accurate methods for the astronomical determination of longitudes, the maps of even the most careful workers could stand on no certain basis, and we find enormous discrepancies in the positions assigned even to the most important places, in those of the seventeenth century. Dr. Sandler has done good service in tracing the progress of reform, which began in the early part of that century, but reached its culmination only with the advent of the eighteenth. The part played by Delisle in this reform, towards which the whole study works up, is matter of general knowledge, though the services rendered by him, as compared with those of his successor D'Anville, have not always met with quite the recognition they deserve. But by going back to the first beginnings of the movement, and assigning to each actor his proper place in the complete performance, the author has treated the subject in a far more instructive manner than could have been the case had he began and ended with the labours of any one man.

The maps of the sixteenth and early seventeenth centuries were all alike seriously at fault in the undue extension, in longitude, of the old world, and especially the Mediterranean. And though the experience of sailors had long suggested that this was the case, the map-makers, as distinct from the compilers of hydrographical charts, held fast, with few exceptions, to their stereotyped ideas. With the continued advance of astronomical science, the basis of reform was in time supplied, but even before the tables of Cassini had provided the means of determining longitude by observations of Jupiter's satellites, attempts had been made to evolve some sort of order out of the existing chaos. The tables of positions industriously collected by men like Kepler, Varenius, and Riccioli show considerable improvement. Thus apart from Constantinople, the longitudes assigned by Kepler to European places only once show an error of more than 1°. The map issued in 1630 under his auspices with the aid of his friend Eckebrecht ('Remarkable Maps:' F. Muller, Amsterdam, Part 2, No. 8) is noteworthy for its comparative accuracy as regards longitude, though this merit has not, Dr. Sandler points out, been sufficiently recognized. When once the tables of Cassini (1668) had supplied the needed facilities, further progress was assured, and that France, now at the height of her political power, took the lead in the reform, is an instance out of many of the impetus given to geography and allied studies by political conquests.

The new data obtained through the labours of the French academicians—Cassini, Picard, De la Hire, and others—were at first incidental to more strictly astronomical work, but reliable longitudes were gradually accumulated, while the surveys for the new map of France led to progress on geographical lines. The expedition for the determination of the longitude of Cape Verde in 1682 was the first undertaken by the academy for purely geographical purposes. The work of the Jesuits also helped, and the *Connaissance des Temps* could report in 1691 that 109 fixed positions were available. The first *modern* map, that of 1682, was constructed on the principle of reducing all the old longitudinal distances in the proportion deduced from such newly fixed points, and the result was on the whole satisfactory. Only twice more, before Delisle, was any practical attempt made to utilize the new material—in the 'Neptune François,' and in the maps of Nicolas de Fer—in the latter case with but slight success.

The last part of the memoir puts forward in clear relief the achievements of Delisle, who was able before his death to complete the task he had set himself in beginning his labours. Dr. Sandler discusses his methods and shows how they bore fruit in the accuracy of his results. The accompanying portfolio of reproductions supplies an excellent means of testing the latter, the true outlines of the continents being shown above the facsimiles on transparent paper. Dr. Sandler shows throughout a full knowledge of his subject, and is to be congratulated on the achievement of an excellent piece of historical work.

THE MONTHLY RECORD.

EUROPE.

The Eruption of Vesuvius.—Among the earliest scientists to visit Vesuvius after the late eruption was Dr. Venturino Sabatini, of the Reale Comitato geologico d'Italia, from whose report the following authentic description of the outburst and its results, sent to us by Dr. Peucker of Vienna, has been taken. The eruption brought to a close a phase in the activity of the volcano which had lasted thirty years, during which period the crater formed in 1872 became gradually filled by the quiet welling up of lava in the interior, only a few of the eruptions making their effects visible externally, though in course of time the piling up of material changed the profile of the summit considerably. Between 5 and 6 a.m. on April 4 a fissure opened on the south-eastern side of the cone at an altitude of 3600 feet, an avalanche of blocks of all dimensions destroying the Albergo Fiorenza, while a narrow stream of lava flowed down a gully of the mountain-side. At 3 p.m. the small lateral cone fell in, and a dense column of smoke rose above the crater, black ashes falling at Naples in the evening. On April 5 a second fissure opened at a lower level, and a lava-stream flowed 2½ miles to within some 500 yards of Bosco Trecase. On the 6th a still more copious stream poured forth, and by midday of the 7th had approached to about 500 yards from Torre Annunziata. By the evening the main crater began to hurl out huge white-hot blocks, with the accompaniment of loud detonations and flashes of light, while at the same time a rain of lapilli and ashes began the destruction of Ottajano and San Guiseppe. Earthquake shocks were felt at Naples and elsewhere. On the 8th the ashes, which continued to fall in great quantities, were reddish-grey, instead of black as at first, and were sometimes so dense as to form a dark pall, rendering artificial light necessary in the daytime. This cloud extended to a distance of 100 miles, while a fall of ashes took place at Venice, Paris, etc. A rough calculation places the total amount of ashes and lapilli which fell at 85 million cubic metres, the place most damaged being Ottajano. The lava-streams occupied a sector of 30°, and evidently had their source at various points of the crater. The three principal ones reached a height of 10 to 12 feet, and in places double this amount. This lava was very rapidly disintegrated, probably because it was formed of a chaotic mixture of irregular blocks and fragments. As regards the more general results, Dr. Sabatini points out that, while lesser outbreaks increase the height of the volcano, a catastrophe like that of April last tends to lower it. Whatever may have been the case in 79 A.D., we know that this was the result in 1631 and 1794, when the cone appeared after the eruptions as if truncated. Similarly, the pointed profile of March last exists no longer, and the present height seems below that of the crater of 1872, though the reduction does not probably exceed 330 feet. Besides this, the whole form and composition of the surface of the mountain have been changed, the old fissures having disappeared, whole sections of the crater wall fallen in, and the whole surface having been covered with a thick layer of ashes. These still retained a high temperature on April 14, and, owing to their loose nature, were constantly slipping downhill or being raised into the air by the wind. Except at the time of the most violent outbursts, the smoke rose quietly from three fissures in three unbroken columns, accompanied by puffs of smoke much resembling balls of cotton-wool. Owing to their great density, these rapidly fall to the ground, and as the density and weight increase, give rise to the avalanches of hot ashes which have been frequently reported, and of which the occurrence is now definitely established. They are really nothing but the so-called "glowing clouds" of very restricted mobility, and the phenomenon (as had been thought by Prof. Lacroix from his observations of Mont Pelé) may occur whenever the necessary conditions are present, and may occasionally lead to destructive results. These emissions may account in part for the high temperature retained by the ashes, which seems due also to emissions of steam at certain spots. The emission of nitrogen or other poisonous gas seems to have been quite an exceptional occurrence. Although the accounts of destruction were in many cases exaggerated, Dr. Sabatini considers that the damage may be reckoned at certainly over a million pounds sterling.

Glacial Traces in the Steiner Alps.—With a view to the discovery of traces of glaciers in the Ice age, Dr. Roman Lucerna has subjected the interesting group of the Steiner Alps to a searching investigation. The results are published in the *Geogr. Jahresbericht aus Osterreich*, which, after an interruption of several years, now appears in its fourth year, in conjunction with the *Bericht des Vereines der Geographen a.d. Universitat Wien* (Vienna, 1906), under the editorship of Privat-dozents Dr. Alfred Grund and Dr. Fritz Machacek. The group arises on the frontier of the three Austrian crownlands, Steiermark, Carinthia, and Krain, and rounds off the southern calcareous Alps in the east. In Penck and Brückner's great work, "Die Alpen im Eiszeitalter," it is omitted. For the present only traces of the most recent of the four Ice ages of the Alps brought to light by Penck, the so-called "Würmeiszeit," could be demonstrated with certainty. There is, however, no doubt that the character of the glaciation of the Steiner Alps in the Ice age is throughout causally connected with that of the other Eastern Alps. Of peculiar interest is the demonstration that the marked local glaciation of the group has kept altogether apart from the glacier system of the other Alps. In the Ice age the Steiner Alps, with their glaciation, formed an advanced post over against the ice-free land in the east and south. Of the fifteen glaciers which, during the younger Ice age, descended the four principal valleys of the group, two were great composite ice-flows. These, during the period of retreat, resolved themselves into different smaller glaciers. Finally, there were only cirque-glaciers, as to-day there are only snow-beds, lasting through the summer.

Results of the German Census.—The results of the German census, which was taken on December 1 last, represent the total population of the home empire as 60,605,183 persons, an increase of over 47 per cent. since 1871, and of 7·52 per cent. since the census of 1900. A study of the distribution of the increase among the various parts of the empire shows that Prussia, with nearly two-thirds (37,278,820) of the total population, has grown at a greater rate than the rest of Germany, the increase in the number of its inhabitants during the past five years being 8·14 per cent. Growth has been most rapid in the three western provinces in the valley of the middle Rhine—Westphalia (13·50 per cent.), Rhineland (11·74 per cent.), and Hesse-Nassau (9·07 per cent.)—which, with an area of less than one-fifth of that of Prussia, contains nearly one-third (12,124,052) of its population. In the county (Regierungs-Bezirke) of Potsdam there has been an exceptionally rapid increase in the population, the number of inhabitants being returned as 2,327,853, or 20·66 per cent. more than in 1900. The city of Berlin, the population of which is enumerated separately, had last December 2,040,222 inhabitants, an increase of 8·01 per cent. In no province or county of Prussia was there a decline in the population during the inter-censal period, but the growth in the eastern provinces, occupying the sandy North German plain, was below both the average for Prussia and the average for the German Empire. In the province of East Prussia the rate of increase was only 1·46 per cent. (in the previous five years, however, a decline had been registered); in the province of West Prussia it was 5·01 per cent., in the county of Frankfurt (Brandenburg) 1·93 per cent., in the province of Pomerania 3·02 per cent., and in Posen, Silesia, and Prussian Saxony between 5 and 6 per cent. In Hanover the rate of increase rose again to 6·52 per cent., while in German Jutland (Schleswig-Holstein) it exceeded the average, being 8·38 per cent. Outside of Prussia the population of the two great southern kingdoms, Bavaria and Wurtemburg, comprising much of the south-western highlands as well as the alpine foreland of Germany, rose by 5·45 and 6·03 per cent. respectively, and amounted last December to 8,813,154, while the already densely populated kingdom of Saxony, with 4,502,350 inhabitants, had increased its population by 7·14 per cent. In the Grand Duchy of Baden (2,009,320 inhabitants), bordering the right bank of the upper Rhine, the rate of increase was precisely that of the German Empire—7·52 per cent., while in Hesse and Oldenburg it reached 8·14 and 9·77 per cent. respectively, furnishing another instance of the rapidity with which the population is increasing in western and north-western Germany. Among the small states bunched together in the highlands of Central Germany, the rate of increase was comparatively small—mostly 3, 4, and 5 per cent. It is noticeable that in Alsace-Lorraine, the population of which declined from 1871 to 1885, there has been since the latter date a progressive increase in population, the percentage of growth during the past five years being 5·53 and the actual population last December 1,814,626, or 265,000 more than in 1871. The continued tendency of population to accumulate in large cities is illustrated by the returns for the Hanse towns, the increase in the case of Hamburg (free city and state) being 13·89 per cent., in the case of Bremen 17·14 per cent., and in the case of Lübeck 9·38 per cent. The male population of Germany (29,868,096) is still slightly less than the female population (30,737,087); but, taking the empire as a whole, the proportional increase in the former (7·68 per cent.) has been slightly in excess of the increase in the latter (7·36 per cent.).

The Topography of Numantia.—A careful investigation of the topography of Numantia has lately been carried out by Prof. Adolf Schulten, who publishes the results in the *Transactions of the Royal Scientific Society of Göttingen* (vol. 8, No. 4, New Series, philologico-historical class). The memoir, which fills 112 quarto pages, reconstructs in large measure the Iberian Numantia, its buttresses, cofferwork walls, fortifications, site of town, population, temple, wells, coins, handmills, etc. It also restores in great part the topography of the famous siege circumvallation of town, camps, strongholds, curtains, wall, moat, signal towers, etc. These points are brought home by three maps and eleven plans. So much having been accomplished, the Academia de Historia will, Prof. Schulten hopes, complete the excavations they began in 1861, and so contribute to the elucidation of Iberian antiquity and of Roman warfare in the time of Scipio and Polybius, doing for Numantia what Napoleon III. did for Alesia. The name of Numantia the author traces through Roman, mediæval, and later literature, showing how in the progress of the centuries the views about the famous city underwent modification and correction. The first serious endeavour, however, to fix its topography was made by Edoardo Saavedra. While in the province of Soria, superintending the building of roads and exploring the Roman roads, he, in 1853, made the first methodic excavations, but, from want of funds, confined to the immediate environment. His treatise of 1861 induced the Academia to extend the excavations. The commission entrusted with the conduct of the undertaking concludes its report with, "que sin interupcion se continuen los trabajos emprendidos en el Cerro de Garray." In 1886 there was in Soria a great commemoration festival, and the hill of Numantia was bought in order to rescue the remains of the historic town from the peasants of Garray. The peasants all the same continue to turn to account, as a stone quarry, the city hallowed by great memories and sung by national poets. To Prof. Schulten has been reserved the merit of rescuing for the world the geography of a great historic action.

ASIA.

Russian Glaciers.—M. J. Shokalski has collected notes on glaciers within the Russian Empire made by travellers during the years 1902 and 1903, and has published them in the *Izvestiya* of the Russian Geog. Soc., vol. 40, No. 4. The glaciers of the Caucasus, the Tian-shan, of Munku-Sardik, and the Ala-taus have been investigated, and several new discoveries are recorded. On the southern Tuyuk-su glacier, in the neighbourhood of Verni, measurements of the movement of the ice were made by Mr. S. Y. Dmitriyef in the month of August. The ice moved 214 mm. (about 8½ inches) in twenty-four hours, and at this rate it would take not less than forty-five years for particles of the snowfield to reach the foot of the glacier.

Dr. M. A. Stein's New Expedition to Central Asia.—Dr. Stein, whose excellent archæological and geographical work in Central Asia is well known to readers of the *Journal*, has just started on a new expedition, with the object of extending his researches in the same region. Dr. Stein's project, though only now taking definite shape, was formed some two years ago, before any of the expeditions now in the field with similar objects were in contemplation; and so far back as September, 1904, an application was addressed by him to the Indian Government for its sanction to the proposed resumption of work. It was, however, necessary that, before starting once more for Central Asia, Dr. Stein's official report on the results of the earlier journey should be ready for press. Thus, although the co-operation of the Government, and a generous grant towards expenses from the trustees of the British Museum, were obtained, it was only on the final completion, a month or two ago, of that report (to be published by the Clarendon Press under the title 'Ancient Khotan') that he was able to bring his long-meditated project to a head. Dr. Stein is proceeding to Chinese Turkestan *viâ* Chitral, Wakhan, and the Pamirs, and he hopes to resume his explorations along the southern edge of the desert, afterwards extending them further east towards the westernmost confines of China. He will endeavour to make use of any opportunities that may offer for exploratory work of a geographical nature in or near the regions visited for archæological research, and his efforts in this direction will be reinforced by the services of Rai Ram Singh, the native surveyor who accompanied him on his former journey, which have again been placed at his disposal by the Survey of India Department. Writing from Sarhad in Wakhan on May 19, Dr. Stein reported that, in spite of the abnormally heavy snowfall of the present year, he had successfully crossed the difficult Lowarai pass (10,200 feet) on May 4, though it is likely to remain closed for normal traffic far longer than usual. During his rapid march through Chitral and Mastuj, he had made an interesting study of ancient Buddhist rock-carvings, survivals of Indian architectural ornament, and pre-Mohammedan sites, including that of the old chief settlement of Mastuj, mentioned in Chinese annals. Since the British pacification of the country, the incipient pressure of population is leading to the re-occupation of patches of arable land in places where cultivation had ceased for centuries. Chitral is an important field to the ethnographer, owing to the shelter it has given to tribes unable to hold their own elsewhere, and the exact anthropological measurements which Dr. Stein was able to make will be of great value. He says that the physical affinity between the "Dards" of Chitral and the Iranian hill tribes on the upper Oxus is as marked as the linguistic. An ascent to the Darkot pass (*circ.* 15,400 feet) showed that the topographical details given in the Chinese account of an invasion of Yasin and Gilgit in 749 A.D., agree remarkably well with the route from Sarhad across the Baroghil saddle to the pass mentioned. Dr. Stein received the most cordial assistance from the Afghan authorities in Wakhan, without which the crossing of the Baroghil pass would have been a matter of difficulty owing to the heavy and soft snow. He hoped, during his stay in the country, to be able to elucidate the early Chinese records and to make a survey of the ancient forts, etc., which still survive. All who are acquainted with Dr. Stein's previous work will feel confident that valuable results may be expected from this new expedition.

Austrian Explorations in Asia Minor.—The Austrian archæological excavations on the site of the ancient Ephesus, conducted by Benndorf at Ajasoluk, were supplemented in the autumn of 1905 by physio-geographical investigations carried out by Dr. Alfred Grund, of Vienna. In the territory of the mouth of the Kuchuk Menderes, or Little Mæander, the archæologists had themselves lighted upon traces of advance of the coasts within historic times amounting to the extraordinary distance of 5 miles. Dr. Grund has now, in general, confirmed the authenticity of this finding. On the other hand, by ascertaining causes and the sequence of the epochs at which the respective advances happened, Dr. Grund has notably supplemented the discovery. There is no longer any deposition by the river; on the contrary, the river empties its alluvium into the Ægean sea at the Gulf of Scalanova to the north-east of the island of Samos. There the alluvium is seized and dragged into the coastal current. The accretion of land follows by purely marine agency, through the formation of new beach-walls. Nearly 2 miles above its mouth the river begins to run between such marine beach-walls. An examination of the ancient building-works, in their relation to the different types of the land formation, yielded the fact that since the beginning of the Christian era the accretion of land must have been effected solely by the agency of the sea. The interior part, on the other hand, of the former bay of the sea penetrating deeply between mountains, has, to a length of over 3 miles, been filled up by the river. This delta, too, must have been formed in the short period of the last seven centuries B.C. The subterranean water of Ajasoluk is still at this day saline. The cause of so great a rate of deposition can be ascribed only to a sinking and subsidence of the valley immediately preceding the historic age. Within the historic age there can have been no further vertical displacement.

The Sakas of the Old Persian Empire.—Among the peoples which formed part of the Persian Empire under Darius were included the Sakas, frequently mentioned by Herodotus and in the inscriptions of Darius, though without any certain indication of their dwelling-place. The subject has been frequently discussed by commentators, but has not yet been quite satisfactorily disposed of, so that a re-examination of the data by Mr. F. W. Thomas, in the *Journal of the Royal Asiatic Society* (January, 1906), is of some interest. The question is complicated by the fact that the name Σάκαι is not always used of precisely the same people, but has a more or less generic sense as applied to various groups of "Scythians." One branch is spoken of as "Sakas beyond the sea," *i.e.* dwelling in Europe. Previous writers have thought that the Asiatic Sakas mentioned in the geographical enumerations of Darius dwelt in the far north-east of the Persian Empire, possibly in the mountainous country about the sources of the Oxus and Jaxartes, but in this case a difficulty is caused by the mention of a "sea" crossed during Darius' campaign against the Sakas. Mr. Thomas suggests that this sea was the Hamun lake, in the vicinity of which was the Sakastana of Isidor of Charax (time of Augustus), though it has been supposed (on quite insufficient grounds, Mr. Thomas holds) that the settlement of Sakas in the modern Sistan dates only from the end of the second century B.C. In favour of this writer's view is the fact that the Sakas are associated by Darius with the Makas (people of Makran), while, as Gedrosia is not mentioned in the enumerations of Herodotus or Darius, the area covered by Sistan would be entirely omitted unless represented by the country of the Sakas. Mr. Thomas thinks that in ancient times the whole mountain region as far south as Sistan was, in fact, "Scythian," a term which seems to be used generally of people of nomadic habits. Mr. Thomas notes that the idea of early Sakas about the Hamun lake is not entirely new, but it had previously been reached by a totally different line of argument.

The Russian Expedition to the Khatanga.—This expedition (*Journal*, vol. 25, p. 564; vol. 26, pp. 86, 332), has completed its labours and returned to St. Petersburg. Its result has been materially to alter the delineation on the map of the courses of the Khatanga and its branches, and of the various lakes of the region, some of which have no existence as hitherto shown. Ethnographical and zoological observations have also been made.

AFRICA.

Condensation from South-East Clouds on Table Mountain.—We alluded, a year or two ago (vol. 24, p. 96), to experiments carried out on Table mountain by Dr. Marloth with a view to ascertaining the amount of water-supply which might be due to the condensation of the moisture from the south-east clouds on the surface of vegetation, as distinct from the actual fall of rain. The figures obtained were so large as to induce a doubt as to the trustworthiness of the results, it being pointed out that an isolated group of reeds, such as were used by Dr. Marloth, might capture a large amount of moisture, but that in the case of a more extended covering of vegetation the outer row of plants might screen those behind and impede their action. Further experiments have, therefore, since been made and are described by Dr. Marloth in the *Transactions* of the South African Philosophical Society (vol. 16, 1905, part 2). Several gauges with reeds were employed, one being placed in the open as before, while others were placed in the midst of closely growing bushes or reeds. The results proved that, while a considerable screening effect is exercised by the outer rows of bushes, especially during short periods of cloudiness, the quantity which did reach the sheltered gauges during longer periods of south-east clouds was far in excess of the total rainfall for the corresponding period. It is not, however, correct to assume that the difference between the records of a gauge with reeds and one without is wholly due to condensation by the reeds, for it was ascertained that during rain the gauge with reeds collects much more water than the ordinary one, but that the most pronounced difference occurs during misty rain, which shows how effective vegetation is as compared with bare ground in capturing moisture apart from real rain. Dr. Marloth endeavours to show by calculations that the amount of moisture available in the south-east clouds must be far more than many miles of reeds could ever capture, the soaking effect of these clouds being exceptionally great as compared with those from other quarters.

Population of Morocco.—In the May number of *La Géographie* appears an interesting series of extracts from a number of letters that have been addressed to a member of the Paris Geographical Society by Captain N. Larras, a French officer who has been detached for service in Morocco since 1898, and who has chosen this means of making known the results of a very careful investigation he has made into the size and distribution of the population of Morocco. Previous estimates have differed greatly; the totals adopted by Erckmann and Rohlfs, 8,000,000 and 6,500,000 respectively, exceed some enumerations and are greatly exceeded by others. But by extensive personal observations, by a study of the personal observations of other travellers, and by judicious inquiries among the Moors themselves, Captain Larras has arrived at results which he considers to approximate more closely to the truth than it has been possible for earlier estimates to do. He distinguishes between three regions of Morocco: (1) Atlantic Morocco, from Tangier to Mogador; (2) the Atlas-Riff country, with which is included the valley of the Muluya draining into the Mediterranean and the valley of the Sus descending to the Atlantic; and (3) the Saharan borderland. The first region comprises most of the large towns, including Fez and Marrakesh, and may be described in general terms as a fertile, well-populated country; but here, as elsewhere in Morocco, the distribution of the population is very unequal, so unequal, indeed, that Captain Larras affirms that between any two points 100 kilometres apart it is possible to journey by alternative routes so chosen that along one the country will appear two or three times as rich as along the other. After carefully estimating the population district by district, tribe by tribe, city by city, Captain Larras has arrived at the conclusion that the number of inhabitants in this region is about 2,200,000. As regards the mountainous zone, the *diara*, or tribes of the *dir*, *i.e.* of the country at the foot of the Atlas, occupy fertile lands, and are fairly rich and numerous; but among the mountains the valleys are narrow and afford shelter to only a very scanty population living in the *chur* (singular *char*), or unfortified hamlets which line the river-banks. Thus Captain Larras estimates the population of the Atlas-Riff country at no more than 1,500,000, and adding 200,000 inhabitants for the valley of the Muluya and a like number for the Wad Sus and the country stretching south as far as but not including the Wad Draa, he arrives at 1,900,000 as the total population of the second of the three regions he distinguishes. The third region, stretching from the southern slopes of the Atlas into the Sahara, comprises the valleys of the Wad Draa, the Wad Ziz, and part of the Wad Gir. Save for a few nomad and robber tribes, the inhabitants of this region are collected in the *ksur*, or fortified villages along the lines of the streams of water that flow above or below ground. To the basin of the Wad Draa Captain Larras assigns a population of from 100,000 to 250,000; to the basin of the Wad Ziz (including Tafilelt) from 120,000 to 200,000; and to the Wad Gir, together with Figig, from 20,000 to 30,000. According to this estimate, the maximum figure for the population of the Saharan borderland of Morocco is under 500,000, so that in the three regions enumerated by Captain Larras the total population would be at most 4,600,000. Contenting himself with the conclusion that the population of the country lies somewhere between 4 and 5 millions, Captain Larras expresses his own conviction that the right number is nearer the smaller total. It is to be noted, however, that in the early part of his study of the question Captain Larras declares himself of opinion that, in spite of a heavy infant mortality and the number of deaths from violence, the population of Morocco ought, under no worse conditions than have prevailed during the nineteenth century, to be on the increase.

AMERICA.

The Adirondacks.—An instructive paper on "The Physiography of the Adirondacks," by Prof. J. F. Kemp, appeared in the March number of the *Popular Science Monthly* (New York, 1906). The area dealt with, which lies in the northern part of the state of New York, is mountainous to the east, but has more of the character of a plateau (though with minor irregularities of surface) to the west. Geologically it consists of a core of crystalline rocks of pre-Cambrian age, on the flanks of which Cambrian and other Palæozoic strata have been laid down. There is no evidence that any newer rocks were laid down until the advent of the Labradorean ice-sheet of the glacial epoch, though whether the area has always been above the sea from the close of the Ordovician to the present cannot be decided with certainty. The extensive glacial deposits are of much importance, as they have greatly modified the relief and drainage system. The mountains are ranged in distinct north-east and south-west lines, and many of their faces are precipitous; but they cannot be described fully without reference to the valleys, which seem to be of two distinct types. An older series probably dates back in part even to pre-Cambrian time. These valleys have gentle slopes and wide openings, and their softened contours suggest long-continued erosion and maturity of form. The existing rivers often pass from a valley of this type to one of the other series, which has been superimposed upon the first. It is obviously, according to Prof. Kemp, the result of faulting, and this of no great geological antiquity, all the characters of a Graben-Senkung or rift-valley being often observable. While the main directions of the older valleys are north and south, east and west, the most marked of the series of fault-escarpments which define valleys of the newer type is north-east, to this being due the general trend of the mountains. A second but less marked series of faults runs north-west and south-east, and is the cause of many cross-breaks which form passes across the ranges, and develop sharp shoulders in the main precipices. A minor series trending due north may also be recognized. In the drainage system one of the most marked features is the rectangular bending between north-and-south and east-and-west courses displayed by the upper Hudson and its tributary the Sacondaga, which may be in part due to rearrangements of the older drainage by glacial drift. The ice, which came from the north-east, rode over the highest mountains, and traces of its action may be seen in the form of cirques, etc. In reference to Prof. Kemp's paper, Prof. Davis, in *Science* of April 20, raises the question of the age of the fault systems, pointing out that the precipitous sides of the valleys might conceivably be due, not immediately to faulting, but to differential erosion, which has removed the weaker strata on one side of the displacement. Prof. Kemp, in a reply, is inclined to adhere to his belief in a comparatively late (post-Cretaceous) faulting, and in support of this gives instances where the rift-valleys strike across the general structural trend.

Geography in Peru.—The annual memoir of the Geographical Society of Lima for 1904 (*Bulletin de la Sociedad Geographica de Lima, Memoria Anual y Anexos*, 1904) records much energetic work during the year, and a well-considered attempt to extend the society's usefulness. It was resolved to establish geographical centres to correspond with the society at Lima. Already there is a centre at work at Arequipa, where the Howard observatory offers special facilities; another at Iquitos, and a third at Ancachs, each with a programme of work. The instruments required for fixing the exact positions of the cities in Peru were decided upon by Admiral Meliton Carbajal. The list was submitted to the R.G.S. President for his advice and help, and Mr. Reeves was so good as to give valuable assistance. The instruments are now expected to arrive at Lima, and a trained geodesist is to be appointed, probably from the United States, to take the observations. The Society has resolved to grant a gold medal every two years to the best scientific explorer within the limits of the republic. In one respect the Peruvian geographers are in advance of ourselves, for they have commenced the formation of a museum. The number also contains a detailed account of the important journey of Baron Erland Nordenskiöld, a synopsis of Peruvian earthquakes, and a table of the political divisions of the republic. The boletin certainly shows that there is well-considered and sustained activity among Peruvian geographers.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Mountain Morphology and Erosion.—In reference to the memoir of Dr. Liez on the distribution of mean elevation in Switzerland (*Journal*, vol. 24, p. 675), Prof. L. Gobet seeks, in the *Bulletin de la Société Neuchateloise de Géographie* for 1905, to elucidate certain principles which may be brought out by a closer study of Dr. Liez's maps. Chief among these is the relation between distribution of altitude and the work of erosion. This is not necessarily so simple and immediate as might at first sight appear, for, however clearly the actually existing relief may be due to erosion, it is not always easy to determine what events in the past geological history of the particular range, or of alpine mountains in general, may have contributed to the present state of things. Attention has often been called to the general agreement in the altitudes of the highest peaks over considerable areas, and to the fact that the greatest altitudes of all commonly lie towards the centre of the range or of its individual groups, and these points are once more emphasized by the study of distribution of altitude in the Alps. Prof. Gobet is inclined to attribute these facts, in the main at least, to the work of erosion, pointing out how generally the highest summits are found just where the base-level of erosion (which may be taken, for various parts of the Swiss Alps, as that of the different lakes receiving the drainage) is itself highest or most remote. This relation may seem a more or less obvious one, for it is evident that, after the first elevation of a mountain range, erosive agencies will act with greatest force from the outer margins, thus lowering the outer parts first, and bringing about a certain regularity in the ultimate arrangement of the relief. But as greater prominence is often given, especially by the adherents of the peneplain theory, to other possible causes, such, as the warping to which the old denuded surfaces is supposed to have been subjected during uplift, it is well that the possible sufficiency of erosion to explain the facts should also be kept in view. In a recent note in the *Bulletin* of the American Geographical Society (suggested by the paper of Mr. Daly, noticed in the *Journal*, vol. 26, p. 565), Prof. Heilprin expresses doubt as to the general prevalence of the arch-form in mountain ranges, but, while asking for stronger evidence in favour of the peneplain theory than has yet been given, thinks that the problem is more complex than is supposed by some.

German Oceanographical Expedition.—The *Planet*, a new vessel specially built by the German Admiralty for survey work, sailed from Kiel in January last on a voyage to the western Pacific, where she will replace the older *Mowe*. The outward voyage is so arranged that as much scientific research as possible in the departments of oceanography and meteorology may be carried out. Among the points to be specially studied in the Atlantic was that of the conditions in the upper atmosphere, with a view to elucidating the interchange of air between the equator and the "Ross-latitudes." The oceanographical programme includes soundings, determinations of temperature and salinity, study of the bottom deposits, wave-measurements, and so forth, and the route has been chosen so as to give as good results as possible on these subjects. The commander is Captain Lebahn, and, in addition to the naval officers, several scientists, including Dr. Krämer (known for his work on Samoa), have sailed in the *Planet*, which reached Durban in May. The further route will lead by Colombo, Batavia, and Amboyna to the Bismark archipelago, and, after surveying for a time in the latter, the ship will make a cruise to the Carolines, Mariannes, etc., special attention being devoted to the deep channels which exist to the east of the Philippines and Mariannes. The *Planet* is provided with special apparatus for photographic surveying.

GENERAL.

Testimonial to the late Hydrographer.—It has been decided by the friends of the late Sir William Wharton to establish a memorial in the form of a fund, the annual proceeds of which shall be given, like the Beaufort Testimonial founded in honour of a former hydrographer, to the officer who has passed the best examination in mathematics and nautical astronomy for lieutenant in his year. Contributions towards this object are received by Messrs. Coutts & Co., of 440, Strand, and if the funds collected admit, it is proposed to give in addition a medal with a bust of the late hydrographer.

Dr. von Neumayer.—The veteran German scientist, Dr. Georg von Neumayer, late director of the *Deutsche Seewarte*, who since his retirement has taken up his abode at Neustadt, in the Palatinate, attained the age of eighty on June 21, and the occasion was made the subject of an interesting celebration by his many friends and admirers. The celebration took place on June 16 and 17, the "Festrede" being delivered on the latter day by Dr. S. Günther of Munich, while a dinner was held later in the day. It is proposed, if sufficient funds can be collected, to found a "Stiftung" for the encouragement of research by young geographical students, while arrangements may possibly be made for the painting of a portrait of Dr. Neumayer, to be placed in the Historical Museum at Speier.

The Twenty-seventh Congress of French Geographical Societies will be held this year at Dunkirk, the session being opened on July 29. The Geographical Society of Dunkirk, in whose hands are the local arrangements for the organization of the meeting, will at the same time celebrate the twenty-fifth anniversary of its foundation. An invitation to be present and to contribute papers or discussions, is cordially extended to members of our Society.

International Seismological Association.—We are informed by Dr. Gerland, the director, that the central bureau of this association, founded at the second International Earthquake Conference at Strassburg in 1903, is now fully equipped and in working order in that city. The installation consists of the most approved instruments, by which a complete series of observations will be made, the seismograms being preserved for future reference, and made available for students who may visit the bureau. It is asked that information be sent regularly to the bureau (the address of which is 10, Schwarzwaldstrasse, Strassburg, in the same building as the Central German Seismological Station) regarding observations taken in other countries represented by the association.

Course on Oceanography at Bergen.—As in former years, a course of instruction in oceanography is being organized at Bergen for the University vacation of the present summer (August 8 to October 15). It will include both lectures and practical work, covering most of the branches of oceanographical research, and the fee charged is about four guineas. All wishing to attend the course are instructed to apply at once to the Oceanographical Institute of Bergen Museum, Bergen, Norway.

OBITUARY OF THE YEAR.

The following is a list of the Fellows who have died during the year 1905–1906 (April 30):—

John Adams; Sir A. J. Adderley; W. J. d'E. Andrews; Captain E. Ball; T. J. Barnardo; Dr. Alfred Barton; Alexander Begg; Dr. W. T. Blanford; G. C. Bompas; James Bonwick; Major W. A. Boulnois; Colonel M. Bowie; Admiral Lindesay Brine; Captain R. J. W. Bristow; G. W. Brocklehurst; James R. Brown; J. Russell Buckler; A. H. Cane; Thomas Christie; Charles Churchill; John Cohen; Captain Claud Clark; Henry Clifford; Admiral the Hon. A. Cochrane; H. Harper Crewe; A. C. S. Draper; Cairns Deas; Sir Mountstuart E. Grant-Duff; George A. Everitt; Sidney Fleming; John Beach Fleuret; Colonel Sir John Farquharson; Colonel O. B. Fielden; Lieut.-Colonel A. Feez; Sir A. C. Gregory; Colonel F. C. T. Gascoigne; Thomas Greer; F. Gaskell; S. H. Hinde; J. McAlister Hall; Rev. H. W. Hussey; F. J. Horniman; Henry George Hollingworth; Colonel L. H. L. Irby; N. Lloyd Jones; J. M. C. Johnston; J. W. Johnston; E. Powell King; Philip King; H. F. Keep; J. F. Kane; P. C. Leckie; Lieut.-Colonel A. B. Loder; Rev. J. R. Langler; Commander W. M. Latham; Jas. A. Marshall; C. E. Mathews; E. M. Marcoso; Captain W. D. McSwiney; Rev. D. S. McClean; Sir G. G. Petre; H. G. Parsons; F. A. P. Pigou; M. Elisée Reclus; Sir P. N. Russell; Baron von Richthofen; C. S. Roundell; John Rudd Rainey; Colonel H. A. Sanford; Victor Streich; General A. A. Stewart; Dr. J. F. Stewart; Rev. Haskett Smith; James Tees; Charles Twite; W. Tufnell; Coutts Trotter; Robert Taylor; Michael Williams; Major von Wissmann; G. A. Witt; Lieut. G. M. Wheeler; Captain J. Wiggins; Admiral Sir W. J. Wharton; Sir Charles Wilson; George Weller; Captain G. Williams-Freeman; Norman Wrigley.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1905–1906.

Anniversary Meeting, May 21, 1906.—The Right Hon. Sir George T. Goldie, K.C.M.G., D.C.L., LL.D., F.R.S., President, in the Chair.

The Secretary read the Minutes of the last Anniversary Meeting, which were confirmed and signed by the President.

The Secretary read a list of the newly elected Fellows, and announced that there were eleven candidates for election.

Elections.—*C. A. Barron; John Arthur Cooper; O. S. Crewe-Read; Thomas Henry Davies; Arthur Wesley Dixon; Captain Oswald Arthur Gerald Fitzgerald; Captain Arthur St. Leger Glyn; Thomas Hamilton; John Hastings; Hyam Marks; Dr. William Michaelis; Robert Alexander Morrow; Arnold L. Mumm; Captain John W. Murray; Wm. Nicholson; Charles Russell; Reginald Schomberg; Captain E. de H. Smith.*

The Presentation of the Medals and Other Awards.

The President (addressing Baron Clauzel, representing the French Embassy): M. le Baron, the Founder's Medal of the Royal Geographical Society has been awarded, with the approval of His Majesty King Edward, to M. Alfred Grandidier, and as this savant, who is of advanced age, has been unable to come to England, His Excellency the French Ambassador has been good enough to depute you to receive the medal and to cause it to be conveyed to M. Grandidier. You, M. le Baron, are aware that M. Grandidier is one of the leading scientific men of France, and that he has rendered special services to geography. From 1857 to 1865 he travelled extensively in the Argentine, Bolivia, Brazil, Chile, and Peru, and also in India and Ceylon. Since 1865 M. Grandidier has devoted his life to the thorough exploration of the island of Madagascar, and to the publication of the results of this exploration, which include physical geography, geodesy, geology, and natural history in all its branches. His explorations enabled a valuable map to be made of the coast of Imerina, and of the central province of the Hova kingdom. In 1875 he began, with the co-operation of various savants, the publication of his great 'Histoire Physique Naturelle et Politique de Madagascar,' which, when completed, will form over fifty large quarto volumes. Altogether M. Grandidier's life-work has been of the highest value in scientific geography, and it forms the basis of our geographical knowledge of the island of Madagascar, which covers an area considerably larger than that of France itself. M. le Baron, in the pursuit of knowledge the Royal Geographical Society admits no distinction of race or nationality, but I think we may be permitted to feel especial pleasure in conferring this medal on the citizen of a country which has always been so thoroughly in the vanguard of geographical exploration as has been France. I now have the honour, M. le Baron, of handing you the Founder's Medal of the Royal Geographical Society, and I beg you to be good enough to transmit it to M. Grandidier with our best wishes.

Baron Clauzel briefly acknowledged the medal.

The PRESIDENT: Dr. Robert Bell, the Royal Geographical Society, with the approval of His Majesty the King, has awarded you the Patron's Gold Medal. You have been, until recently, the acting director of that Geological Survey of Canada which has, amongst its varied labours, done such magnificent geographical work in the Dominion. During forty-five years of field-work you have explored or mapped out so many areas of Canada that I have difficulty in reciting or even recalling more than the leading features of your varied work. Your surveys or explorations include the Gaspé peninsula, the coast of the Labrador peninsula, part of the coast of Baffin Land, and also of Hudson bay with some of its large islands, lakes and rivers innumerable, including the Nelson river with its tributaries, and the north shore of the St. Lawrence. You were in all the expeditions sent by the Canadian Government to Hudson strait and bay, and you were the geologist and naturalist of the *Neptune*, *Alert*, and *Diana* Expeditions. I understand you have written over two hundred Reports of various scientific explorations on different subjects; it is therefore with great pleasure that I now hand you the Patron's Gold Medal, as a Canadian who has done more than any man living to extend our knowledge of the vast areas of the Dominion.

Dr. ROBERT BELL: I find it quite impossible to adequately express my thanks for the great honour which this Society has conferred upon me in awarding me this beautiful medal. I may explain, just for a moment, as the President has mentioned it, how I come to be more or less connected with geography as well as geology. I have been connected with the Geological Survey of Canada for forty-nine years—fifty years next March—and during a great part of that time my work has been very largely geographical. As you are aware, fifty years ago the greater portion of British North America was almost unknown geographically. It was as little known, perhaps, as Africa at that time, so that it became necessary for us to do geographical as well as geological work. The country is so large that to an Englishman it is almost impossible to explain what we have to overcome. Our work extends from the Atlantic to the Pacific ocean and from the United States boundary northward as far as America extends, because not only the whole of the mainland north of the United States, but the islands to the north also belong to us, and in late years we have been operating in these parts, so that our work goes northward to Lancaster sound on the east and to Lower Yunkon territory on the west. My own surveys have been everywhere between these regions, and, indeed, if they were marked by lines on the map, they would cover the country with a network for about 1000 miles. A great deal of that country is exceedingly interesting geographically; but the Government has no reason to survey it except for geological purposes, and the surveys have extended to the distance I have mentioned from the comparatively narrow strip of inhabited land all along the American frontier. In that way I have necessarily surveyed, as carefully as possible, a very large part of Canada, and I feel deeply grateful to this Society for recognizing that work. This recognition is of the utmost value to me, as well as a very great honour, and I have again to thank Sir George Goldie and the members of the Royal Geographical Society for having awarded me the Patron's medal.

The PRESIDENT: Prof. Ramsay, the Victoria Medal was instituted by the Royal Geographical Society as a means of recognition from time to time of geographical research in any branch, including, as a matter of course, the applications of geography to history. You, sir, have been engaged for thirty years in research into ancient geography, and you are the acknowledged leader of European thought in that branch of study. Your work in Asia Minor has revolutionized the methods upon which such study is based, and has originated a whole school of students in this country, in France, and in Germany. The assistance which your labours have rendered to the understanding of important sections of ancient history can hardly be exaggerated. The Royal Geographical Society has published one monumental work of yours and many papers, and it is with great pleasure that I now hand you the Victoria Medal.

Prof. W. M. RAMSAY: While I feel deeply the honour which you have conferred upon me to-day, far more deeply than I can express in words, I must confess I feel still more pleased that the plan of exploration and study of ancient life and ancient art, which was formed in Oxford about 1879, which keenly interested many of the leading men in the university at that time, and which I was finally chosen to carry out, has been recognized so complimentarily by your Society. It was originally intended to be an archæological research. My own private tastes and interests turned it into an historical research, and I very soon found, in the process of studying history on the spot, that history rests on a basis of geography—a truth which you in this Society have no need to be informed of. It is like all great truths—practically an axiom, almost a truism; and when it is stated, one wonders that it takes a great part of one's life to learn that the history of man as he stands upon the Earth must be studied in the place on which it rests. This scheme, formed originally among purely classical scholars, and executed by one whose whole training had been classical and whose interests lay entirely in the department of ancient history—this scheme, which in that way is an offspring from the classical school of one of our great universities, has been at last chosen for special distinction by this Society, which represents the most advanced and the most progressive side of study in the whole range of modern investigation. It seems to me a really interesting fact in the present stage of educational controversy that a classical scheme has gained this honour which you have now conferred upon me, and, as I feel also, upon those who founded this scheme of research. I should only like to add one single word with regard to the death of a member of your Council, through whose advice at first this scheme took the geographical form which it gradually assumed. It happened in the beginning of the year 1880, when my wife and I landed in Smyrna, that Sir Charles Wilson, consul-general in Anatolia, happened to be in Smyrna for one day; and it was meeting with him on that day, and the advice he gave, and the practical instructions and directions he imparted to us, that determined the direction in which our studies and travels and work lay for the following seven-and-twenty years, and it is a matter of the deepest regret to me that his death deprived us of the opportunity of seeing Sir Charles Wilson present to-day to witness the conclusion of the work which he really directed in its first steps.

The PRESIDENT: The Murchison Award has been allotted to Major H. R. Davies, whose services to geography include explorations in the Kachin hills, the Shan States, Yunnan, and Siam from the year 1891 to 1895, and the exploration of trade and railway routes, from 1898 to 1900, in Yunnan and Se-chuan. We owe much of our knowledge of these highly important provinces of China to Major Davies, and the maps which the War Office are bringing out have been compiled by him and are largely based upon his own work. Major Davies, I have the pleasure of handing you the Murchison Award.

Major H. R. DAVIES: I feel very much honoured that anything I should have done should have been thought worthy of this award, but I do not at all wish to take all the credit of the survey work in Western China to myself. It was the work of several hands, and I should like to mention some of my comrades, and I hope I may consider that in giving me this award you have also wished to honour those who worked with me. Two of these, Colonel Manifold and Major Ryder, are already very well known to you. I need hardly remind you that Major Ryder was given a Gold Medal last year, after his journey into Tibet, while Colonel Manifold has read papers to this Society on his two journeys in Se-chuan. I should also like to recall to your memory the name of the late Captain Watts Jones, who, I am sorry to say, in a subsequent expedition lost his life in his zeal for exploration in China. I think those who know the work he has done will agree with me that geographical exploration has suffered a great loss in his early death. Others who worked with us, and who are responsible for a large part of the survey in Western China, are Major Pottinger, R.A., Captain Hunter, R.E., and Mr. Ker, C.E. I should remark that a great deal of the actual work was done by native surveyors of the Survey of India, and I think all who know their work will consider this a guarantee that it was well done. Two other travellers I should like to mention who travelled independently of us and did a great déal of survey work—Captain Fraser and Captain Rigby. They both filled in a large part of the southern portion of Yun-nan. I thank you again for the great honour you have done me.

The PRESIDENT: I have to announce that the recipient of the Gill Memorial, Major A. St. Hill Gibbons, is in South Africa at this moment, consequently we shall have to retain the Gill Memorial for him until he comes home. I will only mention his services to geography in the important exploring and survey work he did in Barotseland on his two expeditions in 1895–6 and 1898–1900. Major Gibbons's map, published in the *Geographical Journal*, shows clearly that for our geographical knowledge of northern Rhodesia we are largely indebted to his careful and conscientious work. At the close of his last expedition in Barotseland, Major Gibbons, practically single-handed, made a route survey, checked by observed latitudes, north to Uganda by Lakes Tanganyika, Kivu, and Albert Edward.

The recipient of the Cuthbert Peek Grant, Major Austin, is also absent—in India. After being employed on the Indian trans-Frontier Survey of 1890–1, he assisted in the preliminary survey of the Uganda railway in 1891–2, and he explored the Lake Rudolf region when serving with Sir R. Macdonald in 1897. He carried out a survey of the Sobat region in 1899–1900. He also carried out an important and hazardous expedition from Ordurman to Mombasa in 1900–1, and the result of these various expeditions were of the highest geographical value. The Cuthbert Peek Grant will be given to Major Bright to convey to Major Austin.

Major Bright has been for six and a half years exploring in the Egyptian Sudan, in Uganda, and in East Africa. The Sobat and Rudolf regions were explored by him under Major Austin in 1900–1. In 1902 he worked under Colonel Radcliffe on the Anglo-German Boundary Commission, and in 1904–6 he worked under Colonel Smith on the Anglo-German Boundary Commission east of Lake Kilimanjaro, and for all these services to geography which I have so briefly recited, but which he has carried out so admirably, he has been awarded the Back Bequest.

Major R. G. T. Bright: I need hardly assure you that I appreciate most highly the honour you have bestowed on me this afternoon in granting me the Back Bequest. To receive this recognition while still in the enjoyment of one's full working powers is a great inducement to continue in the paths of geographical research. I have had the good fortune always to serve under the able leadership of officers well known for their geographical work in Africa. I think it is only right I should take this opportunity of mentioning their names. Sir Ronald Macdonald—no words of mine can add to his reputation as a geographer and military commander; Major Austin, who has just had the honour of receiving one of the Royal Geographical Society's awards; Colonel Delmé-Radcliffe; and Captain Smith. I express once more my gratitude towards the Society.

The President then delivered his anniversary address (see p. 1).

After the visitors had withdrawn, the President appointed as scrutineers Mr. W. M. Corner and Captain Slack.

The Report of the Council was then read; it will be published in the next Year-book.

The President: I have to announce that the ballot papers have been gone through by the scrutineers, and the entire list proposed by the Council has been adopted by the Fellows of the Society without any objection whatever or alterations.

The list is as follows, the names of new members, or of those changing office, being printed in *italics*:—

President: Right Hon. Sir George D. Taubman Goldie, K.C.M.G., F.R.S., D.C.L., etc. *Vice-Presidents:* Sir H. E. G. Bulwer, G.C.M.G.; Colonel G. Earl Church; *Right Hon. Lord Curzon of Kedleston*, G.C.S.I., G.C.I.E., etc.; *Douglas W. Freshfield;* Colonel D. A. Johnston, C.B., R.E.; Sir Clements R. Markham, K.C.B., F.R.S., F.S.A. *Treasurer:* Edward L. Somers Cocks. *Trustees:* Right Hon. Lord Avebury, D.C.L., F.R.S.; Lord Belhaven and Stenton. *Hon. Secretaries:* Major Leonard Darwin, R.E.; James F. Hughes. *Foreign Secretary:* Sir John Kirk, K.C.B., G.C.M.G., F.R.S. *Councillors:* Admiral Sir Nathaniel Bowden-Smith, K.C.B.; Major Chas. F. Close, C.M.G., R.E.; Captain Ettrick W. Creak, C.B., F.R.S., R.N.; F. H. H. Guillemard, M.A., M.D.; Sir Clement L. Hill, K.C.M.G., K.C.B., M.P.; *Colonel Sir Thomas Hungerford Holdich*, K.C.I.E., C.B., R.E.; Sir Harry H. Johnston, G.C.M.G., K.C.B.; *Sir George S. Mackenzie*, K.C.M.G., C.B.; Admiral Sir Albert Hastings Markham, K.C.B.; *John L. Myres*, M.A.; Right Hon. Sir J. West Ridgeway, K.C.B., G.C.M.G., K.C.S.I.; *Howard Saunders*, F.L.S.; Captain R. F. Scott, C.V.O., R.N.; Colonel Sir Colin C. Scott-Moncrieff, K.C.M.G., K.C.S.I., R.E.; General J. H. M. Shaw Stewart, F.R.S.E., R.E.; Colonel Hon. M. G. Talbot, R.E.; *H. Yates Thompson;* Colonel Sir Henry R. Thuillier, K.C.I.E., R.E.; *Prof. W. W. Watts*, F.R.S.; Commander David Wilson-Barker, R.N.R., F.R.S.E.; *Colonel C. E. Yate*, C.S.I., C.M.G.

THE ANNIVERSARY DINNER.

The Anniversary Dinner took place in the evening at the Whitehall Rooms of the Hôtel Métropole. Sir George Goldie, the President, was in the chair, and among those present were Dr. Nansen, Lord Portsmouth, Lord Strathcona, Colonel Sir T. Holdich, Admiral Sir A. Markham, the Dean of Westminster, Sir A. Binnie, Mr. Douglas Freshfield, Colonel Sir C. Scott-Moncrieff, Sir Eric Barrington, Sir M. Ommanney, Mr. Ridgely Carter, Sir G. S. Mackenzie, Admiral the Hon. Sir E. R. Fremantle, the Hon. J. W. Taverner, Mr. R. L. Antrobus, Vice-Admiral Sir J. Bruce, Mr. Moberly Bell, Mr. Walrond Clarke, the Hon. W. Pember Reeves, Sir Harry Johnston, Colonel the Hon. M. G. Talbot, Mr. T. A. Coghlan, Mr. H. Yates Thompson, General Shaw Stewart, Colonel C. E. Yate, Mr. Dobson, Captain F. W. Creak, Mr. Vernon Magniac, Captain O'Connor, Major C. F. Close, Mr. Tudor G. Trevor, Captain W. F. O'Connor, Major L. Darwin, Mr. J. F. Hughes, Mr. E. L. S. Cocks, Major-General Sir T. Fraser, and Colonel Sir C. M. Watson.

After the toasts of "Our Patron, the King," and "Our Vice-Patron, the Prince of Wales," the PRESIDENT proposed the toast of "The Army and Navy," to which the Earl of Portsmouth and the Admiral the Hon. Sir E. R. Fremantle responded.

Sir HARRY JOHNSTON proposed "The Medallists," for whom Dr. ROBERT BELL, F.R.S., and Prof. W. M. RAMSAY responded.

Major L. DARWIN gave "The Guests."

Dr. NANSEN said, in responding, that he felt it to be a very great honour to be the guest of the leading Geographical Society of the world. Geographical explorers had conquered the world, but he hoped they were not going to take their ease. A great many men of great ability had been too much tempted to make records, and had not taken enough trouble to make thorough exploration. They had now got rid of that curse. There was a little temptation left to make records in the polar regions, but there was very little in the rest of the world, and now was the time for scientific geographical exploration. In oceanographical exploration we were very far from being up to the mark in comparison with the strides made by the sciences on *terra firma*. In other directions, also, there was much to be done.

Sir ALEXANDER BINNIE and the Hon. J. W. TAVERNER also responded. The toast list concluded with the toast of "The President and the Society," which was submitted by the Dean of WESTMINSTER and acknowledged by Sir GEORGE GOLDIE.

Fourteenth Meeting, June 11, 1906.—The Right Hon. Sir GEORGE T. GOLDIE, K.C.M.G., D.C.L., F.R.S., President, in the Chair.

ELECTIONS.—*Hamilton Baly, M.A.; Chas. Bampfylde; Lord Basing, C.B.; Lieut.-Colonel Chas. Forbes Blane, R.H.A.; Colonel H. Burnly-Campbell, late 6th Dragoon Guards; Read Crewe; F. D'Almeida; John Horace Fry; Captain Terence Keyes, I.A.; Innes Harold Stranger; Colonel F. H. Ward, late R.A.; Harry Owen White; Edward Neale Wigg.*

The paper read was:—

"The Geography of the Indian Ocean." By J. Stanley Gardiner, M.A.

Fifteenth Meeting, June 18, 1906.—The Right Hon. Sir GEORGE T. GOLDIE, K.C.M.G., D.C.L., F.R.S., President, in the Chair.

ELECTIONS:—*Edgar Pierce Allen; Colonel A. C. Bailward (late R.A.); John George Barkley; C. W. A. Buma; George Carter, M.A.; Herbert Lloyd*

Chittenden; Charles T. Currelly, M.A.; R. Davies; Wm. Mitcheson Dodd; Archibald D. Douglas; Captain G. Drage; John Gaskin Dunlop, M.A.; E. F. Elton, M.A.; George Goss; Edwin Greenacre; Charles Walter Grimwade; Captain John Havington (Rifle Brigade); John Harris; Hugh L. Heber-Percy; Daniel Wilkinson Iddings; Andrew S. Iddings; Andrew D. Lord; S. F. B. Martin; Henry W. Maynard; Dr. Edalj M. Modi; Frederick Morrow; Captain C. C. Newnham (6th King Edward's Own Cavalry); H. A. Ottewill; T. Comyn Platt; Walter Thomas Taylor; W. L. O. Twiss; Leslie Urquhart; Ralph T. Yeates; Captain James Weir.

The paper read was:—

"A Fifth Journey in Persia." By Major P. Molesworth Sykes, C.M.G.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *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.
Col. = Colonies.
Com. = Commerce.
C. R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Is. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological, etc.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
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.

Adriatic. **Cori and Merz.**

Jahresb. V. Förderung naturw. Erforschung Adria **2** 1904 (1905): 12–38.

Bericht über die im Auftrage des löblichen Vereines zur Förderung der naturwissenschaftlichen Erforschung der Adria im Jahre 1904 ausgeführten ozeanographischen und biologischen Untersuchungen und Arbeiten im Golfe von Triest. Von Prof. Karl I. Cori.

Vorläufiger Bericht über die physikalisch-geographischen Untersuchungen im Golfe von Triest, vom Juli 1904 bis Mai 1905. Von Alfred Merz.

Austria. **Haidenthaller.**

The Saline Ioduretted Springs of Hall-Baths in Upper Austria. By Dr. J. Haidenthaller. ('Illustrated Europe,' No. 182.) Zürich: Art. Institut Orell Füssli, [1906]. Size 7½ × 5, pp. 36. *Illustrations and Plan. Presented by the Publishers.*

Austria—River-Terraces. *M.K.K.G. Ges. Wien* **48** (1905): 587-591. **Schaffer.**
Bemerkungen zur Frage der alten Flussterrassen bei Wien. Von Dr. F. X. Schaffer.

Balkan Peninsula. **Herbert.**
By-paths in the Balkans. By W. V. Herbert (Captain Frederick William von Herbert). London: Chapman & Hall, 1906. Size 9 × 6, pp. xiv. and 270. *Frontispiece. Price* 10*s.* 6*d. net. Presented by the Publishers.*

Central Europe. **Sommer.**
Die wirkliche Temperaturverteilung in Mitteleuropa. Von Dr. Emil Sommer. (Forschungen zur deutschen Landes- und Volkskunde . . . herausgegeben von Dr. A. Kirchhoff. XVI. Band, Heft 2.) Stuttgart: J. Engelhorn, 1906. Size 9¼ × 6¼, pp. 125-166. *Maps.*

Europe—Communications. *M.K.K.G. Ges. Wien* **48** (1905): 515-560, 592-628. **Doblhoff.**
Europäisches Verkehrsleben (vom Altertume bis zum Westfälischen Frieden). Eine Studie von J. v. Doblhoff.

Europe—Gravity Determination. **Borrass.**
Relative Bestimmungen der Intensität der Schwerkraft auf den stationen Bukarest Tiglina bei Galatz, Wien, Charlottenburg und Pulkowa im Anschluss an Potsdam. Ausgeführt und bearbeitet von E. Borrass. (Veröffentlichung des Königl. Preussischen Geodätischen Institutes, N.F. No. 23.) Berlin: P. Stankiewicz, 1905. Size 10 × 7, pp. 68. *Presented by the Institute.*

Europe—Languages. **Mikkola.**
Öfversigt Finska Vet.-S. Förhandl. **45**, 1902-3, No. 4 (1903): pp. 47.
Baltisches und Slavisches. Von Joos. J. Mikkola.

Færoe Islands. *P.R.S. Edinburgh* **25** (1906): 2-24. **Annandale.**
The People of the Faroes. By Nelson Annandale. *With Sketch-map.*

Færoe Islands. *Scottish G. Mag.* **22** (1906): 61-76, 134-147 **Currie.**
The Færöe Islands. By James Currie. *With Illustrations.*

France. *B.S.G. Com. Bordeaux* **29** (1906): 21-30. **Abrioud and Descombes.**
La Déforestation du sol français. Par L. Abrioud.
Rapport sur le vœu du Syndicat d'initiative de la Savoie. Par Paul Descombes.

France. *C. Rd.* **142** (1906): 184-186. **Glangeaud.**
Une ancienne chaîne volcanique au nord-ouest de la chaîne des Puys. Note de P. Glangeaud.

France—Coasts. *B. de G. Historique et Descriptive* (1904): 439-479. **Pawlowski.**
Les transformations du littoral français. Le golfe de Brouage et le pays marennais à travers les âges, d'après la géologie, la cartographie, et l'histoire. Par M. Auguste Pawlowski.

France—Historical. *B. de G. Historique et Descriptive* (1905): 45-160. **Loisne.**
Catalogue raisonné des cartes et plans de l'ancienne province d'Artois. Communication de M. le Comte de Loisne.

Germany. *T. Edinburgh Geol. S.* **8** (1905): 403-412. **Currie.**
The Stassfurt Salt Industry. By James Currie.

Germany. **Wimmer.**
Geschichte des deutschen Bodens mit seinem Pflanzen- und Tierleben von der keltisch-römischen Urzeit bis zur Gegenwart. Historisch-geographische Darstellungen von J. Wimmer. Halle a. S.: Buchhandlung des Waisenhauses, 1905. Size 9 × 6, pp. viii. and 476. *Price* 8*m. Presented by the Publisher.* [To be reviewed.]

Germany—Bavaria. *M.G. Ges. München* 1 (1905): 313-354. **Rösch.**
Der Kontakt zwischen dem Flysch und der Molasse im Allgäu. Von A. Rosch. *With Map and Plate.*

Germany—Gazetteer. **Neumann.**
Neumanns Orts- und Verkehrs-Lexikon des Deutschen Reichs. Vierte Auflage, herausgegeben von Dr. jur. Max Broesike und Wilhelm Keil. Leipzig und Wien: Bibliographischen Institut, 1905. Size 10 × 6½, pp. 1256. *Maps and Plans. Price* 16*s.* 8*d.*

This standard work, the third edition of which appeared some twelve years ago, has now been considerably enlarged and thoroughly revised.

Germany—Harz. *M.G. Ges. Jena* 23 (1905): 1-7. **Walther.**
Einige wichtigere Ergebnisse der geologischen Untersuchung des Harzgebirges. Von Dr. Karl Walther.

Germany—Hessen. **Hessler.**
Hessische Landes- und Volkskunde. Das ehemalige Kurhessen und das Hinterland am Ausgange des 19. Jahrhunderts. In Verbindung mit dem Verein für Erdkunde zu Cassel und zahlreichen Mitarbeitern herausgegeben von Carl Hessler. Band I. Hessische Landeskunde, Erste Hälfte. Band II. Hessische Volkskunde. Marburg: N. G. Elwert, 1904–1906. Size 9½ × 6½, pp. xii. and 532, and xvi. and 662. *Maps and Illustrations.* *Price* 16*s*. 3*d*.

Germany—Silesia. *Z. Ges. E. Berlin* (1906): 10–38. **Friedrich.**
Die glazialen Stauseen des Steine-Tales bei Möhlten und des Neisse-Tales zwischen Wartha und Camenz, ein Beitrag zur Glazialforschung im Gebiet der oberen Glatzer Neisse. Von E. G. Friedrich. *With Map and Profiles.*

Iceland. *M.K.K.G. Ges. Wien* 48 (1905): 629–630. **Schneider.**
Vorläufiger Bericht über die Ergebnisse einer Studienreise nach Island im Sommer 1905. Von Dr. Karl Schneider.

Italy—Lipari Islands. *M.G. Ges. Hamburg* 21 (1906): 202–205. **Schlee.**
Die Liparischen Inseln und ihre Vulkane. Von Dr. Schlee.

Northern Europe—Lapland. *La G., B.S.G. Paris* 13 (1906): 48–50. **Rabot.**
Actions géologiques des débâcles en Laponie. Par Charles Rabot. *With Illustrations.*

Norway. *La G., B.S.G. Paris* 13 (1906): 43–48. **Rabot.**
Exploration géologique du Sognefjord supérieur. Par Charles Rabot. *With Illustrations.*

Portugal. *B.S.G. Lille* 45 (1906): 48–54. **Quiévreux.**
De la défense naturelle du Portugal et pourquoi la fusion des Portugais et des Espagnols en une seule nation est impossible. Par C. J. Quiévreux.

Russia. *M.G. Ges. Hamburg* 21 (1906): 224–228. **Friederichsen.**
Russland, Land und Leute. Von Dr. Max Friederichsen.

Scandinavia—Earthquake. *M.G. Ges. Hamburg* 21 (1906): 205–207. **Petersen.**
Mitteilungen über die Erderschütterungen in Skandinavien. Von Dr. J. Petersen.

Scandinavia—Historical. *M.K.K.G. Ges. Wien* 48 (1905): 631–633. **Schoener.**
Hat es eine vorskandinavische Einheit gegeben? Von J. G. Schoener.

The writer holds that the peoples of Sweden and Norway were differentiated from the earliest times of the settlement of the peninsula.

Sweden. **Gavelin.**
Grunddragen af Kartbladet Loftahammars Geologi. Akademisk Afhandling som med tillstånd af Vidtberömda Filosofiska Fakultetens i Upsala, Matematiskt-Naturvetenskapliga Sektion för Filosofiska Gradens Vinnande till Offentlig Granskning Framställes af Axel Gavelin. Stockholm, 1905. Size 9½ × 6, pp. 92. *Maps and Illustrations.*

United Kingdom—Cornwall. *Nature* 73 (1906): 366–368. **Lockyer.**
Notes on Some Cornish Circles. By Sir Norman Lockyer, K.C.B., F.R.S. *With Illustrations.*

United Kingdom—Scotland. *P.R.S. Edinburgh* 25 (1905): 616–629. **Blyth and Tait.**
Notes on the Rainfall on the Drainage Area of the Talla Reservoir. By B. Hall Blyth and W. A. Tait. *With Map and Diagrams.*

United Kingdom—Scotland. *T.R.S. Edinburgh* 43 (1905): pp. 566. **Buchan and Omond.**
The Meteorology of the Ben Nevis Observatories. Part iii. Containing the Observations for the years 1893, 1894, 1895, 1896, and 1897, with Appendix. Edited by Dr. Alexander Buchan and R. T. Omond. *With Diagrams.*

United Kingdom—Scotland. **Chrystal and Maclagan-Wedderburn.**
T.R.S. Edinburgh 41 (1905): 823–850.
Calculation of the Periods and Nodes of Lochs Earn and Treig, from the Bathymetric Data of the Scottish Lake Survey. By Prof. Chrystal and Ernest Maclagan-Wedderburn. *With Maps.*

United Kingdom—Scotland. *T.R.S. Edinburgh* 41 (1905): 359–366. **Falconer.**
The Igneous Geology of the Bathgate and Linlithgow Hills. By J. D. Falconer. *With Map.*

United Kingdom—Scotland. *Scottish G. Mag.* 22 (1906): 117–134. **Geikie.**
The History of the Geography of Scotland. By Sir Archibald Geikie, F.R.S. *With Maps and Illustrations.*

On the evolution of the physical features.

United Kingdom—Scotland. *Quarterly J. Geol. S.* 62 (1906): 40–69. **Harker.**
The Geological Structure of the Sgùrr of Eigg. By Alfred Harker. *With Map and Illustrations.*

United Kingdom—Scotland. *Quarterly J. Geol. S.* 62 (1906): 13–39. **Jamieson.**
The Glacial Period in Aberdeenshire and the Southern Border of the Moray Firth. By T. F. Jamieson.

United Kingdom—Scotland. **Maclagan-Wedderburn.**
P.R.S. Edinburgh 25 (1906): 25–26.
Seiches observed in Loch Ness. By E. Maclagan-Wedderburn.

United Kingdom—Scotland. *T.R.S. Edinburgh* 40 (1903): 469–509. **Mossman.**
The Meteorology of Edinburgh. Part iii. By R. C. Mossman. *With Diagram.*

United Kingdom—Scotland. *P.R.S. Edinburgh* 25 (1905): 609–615. **Murray.**
The Rhizopods and Heliozoa of Loch Ness. By James Murray.

United Kingdom—Scotland. *T.R.S. Edinburgh* 40 (1904): 835–877. **Peach and Horne.**
The Canonbie Coalfield: its Geological Structure and Relations to the Carboniferous Rocks of the North of England and Central Scotland. By Dr. B. N. Peach and Dr. J. Horne. *With Map and Sections.*

United Kingdom—Scotland. *P.R.S. Edinburgh* 25 (1905): 593–608. **Penard.**
Sur les Sarcodinés de Loch Ness. Note de M. le D. E. Penard. *With Illustrations.*

United Kingdom—Wales. *Nature* 73 (1906): 425–426. **Galloway.**
The Landslide in the Rhymney Valley. By Prof. W. Galloway.

United Kingdom—Wales. *T.R.S. Edinburgh* 41 (1904): 53–87. **Jehu.**
The Glacial Deposits of Northern Pembrokeshire. By Dr. T. J. Jehu. *With Plate and Diagram.*

Noticed in the Monthly Record (May number, p. 501).

United Kingdom—Wales. **Smith.**
The Itinerary in Wales of John Leland in or about the years 1536–1539. Extracted from his Manuscripts. Arranged and edited by Lucy Toulmin Smith. London: George Bell & Sons, 1906. Size 9½ × 7, pp. xii. and 152. *Map. Price* 10*s*. 6*d*. *net.*

Brings together, from the old topographer and antiquarian's 'Itinerary through England and Wales,' the scattered portions relating to the latter. The descriptions are of much interest as supplying a means of comparing the state of things in Wales in the sixteenth century with those of later times. The map traces the itinerary, so far as it can be made out.

United Kingdom—Waterways. **Forbes and Ashford.**
Our Waterways: A History of Inland Navigation considered as a branch of Water Conservancy. By Urquhart A. Forbes and W. H. R. Ashford. London: John Murray, 1906. Size 9 × 6, pp. xiv. and 336. *Map. Price* 12*s*. *net. Presented by the Publisher.*

United Kingdom—Yorkshire. *Quarterly J. Geol. S.* 62 (1906): 5–12. **Davison.**
The Doncaster Earthquake of April 23, 1905. By Charles Davison SC.D. *With Map.*

ASIA.

Armenia and Kurdistan. *Globus* 89 (1906): 41–44. **Volland.**
Bilder aus Armenien und Kurdistan. Von Dr. Volland. *With Illustrations.*

Caspian Sea. *Naturw. Wochenschrift* 4 (1905): 689–698. **Stahlberg.**
Der Karabugas als Bildungsstätte eines marinen Salzlagers. Von Walter Stahlberg. *With Maps.*

China. *J. Manchester G.S.* 21, 1905 (1906): 13–29. **Swallow.**
Tai Yuan fu to Hankow: an Overland Trip in North China. By Prof. R. W. Swallow. *With Illustrations.*

China. ———

China. Imperial Maritime Customs. 1, Statistical Series. Nos. 3 and 4. Returns of Trade (46th Issue) and Trade Reports (40th Issue), 1904. Part ii.—Reports and Statistics for each Port. Vol. 2. Southern Ports (with Report on the working of the Post Office). Shanghai: Kelly & Walsh; London: P. S. King & Son, 1905. Size 11½ × 9, pp. xx. and 535–1015. *Maps.*

Eastern Asia—Sakhalin. *B. American G.S.* 37 (1905): 724–726. ———

The Partition of Sakhalin. *With Map.*

French Indo-China—Cambodia. **Aymonier.**
B. de G. historique et descriptive (1905): 43–44.

Identification de noms de lieux portés sur les cartes publiées par M. Marcel dans le "Siam ancien" de M. Fournereau. Par M. Étienne Aymonier.

French Indo-China—Cambodia. *B.S.G. Rochefort* 27 (1905): 177–186. ———

Le carnet d'un marsouin, Cambodge.

India—Bombay. *Tour du Monde* 12 (1906): pp. 1–48. **Menant.**

Aux monuments bouddhiques et Jaïnas du Girnar (Présidence de Bombay). Par M^lle D. Menant. *With Map and Illustrations.*

India—Calcutta. *J.S. Arts* 54 (1906): 275–298. **Buckland.**

The City of Calcutta. By C. E. Buckland.

India—Ethnology. *P.R.S., Ser. B.* 77 (1906): 239–241. **Rivers.**

Report on the Psychology and Sociology of the Todas and other Indian Tribes. By Dr. W. H. R. Rivers.

India—Himalayas. **Ferber.**

Die Erkundung des Mustaghpasses im Karakorum-Himalaya. Von Aug. C. F. Ferber. (Sonderabdruck aus der Zeitschrift des Deutschen und Osterreichischen Alpenvereins, 1905.) Innsbruck, 1905. Size 10½ × 7½, pp. [20]. *Illustrations and Maps. Presented by the Author.*

On a journey carried out by the author in 1903 in company with E. Honigmann.

India—Himalayas. *Alpine J.* 23 (1906): 51–54. ———

The Disaster on Kangchenjunga.

India—Hindustani. **Harrison.**

A Manual of Lascarī-Hindustānī, with technical terms and phrases. By N. Harrison. London: N. Harrison, 1905. Size 7 × 5, pp. 116. *Price 2s. 6d. net. Presented by the Author.*

Intended primarily for the use of officers and engineers of steamers carrying Lascar crews.

India—N.W. Frontier. ———

Administration Report of the North-West Frontier Province for 1904–1905. Calcutta, 1905. Size 13½ × 8½, pp. iv., viii., and 40.

Indian Ocean—Maldive Islands. *A travers le Monde* 12 (1906): 28. ———

Le Couronnement du Sultan des Maldives.

Japan. *Alpine J.* 23 (1906): 1–15. **Weston.**

Mountaineering in the Southern Alps of Japan, and Japanese Mountain Clubs. By Walter Weston. *With Map and Illustrations.*

Malay Archipelago—Seas. **Baren.**

J. van Baren. Die Zeeën van den Indischen Archipel. (Overgedrukt uit de Encyclopædie van N.-I., Dl. iv.) Leyden, 1905. Size 10½ × 7½, pp. [12]. *Presented by the Author.*

Scientific description of the various sea-basins of the archipelago.

Persia. *M.G. Ges. Jena* 23 (1905): 8–15. **Strauss.**

Ein Ausflug von Kermanschah an den Seimere. Von T. Strauss.

Persia. *J. Manchester G.S.* 21, 1905 (1906): 1–12. **Sykes.**

Some Notes on Journeys in Southern and South-Eastern Persia. By Herbert R. Sykes. *With Illustrations.*

Russia—Siberia. **Patkanow.**

Versuch einer Geographie und Statistik der Tungusenstämme Sibiriens. Nach den Angaben der Volkszählung 1897 bearbeitet von S. Patkanow. [Publications du Comité Hongrois de l'Association Internationale pour l'Exploration de l'Asie Centrale et de l'Extrême Orient. I.] (Sonderabdruck aus den IV.-VI. Jahrg. der Zeitschrift Keleti Szemle (Revue Orientale).) Budapest, 1905. Size 9 × 6½, pp. 204. *Presented by the Author.*

Russian Central Asia. *Acta S. Sc. Fennicæ* **25**, p. 1 (1899): pp. 132, etc. **Tallqvist.**
Ibn Sa' îd : Kitâb al-muġrib fî ḥulâ al-maġrib, Buch IV. Geschichte der Ihšîden und Fusṭâṭensische Biographien. I. Deutsche Bearbeitung nebst einem Auszug aus al-Kindîs Ta'-riḫ Miçr. II. Arabischer Text mit Anmerkungen und Registern. Von Dr. Knut L. Tallqvist.

Ihsid was the title of the rulers of Ferghana.

AFRICA.

Abyssinia. *Deutsch. Rundschau G.* **28** (1905): 145–150. **Bieber.**
Die österreichische Expedition nach Kaffa. Nach den Mitteilungen des Expeditionsmitgliedes Friedrich J. Bieber. *Illustrations.* [See vol. **27**, p. 503.]

Algeria. *La G., B.S.G. Paris* **13** (1906): 40–42. ———
A propos de la position géographique d'El Oued.

British East Africa. *Globus* **89** (1906): 141–144. **Schütze.**
Der Elefant in Britisch-Ostafrika und Uganda. Von W. Schütze.

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See vol. **27**, p. 632.

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New South Wales—Anthropology. **Parker.**
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Das paläokrystische Eis. Von Gunnar Isachsen.

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Les gradients verticaux de la température dans les minima et les maxima barométriques. Par S. Grenander. *With Diagrams.*

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L'état actuel et l'avenir de la Météorologie maritime. Par H. Hergesell.

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Sounding and Pilot balloons over the ocean. By H.S.H. the Prince of Monaco.

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El decrecimiento de la temperatura con la altitud. Por M. Moreno y Anda.

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A Contribution to the Oceanography of the Pacific. Compiled from data collected by the United States steamer *Nero* while engaged in the survey of a route for a Trans-Pacific Cable. By James M. Flint. (*B. United States Nat. Museum,* No. 55, 1905.) Pp. 62. *With Charts and Plates.*

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Die territoriale Entwicklung der Europäischen Kolonien. Von Prof. Dr. Alexander Supan. Gotha: Justus Perthes, 1906. Size 11 × 7½, pp. xii. and 344. *Maps. Price* 12*m. Presented by the Author.* [To be reviewed.]

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Prof. Geddes continues his discussion on the scientific study of the city, commenced in vol. 1.

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Minnestal öfver professorn friherre Adolf Erik Nordenskiöld, hallet vid Finska Vetenskaps-Societetens årshögtid den 29 April 1902 af Wilhelm Ramsay. *With Portrait.*

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Drei Jahre Erdkunde in den Oberklassen einer Oberrealschule. Von Dr. Otto Ankel.

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Reformbestrebungen im französischen Erdkundeunterricht. Von Heinrich Fischer.

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NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

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ORDNANCE SURVEY OF ENGLAND AND WALES:—Sheets published by the Director-General of the Ordnance Survey, Southampton, from May 1 to 31, 1906.

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3, 4; XIII. 8, 14; XXII. 6, 14, 15, 16; XXIII. 13, 14, 15, 16; XXIV. 13, 14, 15, 16; XXV. 13, 14, 15, 16; XXVI. 13, 14, 16; XXVII. 13, 14; XXX. 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12; XXXI. 5; XXXII. 3; XXXIV. 2, 4, 5, 6; XXXV. 1, 2, 5. **Devonshire**, XXXIX. 3, 5, 6, 7, 9, 10, 13, 14, 15; XL. 1, 5, 9, 13, 14, 15, 16; LI. 2, 3, 4, 6, 7, 8, 10, 14, 15, 16; LII. 9; LXIII. 1, 3, 5, 11, 12, 13, 16; LXIV. 1, 5, 9, 13; LXXV. 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 15, 16; LXXVI. 1, 5, 9, 13; LXXXVIII. 1, 5, 9, 13; CXXXIII. 2, 3, 6, 9, 10, 15; CXXXVI. 2, 4; CXXXVII. 1, (2 and 3), 5, 6, 10. **Lincolnshire**, L. 8, 12; LIX. 4; LX. 3, 15; LXII. 1, 4, 8, 12, 13, 16; LXIII. 1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16; LXIV. 5, 10, 11, 14; LXXVI. 1, 2, 3, 5, 7, 9, 10, 11, 13, 14, 15, 16; **Norfolk**, IV. 15, 16; IX. 4, 12; X. 3, 5, 7; XVII. 12; XVIII. 1, 3, 5, 6, 14; XXVI. 4, 12, 16; XXVII. 1, 2, 3, 5, 6, 7, 9, 10, 11, 13, 14, 15; XXXVII. 4, 8, 12, 16; XLIX. 4, 8, 13, 16; LXI. 3; LXVI. 3, 7, 9, 10, 11, 13, 14, 15; LXXII. 8, 12; LXXIII. 1, 5, 10, 14, 15; LXXVIII. 1, 2, 3, 7; LXXX. 5. **Suffolk**, II. 1, 2, 3, 7; **Yorkshire** (First Revision of 1891 Survey), CCLX. 16; CCLXIV. 15; CCLXVI. 10, 13; CCLXXVII. 3; CCLXXVIII. 6, 7, 10, 11, 14, 15. *3s. each.*

(*E. Stanford, London Agent.*)

England and Wales. **Geological Survey.**

Map of the British Islands. Scale 25 miles to 1 inch. *Price, coloured, 2s.; uncoloured, 1s.*

This map will be issued to educational authorities, universities, and schools at reduced prices—1*s.* per copy coloured, and 6*d.* uncoloured, provided not less than 20 copies of either are taken at one time.

Applications for maps at the reduced prices must be made direct to the Ordnance Survey, Southampton.

(*E. Stanford, London Agent.*)

Germany. **Rauers.**

Versuch einer Karte der alten Handelsstrassen in Deutschland. Von F. Rauers. Scale 1 : 1,500,000 or 1 inch to 23·6 stat. miles. 2 sheets. *Petermanns Mitteilungen*, Jahrgang 1906, Tafel 6. Gotha: Justus Perthes, 1906. *Presented by the Publisher.*

This map accompanies the author's paper in the March number of *Petermanns Mitteilungen* upon the history of the old German trade routes. It is an outline-map only, on a fairly large scale, measuring 31 × 38 inches, and shows the early trade routes in red. These lines are distinguished, as to their character and importance, by the symbol by which they are represented.

Russia. **Peucker.**

Die Eisenbahnen des europäischen Russland mit Theilen der angrenzenden Länder und Klein-Asiens. Neu bearbeitet von Dr. K. Peucker. Scale 1 : 6,336,000 or 1 inch to 100 stat. miles. Vienna: Artaria & Co., 1906. *Price* 1.50*m. Presented by the Publisher.*

A new edition of a useful little railway map of Russia, printed in colours. In the north-east and south-east corners of the map an alphabetical index to the various railway lines is given, which will be useful for reference.

Turkey. **Topographical Section, General Staff.**

Map of Turkey. Scale 1 : 250,000 or 1 inch to 3·9 stat. miles. Sheet: Constantinople. London: Topographical Section, General Staff, War Office, 1906. *Price 2s. 6d. Presented by the Director of Military Operations.*

The area included in this sheet extends from lat. 40° 35′ N. to 41° 25′ N., and from long. 27° 40′ E. to 29° 20′ E. Constantinople and the Bosphorus thus appear on the eastern side of the sheet. Land relief is shown by approximate contours in brown, at 100 feet intervals; water, including river and sea names, in blue; forest areas, green; and the rest of the map is in black. The general effect is very satisfactory. It is intended that the map should eventually include the whole of Turkey, but this will take considerable time.

ASIA.

Palestine. **Mackinder.**

Stanford's new orographical map of Palestine. Compiled under the direction of H. J. Mackinder, M.A. Scale 1 : 253,440 or 1 inch to 4 stat. miles. London: Edward Stanford, 1906. *Price 16s. Presented by the Publisher.*

This forms one of the series of orographically coloured wall maps, prepared under the superintendence of Mr. H. J. Mackinder, and now being published by

Mr. E. Stanford. Numerous sources of information have been taken advantage of in the preparation of this map, especially the surveys of the Palestine Exploration Fund. It is satisfactory to find that land elevation is shown by white and tints of brown only, instead of green and brown as is frequently the case, although in the Dead sea depression it has been found necessary to employ another tint, and a neutral tint has been selected for this, as green so easily suggests vegetation. As in the previous maps of the series, the names are printed in an almost transparent grey, which enables a fair number to be inserted without interfering with the graphic appearance of the map. The depth of the sea is indicated by tints of blue. Old Testament, New Testament, classical, and modern place-names are distinguished by the style in which they are printed.

Sechuan. **Topographical Section, General Staff.**

Province of Ssŭ-Ch'uan (Eastern sheet). (Provisional issue without hills.) Compiled in the Topographical Section, General Staff. Scale 1 : 1,000,000 or 1 inch to 15·8 stat. miles. London: Topographical Section, General Staff, War Office, 1906. *Price 2s. 6d. Presented by the Director of Military Operations.*

Although only a provisional issue, without hills, this sheet contains a large amount of information, and no pains have been spared to render it as complete as the scale will admit. A reference to the list at the foot of the sheet shows that no less than twenty-eight different authorities and sources of information have been utilized in compiling the sheet. Special attention has been paid to the nomenclature, and an explanation of the usual terminations is given. The sheet is printed in colours, and extends from lat. 28° N. to 33° N., and from long. 103° E. to 111° E.

AFRICA.

Africa. **Topographical Section, General Staff.**

Map of Africa. Compiled in the Topographical Section, General Staff. Scale 1 : 1,000,000 or 1 inch to 15·8 stat. miles. Sheet 84, Nouvelle Anvers. Topographical Section, General Staff, War Office, 1906. *Price 2s. Presented by the Director of Military Operations.*

Africa. **Fraunberger.**

Jährliche Regenmengen auf dem Festlande von Afrika. Gezeichnet von Georg Fraunberger. Scale 1 : 25,000,000 or 1 inch to 394·5 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1906, Tafel 7. Gotha: Justus Perthes, 1906. *Presented by the Publisher.*

In the preparation of this most useful general rainfall map of Africa, the author has consulted the best available sources of information. These he refers to in his paper, "Studien über die jährlichen Niederschlagsmengen des afrikanischen Kontinents," which the map accompanies, and which gives a valuable *résumé* of our present knowledge of the subject. The geographical basis of the map is the map in Stieler's Hand Atlas, and upon this the annual rainfall is indicated by twelve different tints. Stations where actual measurements are made are indicated, and insets on enlarged scales are given of the Kameruns and East Africa. In many parts of the continent as yet little exact information exists for constructing a map of this kind, but the rapid opening up of the continent renders it now possible to arrive at a much better general idea than was ever possible before.

Egypt. **Survey Department, Cairo.**

Map of Egypt. Scale 1 : 50,000 or 1·3 inch to a stat. mile. Sheets: S.E., Nos. L.-II., II.-I., II.-II., III.-II., XXIV.-VI. and VII., XXIX.-VIII. Cairo: Survey Department, 1906. *Presented by the Director-General, Survey Department, Cairo.*

AMERICA.

Canada. **Dept. of the Interior, Ottawa.**

Sectional map of Canada. Scale 1 : 190,080 or 1 inch to 3 stat. miles. Sheet 24, Lake of the Woods, revised to March 24, 1906. Ottawa: Department of the Interior, Topographical Surveys Branch, 1906. *Presented by the Canadian Department of the Interior.*

GENERAL.

World. **Stieler.**

Neunten, von Grund aus neubearbeiteten und neugestochenen Auflage von Stielers Hand-Atlas. 100 Karten auf 200 Seiten mit 162 Nebenkarten in Kupferstich und einem alphabetischen Verzeichnis aller im Atlas vorkommenden Namen (ungefähr 240,000 Namen enthaltend) herausgegeben von Justus Perthes' Geographischen

Anstalt in Gotha. Lieferung 1. Gotha: Justus Perthes, 1906. *Price* 60 *pf. each part.*

Although less than a year has passed since the completion of the last edition of Stieler's Hand-Atlas, a new edition has already been commenced. This is a clear indication that the atlas is, as it deserves to be, still extremely popular, and that the pains that have been taken to maintain for it a high standard of excellence and reliability is appreciated. In the geographical world changes are continually taking place—alterations in boundary-lines, new and more exact surveys, polar explorations, and other events, are constantly rendering map revision and correction necessary, and recently this has perhaps been more than ever the case. The Russo-Japanese war and new boundary surveys in Africa and elsewhere have already put some of the sheets of this atlas out of date. There is no alteration in the general appearance of the maps in this edition, but they are all being carefully revised and corrected. The first part, which has just appeared, contains—Sheets: 15, Ostalpen (Alpenländer, östliches Blatt), 1 : 925,000, by C. Sherrer and H. Habenicht; 42, Süd-Skandinavien, 1 : 2,500,000, by C. Sherrar; 72, Afrika, 1 : 750,000; 4, Kongo, Deutsch-Ostafrika, etc., by C. Barich. In addition to these, the part contains the first section of the alphabetical index.

Upon sheet 72 the corrected position of Lake Albert Edward is given, together with the newly delimited boundary-line between Uganda and German East Africa.

CHARTS.

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

Charts and Plans published by the Hydrographic Department, Admiralty, during March and April, 1906. *Presented by the Hydrographer, Admiralty.*

No.	Inches.	
3552 m =	3·47	White sea:—Approaches to Shuya river. 3*s.*
1846 m =	10·0	France, south coast:—Villefranche bay. 2*s.*
3344 m =	1·23	San Domingo, north coast:—Monte Cristi bay and approaches. 2*s.*
3559 m =	2·75	Philippine islands:—Bolinao harbour and approaches. 3*s.*
3544 m =	5·96	China, east coast. Mirs bay:—Starling inlet, Crooked harbour, and Double haven. 4*s.*
3541 m =	2·9	Korea, south-east coast:—Masampo and Pu To channel. 3*s.*
803 m =	9·9	New Zealand, north island:—Lambton harbour and Evans bay. 3*s.*
1312		Plans on the coast of Chile. New Plan:—Tongoi bay.
699 m =	6·35	Plans on the east coast of Chile. Plan added:—Port Taltal.
840		Nicobar islands. Plans added:—Mus anchorage, Hoinipoh bay.
2193		Sketch-plan of anchorages between Mindinao and Celebes. New plan:—Channels between Tangulandang and Ruang.
1179 m =	0·5	England, west coast:—Bristol channel. 5*s.*
555 m =	1·4	Norway:—Dolm Sund to Lyngvær. 2*s.* 6*d.*
3567 m =	14·0	Africa, north coast:—Marsa Matruh. 2*s.*
3560 m =	8·7	Haiti or San Domingo:—San Pedro de Macoris. 2*s.*
3561 m =	0·72	South America, east coast:—Entrance to the rivers Paraná and Uruguay. 2*s.*
1893 m =	0·97	Chile. Plans on the east coast of Chiloe island:—Port Quellon and approaches. 2*s.*
3324 m =	{0·49, 3·0}	India, west coast. Maldive islands, Mále and Fadiffolu atolls (Plan:—Mále anchorage). 4*s.*
1701 m =	{2·42, 1·82}	Anchorages on the west coast of Sumatra:—Rigas and Chalang bays, Tabekat bay, Tarusan bay. 2*s.*
3470 m =	{0·3, 1·21}	Celebes. Buton strait:—South Narrows, North Narrows. 2*s.*
1493 m =	var.	Japan, south-west islands. Plans in Tanega shima and Kuchinoyerabu shima:—Nishi no amate wan, Mage shima Shimama road, O ura, Kuchinoyerabu shima, Kuchinoyerabu wan. 2*s.*
2724		Plans of bays and ports in Candia or Crete. New plan:—Sitia bay.
318		River St. Lawrence. The Traverses. New plan:—Beaujeau channel, West Narrows.
2732 m =	{1·8, 1·45}	Eastern archipelago. Plans of anchorages in Bali, Lombok, Sumbawa, and adjacent islands. Plans added:—Segara bay, Badung road.

No.	Inches.	
935		Eastern archipelago. Harbours and anchorages between Bali and Timor. New plan:—Cyrus harbour.
957 m	= 1·44	Ports in the Philippine islands. Plan added:—Port Banga.

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

Charts Cancelled.

No.		Cancelled by	No.
2406	Monte Cristi bay. Plan on this sheet.	New plan. Monte Cristi bay and approaches . . .	3344
1276	Chile Herradura de Carrizal to Grande point. Plan of Port Taltal on this sheet.	New plan. Port Taltal	699
3392	Port Bolinao. Plan on this sheet.	New plan. Bolinao harbour and approaches	3559
1423	Plan of Lambton harbour on this sheet.	New plan. Lambton harbour and Evans bay . . .	808
1179	England, west coast. Bristol channel.	New chart. England, west coast. Bristol channel .	1179
374	Ras Bulau to Alexandria. Plan on this sheet:—Marsa Matru.	New plan. Marsa Matruh	3567
2859	Plans on the south coast of San Domingo. Plan on this sheet:—San Pedro de Macoris bay.	New chart San Pedro de Macoris	3560
1938	South America, east coast. River Uruguay from Martin Garcia to Paysandu and Salto Grande.	New charts. Entrance to river Paraná and Uruguay . Uruguay river, parts I. and II. . . . Uruguay river, parts III., IV., V. . .	 3561 3549* 3550*
2760 2284	Acheh head to Tyingkok bay. Plan on this sheet:—Rigas bay. Plans of anchorages on the west coast of Sumatra. Plan on this sheet:—Tabekat bay.	New chart. Anchorages on the west coast of Sumatra, Rigas, and Chalang bays, Tabekat bay, Tarusian bay	1701
2196	Sketch plan of anchorages in the southern part of Celebes. Plan on this sheet:—Buton road.	New Chart. Buton strait, South Narrows, North Narrows	3470

Charts that have received Important Corrections.

No. 469, Spain:—Port of Alicante. 2819, France:—Ciotat and Sanary bays with adjacent roadsteads. 1744, France:—Gulf of St. Tropez. 847, Cyprus:—Famagusta and Salamis, Famagusta harbour. 331, United States, east coast:—Wassan, Ossaban, St. Catharine's and Sapelo sounds. 3005, Gulf of Mexico:—Tortugas harbour and approaches, 1318, Chile:—Port of Valdivia and approaches. 1697, Africa, west coast:—Garraway point to Growa point. 625, Africa, west coast:—River Congo from the entrance to Matadi. 2899, Indian ocean islands:—Chagos archipelago to Madagascar. 3, Indian ocean islands:—Chagos archipelago. 4, Indian ocean islands:—Principal groups of the Chagos archipelago. 942*a*, Eastern archipelago:—Eastern portion, Sheet I. 942*b*, Eastern archipelago:—Eastern portion, Sheet II. 2575, Celébes:—Celébes sea, eastern part. 2578, Philippine islands:—Eastern part of the Sulu or Mindoro sea. 2243, Japan:—Noto peninsula. 993, Japan:—Anchorages in Yezo island. 2726, New Zealand:—Manukau harbour. 2532, New Zealand:—Sheet ix. 90-mile beach to Otago. 3497, England, east coast:—Hull road. 1758, Spain, west coast:—Arosa and Pontevedra bays. 3408, Leeward islands:—Puerto Rico. 1751, South America, east coast:—Saucé point to Martin Garcia island. 2839, United States, west coast:—Columbia river. 688, Africa, west coast:—River Congo and adjacent creeks. 1881, Indian ocean islands:—Cargados Carajos shoals. 3296, Plans in Timor:—Koepang bay and approaches, Koepang road, Hansisi anchorage. 166, China, east coast:—Pagoda anchorage and approaches. 452, Japan:—Yezo island with adjacent straits.

(*J. Potter, Agent.*)

* *See* Bi-monthly List, January-February, 1906.

Indian Ocean. **Meteorological Office.**

Meteorological Chart of the Indian Ocean north of 15° S. lat. and Red Sea for May and June, 1906. London: Meteorological Office, 1906. *Price 6d. Presented by the Meteorological Office.*

Liverpool Bay. **Belam and Ashton.**

Chart of Liverpool Bay. Surveyed by Commander Henry Belam, M.V.O., R.N., Marine Surveyor, and Henry G. G. Ashton, F.R.G.S., Assist. Marine Surveyor, Mersey Docks and Harbour Board, 1905. Scale 1 : 36,000 or 1·8 inch to a stat. mile. Liverpool: Mersey Docks and Harbour Board, 1905. *Presented by Henry G. G. Ashton, Esq.*

Mersey River. **Belam and Ashton.**

Chart of the River Mersey, from Rock Lighthouse to Eastham and Garston. Corrections to 1906. By Commander Henry Belam, M.V.O., R.N., Marine Surveyor, and H. G. G. Ashton, F.R.G.S., Assist. Marine Surveyor, Mersey Docks and Harbour Board. Scale 1 : 18,000 or 3·52 inches to a stat. mile. Liverpool, 1906. *Presented by H. G. G. Ashton, Esq.*

North Atlantic. **U.S. Hydrographic Office.**

Pilot Chart of the North Atlantic Ocean for June, 1906. Washington: U.S. Hydrographic Office, 1906. *Presented by the U.S. Hydrographic Office.*

North Atlantic and Mediterranean. **Meteorological Office.**

Pilot Chart of the North Atlantic and Mediterranean for June, 1906. London: Meteorological Office, 1906. *Price 6d. Presented by the Meteorological Office.*

North Pacific. **U.S. Hydrographic Office.**

Pilot Chart of the North Pacific Ocean for June, 1906. Washington: U.S. Hydrographic Office, 1906. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

British East Africa. **Woodhouse.**

Thirteen photographs of the Tana river, British East Africa, taken by Alfred Woodhouse, Esq. *Presented by T. W. Barber, Esq.*

An interesting set of photographs taken by Mr. Alfred Woodhouse during his surveying expedition up the Tana river last year. In addition to the photographs, Mr. Woodhouse has presented the Society with a tracing of the large-scale chart which he and Mr. T. W. Barber, who accompanied him, made, and which gives a considerable amount of detailed information concerning the course of the river. The photographs are well taken, and give a good idea of the scenery of this part of East Africa. Those of native types are specially interesting.

(1) Mouth of the Ozi and Tana at Kipini; (2) Launch *Mongolia*, used by the expedition; (3) Hargatzo rapids; (4) Guyo, the chief of the river Gallas, and his *aide-de-camp;* (5) Guyo's wife and two sisters at Oda Boruruba; (6) A Waboni chief, his mother, and two village belles; (7) Camp at Gurura; (8) View of the Tana, 300 miles from the coast; (9) Ariti; (10) Launch *Mongolia*, moored at junction of Tana river and Belezo canal; (11) Hameye, a Pokomo village; (12) The chief of Marumbini; (13) The old Tana bed, now nearly filled up, since the cutting of the Belezo canal.

Gambia. **Viner.**

Photograph of King Musua Melea, chief of McCarthy Island, Gambia, with his chief headsman and executioner, taken by C. C. Viner, Esq. *Presented by C. C. Viner, Esq.*

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.

TRANSVAAL
TREVOR.

THE GEOGRAPHICAL JOURNAL 1908.

The Geographical Journal.

No. 2. AUGUST, 1906. Vol. XXVIII.

TRAVELS ON THE BOUNDARIES OF BOLIVIA AND PERU.*

By Baron ERLAND NORDENSKIÖLD.

The travels in South America, the archæological and ethnographical results of which I am about to describe, were undertaken by Dr. Nils Holmgren (a zoologist) and myself during 1904 and the early part of 1905. In the start of the expedition Mr. D. de Bildt, one of our generous patrons, also took part. The field of our researches was the Peruvian-Bolivian plateau, previously visited by many investigators, lying north, south, and east of Lake Titicaca, and, above all, the eastern slopes of the Andes in the direction of the primeval forests between Rio Madre de Dios and Rio Beni, *i.e.* the province of Caupolican in Bolivia, at this spot known by Evans's † investigations, and the Peruvian provinces of Sandia and Caravaya, where researches were first carried on scientifically by Sir Clements Markham. ‡ Among other scientists who have visited this part of the boundary between Peru and Bolivia previously to our doing so, let me first of all mention Raimondi § and Bandelier,‖ as also the Bolivian and Peruvian travellers, *e.g.* Pando,¶ Stiglich,** Cipriani,** etc.

* Read at the Royal Geographical Society, February 26, 1906.

† Evans, "Expedition to Caupolican, Bolivia, 1901-1902," the *Geographical Journal*, vol. 22, 1903.

‡ Markham, "The Province of Carabaya, in Southern Peru," the *Journal of the R.G.S.*, vol. 31, 1861. Markham, 'A List of the Tribes in the Valley of the Amazon, including those on the Banks of the Main Stream and of all its Tributaries.' Second edition. London: 1895.

§ Raimondi, "On the rivers San Gaban and Ayapata in the Province of Carabaya, Peru," *Journal of the R.G.S.*, vol. 37, 1867. Raimondi, 'El Peru.' Lima: 1874-1880.

‖ Bandelier, "On the Relative Antiquity of Ancient Peruvian Burials," *Bull. Amer. Mus. Nat. Hist.*, vol. 20. New York: 1904.

¶ Colonel George Earl Church, "Northern Bolivia and President Pando's New Map," the *Geographical Journal*, vol. 18, 1901.

** 'Vias del Pacifico al Madre de Dios.' Publicación de la junta de vias fluviales. Lima: 1903.

Most of them having devoted their energies to other branches of science, previous to our investigations very little had been known of the ethnology of the regions in question.

It is but natural that on the eastern slopes of the Andes we experienced the utmost variations of temperature and scenery, being at times in the regions of eternal snow, and again in the tropical primeval forests, where indiarubber trees are plentiful. Moreover, as the declivity of the Andes is very abrupt towards the east, the distance between the snow-line and the forests where indiarubber is obtained, or the most sensitive tropical plants can be cultivated, is often but 50 to 60 miles. In some valleys it is possible, if mounted on a good steed, to plunge through snow on the one day, and on the next to pluck papaya or tap the rubber tree.

The Bolivian-Peruvian plateau round Lake Titicaca is inhabited by Aymara and Quichua Indians—the former south, east, and west of this lake; the latter north thereof. To the east of Lake Titicaca we passed the "language boundary" at Cojata; west of the lake, it was at the town of Puno.

The mountain valleys on the eastern slopes of the Andes have a population speaking Quichua, among which, on the fringes of the primeval forests east of the Bolivian province Caupolican, we came across some few Apolistas speaking Lapachu, Rica-Rica-speaking Lecos, and Tacana-speaking Ydiamas. These tribes are, however, completely losing their own languages, which are superseded by Quichua. It was only with the greatest difficulty that I could obtain words and phrases of the Lapachu or Lapa-Lapa language, which is at present only spoken by elderly persons.

Farther east, towards the interior of the primeval forests on Tambopata, a tributary of Rio Madre de Dios, we met a small Tacana-speaking tribe, the Tambopata-Guarayo, and visited them. Other Indians live on the shores of the same river, but, as they were very shy, we did not succeed in coming in touch with them. On Rio Inambari the Pano-speaking Yamiaca live, as also the Tuyoneiri; the last mentioned speak a language which I cannot place. Between Rio Inambari and Tambopata there is another very small Pano-speaking tribe, the Atsahuaca; coming as I did from the Yamaica Indians, I was the very first white man that visited them. On Rio Marcapata, probably a tributary of Rio Inambari, there are some Indians speaking Tacana, who call themselves Arasa; north-east of them the Huachipairi Indians are settled. The Tuyoneiri, Arasa, and Huachipairi Indians were not visited by us; I have, however, succeeded in making a collection of words from the languages of the first two of these tribes, as I have come across members of the tribes at other places.

The Aymaras and Quichuas, *i.e.* the Indians of the plateau, fells, and mountain valleys, are all Christians, being, of course, in many other respects under the influence of Spanish civilization, though simultaneously they have retained many customs (either unchanged or modified) from the pre-Spanish period, when they exhibited a purely Indian civilization, which was the most remarkable of any at that time existing in South America. The Apolistas, Lecos, and some Tacana-speaking Indians nowadays are not easily distinguishable from the adjacent Quichua Indians, or those Quichuas actually living with them.

The Yamiaca, Guarayo, and Atsahuaca, etc., or those small tribes that inhabit the primeval forests of Rio Inambari and Rio Tambopata, live, or at any rate a year or two ago lived, in the Stone Age almost entirely unaffected by the civilization of either the Indians of the mountain valleys or that of the whites. That we could find Indians so utterly untouched by civilization so close to the Andes and near tracts known since their early conquest, is solely owing to the difficulty of penetrating the primeval forests, as also that those rivers which flow from the Andes to the primeval forests in the beginning of their course through the latter are not navigable. We thus see that the district I visited is a borderland, not only as regards nature itself, but also with respect to man.

Without touching on the more well-known plateau, I will divide my paper into three parts—first dealing with the Quichua-speaking Indians on the eastern slopes of the Andes; then our archæological researches both in the mountain valleys and the primeval forests; and, lastly, the savages of the primeval forests.

When studying the Quichua-speaking Indians, I specially devoted my attention to the economic conditions under which they live, and the customs they have retained from the period previous to the Spanish invasion. All the Quichua-speaking Indians on the eastern slopes of the Andes are agriculturists. The plants cultivated in the higher colder valleys or in the lower warmer ones are, of course, very different. In the Corani valley, for instance, which is 3985 metres (13,074 feet) above sea-level, various kinds of potatoes, oca (*Oxalis tuberosa*), broad beans, quinua (*Chenopodium quinua*) and cañagua (*Chenopodium*, cañagua), papa lisa (*Ullucos tuberosus*), and barley are all cultivated. In the Queara valley, 3460 metres (11,352 feet) above sea-level, besides all these, we met with both maize and a few garden plants. At Mojos, 1617 metres (5305 feet) above sea-level, the Indians have bananas, coffee, the sugar-cane, yucca, rice, mani, racacha (*Arracacha esculenta*), hualusa (*Colocasia esculenta*), oranges, lemons, maize, aji, tomatoes, coca, sweet potatoes, cotton, etc. Naturally each Indian does not cultivate all these plants; the most indispensable are bananas, coffee, the sugar-cane, yucca, coca, rice, and maize. Frequently the Indians of the higher mountain valleys not only have fields there, but also on the verge of the great primeval forest district in the east; for instance, the Indians of the elevated Chia valley, where only potatoes, oca,

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quinua, cañagua, broad beans, and barley can be cultivated, possess fields in the vicinity of Rio Sangaban, there cultivating coca, maize, etc.

The fields are tilled in a very primitive manner. In order to loosen the soil, hoes are in use which, though nowadays provided with blades of iron, are in shape the same as those first made of bronze. The fields are seldom manured, whereas a rotation of crops is extensively used. In the mountain valleys the fields lie in neat terraces; farther towards the interior, clearings are made in the bamboo thicket or in the forest. In days of yore, when only bronze or stone implements were available, this method of clearing was no easy matter, as even with iron axes a good deal of labour is required to break a field in the primeval forest. These forests are a great obstacle to the agricultural Indian of the fell, used as he is to the fell valleys that are so easily cleared.

In the higher valleys of the fells the Quichua-speaking Indians are cattle-keepers, having alpacas, llamas, sheep, cows, small pony-like horses, donkeys, and mules. During the time of the missions, according to Armentia,* the more tropical grass-grown heights at Mojos, Pata, and Santa Cruz, etc., were well supplied with cattle, but these golden days are long since past. Farther in, towards the primeval forests no cattle-keeping can be carried on, as, in spite of the luxuriant vegetation, good pasturage is very scarce, while the animals are destroyed by the insects and vampires. The fact that the Indians of the fell are cattle-keepers is one of the chief reasons why they do not settle—except very occasionally—farther within the primeval forests.

Besides agriculture and cattle-keeping, the Indians of the fell earn their livelihood by working for the whites, more especially by tapping rubber in the primeval forests. A secondary source of income of but small importance is washing for gold, this being undertaken by Indians at Juan del Oro and at Rio Inambari in Peru. While it is true that in the provinces of Caravaya and Sandia, in Peru, a good deal of gold has been found—above all, by a North American company working a mine between Rio Inambari and Rio Tambopata with much success—it is also a fact that the importance of these finds has been much exaggerated. The trade in rubber, should good roads be constructed, may prove of vast importance; the days of cinchona are now past.

The Indians of the fells import very few necessaries from outside their own domain; some pottery and bronze pins from the Indians of the plateau, colours and a few implements from the whites, that is all. They might live very happily if they were not addicted to certain vices, chiefly insobriety, and were not oppressed by many white parasites living at their expense. By the aid of "fire-water" these cheat the Indians of the product of their agriculture and cattle-keeping, and by

* Armentia, 'Relación Historica de las misiones Franciscanas de Apolobamba.' La Paz: 1903.

means of strong drink they lure the Indians to the indiarubber barracks for the purpose of tapping rubber. The most usual method is giving the Indians the intoxicant, either on credit, or during some great dance to lend them money with which to buy the wretched stuff. When the festivity and intoxication are past, the Indians cannot pay their debt, running as it does at a high rate of interest, but are forced to enter some indiarubber barracks. Once they are there, by various tricks it is arranged that the Indians remain in debt to their master.

The Governments of Peru and Bolivia, being now recruited from patriotic men who are deeply interested in the future of these districts, really ought to interfere and protect the Indian from both "fire-water" and the oppression of the white man. They would then, on the Andes, call into being a happy population of intelligent, industrious small farmers of the chaste Quichua race, for what I have just expressed applies certainly not only to the small and limited district I visited, but also to large portions of the Andes.

In direct opposition to the Indians of the primeval forest, the fell, Indians show great possibilities of development. Both Peru and Bolivia would in this manner solve the question of immigration far better than by importing Chinese, and the inferior elements among European emigrants.

The Quichuas still practise several customs which remain, more or or less modified, from the pre-Spanish period. Among these we must reckon their dances, which are always performed in connection with religious, *i.e.* Roman Catholic festivals. Among other festivals I have witnessed, there is the festival of the Cross (La fiesta de la Cruz). The crosses on the heights and in or near churches were hung with flowers, and in the huts crosses decked with flowers were set up. In some huts I saw two crosses, one larger than the other, representing a male and female cross. Among the very peculiar customs at this festivity, let me mention two paper lanterns which were taken to the cross by night, the one shaped like the sun, the other in form like the moon. The sun is carried by a man, the moon by a woman. As we know, the Incas worshipped the sun and moon, the sun being the male, the moon the female divinity. It is only the men who take any part in this dance, as in most purely Indian dances. In Pelechuco the dancers at the Easter festivities had large feather ornaments in the form of suns on their heads (Fig. 1). At these dances both "fire-water" and chicha (ale made from maize) are drunk to excess.

Even now the dead Christian Quichua Indian takes with him his worldly possessions when departing to another sphere. This is accomplished by there first being a regular drinking-bout for a full week after a death, and then the things deemed necessary for the deceased's future state, *e.g.* tools, food, clothes, and, as a matter of course, "fire-water," are taken to an open place, where they are all burnt.

Presumably the Indians imagine they succeed in freeing the souls of these objects by this means, so that they can accompany their master. In Pelechuco these sacrifices were offered by night outside the consecrated churchyard where the dead Indian (man or woman) had been buried. The corpses themselves are never burnt.

Should the Quichua Indian build a new hut, he buries the fœtus of a llama, coca, tin figures, etc., underneath it. This is to bring luck. According to Bandelier,* during the pre-Spanish period, the

FIG. 1.—QUICHUA INDIANS DANCING AT THE EASTER FESTIVITIES WITH LARGE FEATHER ORNAMENTS IN THE FORM OF SUNS ON THEIR HEADS.

natives on the Peruvian coast, when building palaces or similar buildings, gave their walls a core formed of objects, some of which were of metal. The most valuable treasures found in Peru are said to have been obtained from such cores. The above-mentioned custom of burying objects when erecting huts is apparently a survival of this usage.

* Frederick Webb Hodge, "Bandelier's Researches in Perú and Bolivia," *American Anthropologist*, 1897.

If the Quichua Indian erects a mill in order to grind the sugar-cane, under the central post he buries the fœtus of a llama, laden with small jars of wine, fire-water, and chicha. Should the Quichua Indian desire a drought, he takes the cranium out of a modern, *i.e.* Christian Indian, grave, and sets it on a pole. Sometimes the skull is again buried, but very often it is allowed to moulder above ground. This peculiar custom may perhaps explain the headless graves described by Ten Kate,* as found among the so-called Calchaquies of Argentina. The Quichuas have very peculiar ideas concerning diseases. Should they wish a certain individual to fall ill, they place a small quantity of that person's hair, or something similar, in an ancient grave. Moreover, on all possible occasions the Indians offer up coca and fire-water; on many occasions when searching for archæological remains for me.

The Quichua-speaking Indians east of the Andes have very few objects of their own manufacture which possess any interest of importance. On the plateau you become accustomed to see stuffs where viscachas, birds, and llamas, etc., predominate as ornaments, but east of the Andes such stuff is rare. The high caps they wear (Fig. 2) are, however, of a certain interest, as their ornaments generally are different in the various valleys. In the Queara valley you find llamas on the caps; while plants ornament on those of the Quiaca valley. These latter ornaments have a certain connection with a passion that these Indians have for flowers, since in this valley, both men and women decorate themselves with flowers, and have regular gardens containing pelargoniums, chrysanthemums, tulips, etc. In the Corani valley the Indians adorn themselves with wild flowers.

Let me now touch on my archæological excavations on the eastern slopes of the Andes. In the higher fell valleys at present inhabited by Indians speaking Quichua, I have excavated many sepulchres, so-called Chulpas, and sepulchral grottoes, collecting the objects and skeletons I found therein, carefully keeping the contents of each separate from every other find. Moreover, I have purchased various articles of bronze and stone, which the Indians now living in the fell valleys have found when breaking ground, etc. Some rock carvings and sculpture on stone have been photographed by me. Old dwelling-places have been discovered by me in the primeval forest at Buturo (670 metres, 2198 feet), where pottery and stone implements were found totally unlike those of the fell valleys.

The types of graves found east of the Andes are chulpas and sepulchral grottoes. Moreover, the former are chiefly met within that district of the Andean plateau inhabited by Aymaras, and for many reasons are

* Ten Kate, "Anthropologie des anciens habitants de la région Calchaquie," *Anale del Museo de La Plata*, 1896.

ascribed to their ancestors. As Middendorf,* by studying the names of places, having proved that these Indians were formerly far more widely spread than now, it is believed that those sepulchres met with in the Quichua-speaking districts are also derived from the Aymaras. If this is correct, the valleys of the fell in question must formerly have had an Aymara population which has been ousted by Quichua, or, what

FIG. 2.—QUICHUA INDIANS FROM SANTA ROSA WITH HIGH CAPS (WEST OF THE ANDES).

is far more probable, has adopted the Quichua language. By the way, let me observe that, as the study of the nomenclature of places is in these parts so very important, it is a great mistake to do as did the French expedition to Bolivia under de Créqui Montfort,† when on their map they call the well-known islands of Lake Titicaca by the names of French discoverers, instead of retaining the Indian names thereof.

* Middendorf, 'Die Einheimischen Sprachen Perus,' Bd. V. Leipzig: 1891.

† De Créqui Montfort and Sénéchal de la Grange, "Rapport sur une Mission scientifique en Amérique du Sud." Nouvelles Archives des Missions scientifiques, Tome 12. Paris: 1904.

Chulpas or sepulchral grottoes, or both of them, have been found by me in all the higher valleys of the fells visited by our expedition. There is no essential difference between chulpas and sepulchral grottoes, a natural grotto having often been used as a wall or roof for a sepulchre. In Pelechuco valley, where it is easy to obtain large slates, very beautiful stone sepulchres (Fig. 3) have been made thereof. In some valleys where natural grottoes are numerous, these are used as burial-places.

FIG. 3.—CHULPA PELECHUCO VALLEY.

In the Quiaca valley there is a peculiar kind of sepulchre, consisting of a massive pillar above a small sepulchral chamber. Many of the chulpas are constructed like regular miniature houses, being provided with a door (Fig. 4). These belong to a type often seen represented in travels on the plateau. The door is not directed towards any special point of the compass as a general rule. Some of the graves in the Ollachea valley are constructed on such inaccessible spots on the mountain that it is quite perilous to reach them. Several graves are of masonry. On some in the Ollachea valley, there are traces of their having been painted red.

Neither chulpas, sepulchral grottoes, nor stone or bronze implements are here found west or east of the highest chain of the Andes, above the present limit of cultivation. Not once have I made a single observation pointing at this limit being higher or lower than at present, so long as these districts have been inhabited by man. The settled population, mostly speaking Quichua, and exclusively devoted to cattle-keeping, now inhabiting the extensive plains round Cojata, Macusani, etc., lying west of the highest chain of the Andes, and above the limit of cultivation, have settled there in a period later than the time when sepulchres were erected, or bronze implements were in use. On the lower parts of the plateau, on the contrary, the Indians live both by cattle-keeping and agriculture. East of the Cordillera Real, in the higher valleys of the fell, the possibilities of human subsistence are about the same as on the plateau. On the verge of the primeval forests, as I have previously observed, far more tropical plants can be cultivated than anywhere on the plateau.

Penetrating deeper down into the valleys to the east, farther into the primeval forests, we find, as I have before stated, that it is no longer possible to carry on cattle-keeping, above all, to keep llamas, the cultured plants that can be grown being different to those that can be cultivated in the higher valleys of the fell, or on the plateau. It will also be found that you never meet with chulpas or sepulchral grottos (at any rate, not in those valleys I visited), and very rarely come across objects of bronze or pottery typical of the valleys of the fell or the plateau farther towards the interior of the primeval forests, except in those places where pasturage for llamas has existed in the vicinity, and it has been possible to cultivate those plants so characteristic of the plateau.

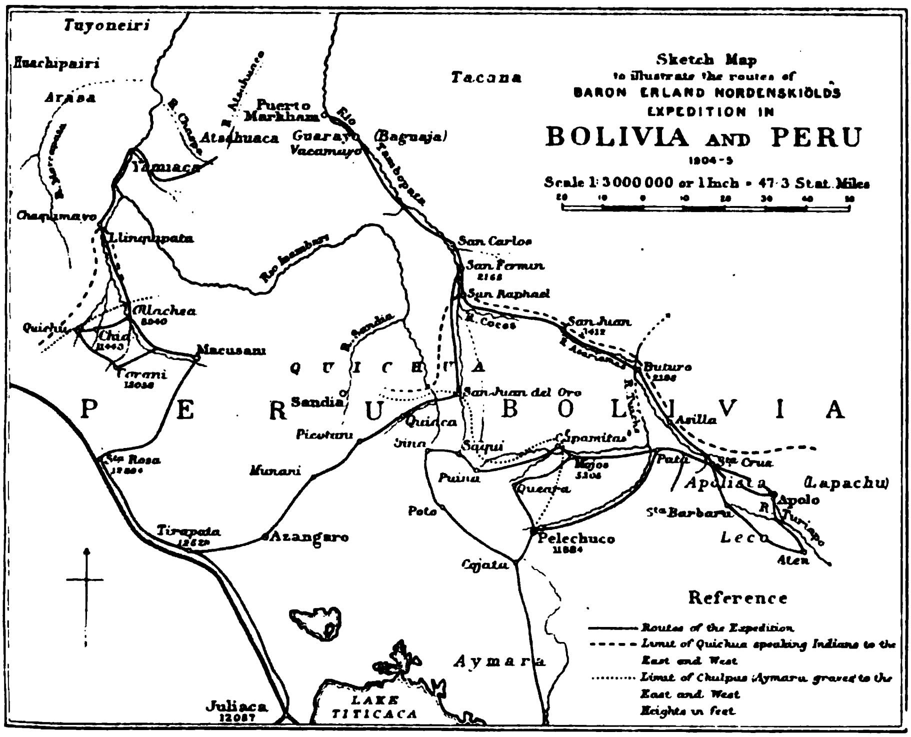
On the accompanying map the chulpa limit to the east in that district visited by me is marked. It proceeds somewhat further up the Andes than the limit of the present expansion of the Quichua-speaking Indians. The difficulty of breaking ground with the primitive implements they possess, the dread of fever and of the savage Indians of the primeval forests, have contributed to the fact that the Indians of the fell (which otherwise present so great a power of expansion) have not spread towards the interior of the exceedingly fertile districts of the primeval forests; but the chief reason has probably been their not having pasturage for their llamas, and their not being able to cultivate the same plants they were accustomed to on the fells.

In the primeval forests east of Cuzco the Indians of the fell (with the exception of some military expeditions of the Incas) have not spread. There, according to Squier,* the fortresses of Paucartambo,

* Squier, 'Peru.' New York: 1877.

Pisac, and Ollantaytambo determine the eastern boundary of the Inca rule. Their territory did not extend further than 60 miles east of their capital, Cuzco, and yet they, or, at any rate, their cultural influence, predominated from Argentina to Equador. Squier considers that the vast primeval forests and the savages hindered the Incas in their passage eastwards.

Most of the chulpas and sepulchral grottoes had been plundered previous to their being discovered by me. In the valleys of Pelechuco and Queara, however, Mr. and Mrs. Bandelier excavated several



graves, thus preserving a good deal of material from destruction. Most Quichuas of the present day were not much inclined to show me where the graves were, but made no attempt to hinder me from digging. In the Queara valley they believed that I took the skeletons in order to bring them to life in my own country, where they would either be employed as workmen—the people of my own land being weak and lazy—or would be whipped till they discovered where the Incas had their gold-mines. It is very pardonable for the Indians to think that gold always attracts the white man.

Only in a few of the graves did I find one single skeleton; most of them contained a quantity. In one sepulchral grotto I found close upon two hundred, and in one chulpa sixteen. Those skeletons that I found entire, and that I feel convinced have never been disturbed, were always in a sitting posture. All the dead have been placed in the sepulchral chambers, not merely buried in the grave.

The chief finds of the graves are bronze pins—so called topos. They are adorned with llama heads, or have heads in the form of leaves, at times also flowers (?), or still more often simply a flat disc. Topos are

FIG. 4.—CHULPA QUIACA VALLEY.

used by the Quichua women of the present day to fasten the shawl they wear over their shoulders. The modern topos are invariably more pointed than those of ancient days. The cloths of which remains are found in the graves were so coarsely woven that blunt topos did not necessarily damage the garment. Pottery is rare. The patterns thereon are mostly diamond or spiral, painted in black, seldom in yellowish-white. In most graves, though they have certainly not been disturbed, nothing but skeletons were found. Perfectly empty sepulchres were also found; this is often owing to the skeletons having entirely mouldered away, but at times it seems probable that the sepulchre has never been used.

Sometimes quite modern articles are found in the graves. In a grave at Quiaca, in which bronze objects had been discovered, I found not only trepanned crania, but pottery of modern Pucara manufacture, and glass bottles. On one of these bottles there stood, "Die Keisserliche Privilegirt Altonatiche W. Kronessents." They have evidently been put into the graves by the Quichua-speaking Indians at present living in the vicinity, probably in connection with the plundering of the grave. I have already mentioned the customs of placing objects in graves for the purpose of bewitching persons that are disliked. In one sepulchral grotto I found a gilded glass bead; in another, together with bronze objects, a piece of a cow-horn.

Burial in the old manner in chulpas, etc., was continued long after the conquest of the country by the Spaniards in exactly the same way as before, as also artificial deformation of the crania, etc. Bandelier,* when mentioning the attempts of the Catholic priesthood to eradicate the ancient mode of burial prevalent among the Indians, states, "Not only was the ancient mode of burial extensively practised until more than a hundred years after the first arrival of the Spaniards, but the cloth with which all the corpses (ancient and modern) were covered was periodically renewed as late as the middle of the seventeenth century. The fact that food and drink also were replaced from time to time implies that the vessels found along with the bodies are no longer those originally buried with them." Bandelier points out that as late as the close of the sixteenth century artificial deformation of the cranium was practised, since it was prohibited by the viceroy D. Francisco Toledo. It is, therefore, very difficult to decide whether what is found was really deposited in the graves at the same time as the skeleton or no when all the objects are met with superficially.

In the sepulchres incomplete articles are often found, *e.g.* handles of hoes without any blade, pestles without any mortar, pieces of pottery, etc. This must be some kind of "grave goods" for some reason or another placed in the sepulchres in this incomplete state. It cannot possibly be owing to these sepulchres having been inhabited —which, according to Bandelier,† has been the case with some chulpas —since the objects are found in this state in chulpas which cannot possibly be used even for a casual shelter over-night.

One great deficiency in my investigations of the eastern slopes of the Andes is my not having succeeded in making a single thorough

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* Bandelier, "On the Relative Antiquity of Ancient Peruvian Burials," *Bull. Amer. Mus. Nat. Hist.*, vol. 20. New York: 1904.

† 'Sinopsis Estadistica y Geográfica de la Republica de Bolivia,' Tomo 1, p. 129. La Paz: 1903. Original paper not seen.

examination of any dwelling-place in the valleys of the fell. There are a number of ruins of houses, deemed by some Indians to be of ancient date, but the finds made by me were generally very poor, and certainly belonged to different periods. In the valley of Queara there are a couple of round houses with slate roofs that are called Incahuasi, resembling large chulpas of the type I have mentioned as having a small door. At Corani there are remains of a number of houses that are also round, which, in my opinion, might belong to the chulpa period. Entrance to these houses has probably been obtained through the roof. The reason why the dwelling-places are destroyed is that the Indians do not leave them undisturbed, as is the case with the sepulchres, when making fields or gardens, etc. Most of the finds made when the Indians break ground are derived from dwelling-places that have been destroyed.

A number of bronze and stone implements found by the Indians when making similar clearings have been purchased by me. The articles of bronze are so far interesting that they prove how widely those implements, so characteristic of the civilization of the Andean fells, have spread. Axes, hoes, chisels, awls, knives, so-called "tumis," are found here that are in form almost identical with those described by Ambrosetti * as seen in North Argentina, 600 or 800 miles from these districts.

Here, as in Argentina, bronze and stone axes of a T-shape are found. One stone axe found by me shows the influence of metal technics on working in stone, as its edge is curved outwards. Similar instances are very common with us in Northern Europe from the early days of the Bronze Age, but I have not met with any mention of their having ever been discovered in South America.

In the Sina valley numerous sculptured stones are found, which may possibly be derived from some vast building. They are, for the most part, built into the walls of the church and belfry, but you come across many here and there in the village of Sina. One I found on which a jaguar was cut; another had a conventionalized head of a jaguar. This latter is a great stone that serves as a bridge over the brook of Sina. Each mule or pedestrian passing across it naturally gives the head one or several kicks, so that in a very short time the sculpture will be totally obliterated. Several stones are ornamented with serpents, while one is adorned with a fish, seen from above. These large stones with animal figures thereon are the only specimens of a highly developed stone-cutting found in this part of the eastern slopes of the Andes.

Rock paintings and carvings are rarely seen here. I must mention a grotto at Corani, lying far above the limits of cultivation

* Ambrosetti, "El bronce en la Región Calchaquí," *Anales del Museo Nacional de Buenos Aires*, tomo xi. Buenos Aires: 1904.

and chulpas, in which the wall is perfectly covered with figures (Fig. 5). To this very day the Indians offer coca there. A few crosses painted in red above a number of incised figures are probably intended to counteract the evil influence the figures may be deemed to exercise. It was probably with the same idea that a priest read prayers above the painted grottoes at Quatchichocana * in North Argentina, in order to exorcise witchcraft and evil.

This is, in brief, what I have discovered in the fell valleys east of the Andes, bearing any close connection with the civilization of the Andean fells, more especially with the builders of the chulpas, who

FIG. 5.—FROM THE CAVE AT CORANI.

were probably the ancestors of the Aymaras. *As we have ascertained, the remains of this civilization is not met with farther east than the verge of the primeval or dense tropical forests, with the sole exception of the valleys of the fell, which afford to man about the same conditions of life as the lower parts of the Bolivian-Peruvian elevated plateau round Lake Titicaca.*

Further east towards the interior of the primeval forests, in the dense tropical forests at Rio Tuiche (Buturo), 600 to 700 metres (1960 to 2300 feet) above sea-level, I found large dwelling-places. They prove that the now uninhabited primeval forests formerly had a numerous population. The things found there were absolutely unlike

* Erland Nordenskiöld, "Resa i gränstrakterna mellan Bolivia och Argentina," *Ymer*, 1902, Fig. 8, p. 451.

anything discovered in the fell valleys, and are derived from a population that has evidently occupied a higher status than the savages at present living in the primeval forests at Rio Madidi, Rio Tambopata, and Rio Inambari.

Thus in the primeval forests large grinding-stones (Fig. 6) are found, masses of fragments of pottery, furnished with totally different ornaments from those seen on the pottery from the chulpas, the ornamentation being made by the laying on of fillets of clay, whereas the ornaments on the pots from the valleys of the fell are diamond, spiral, and triangular patterns chiefly painted in black. The stone axes from the primeval forests possess a characteristic form. Human faces, modelled in clay, have also been found by me, one having the lower and the upper lip perforated, another being simply perforated through the upper.

It is no easy matter to decide from which tribe these finds from the primeval forests are derived. About 1670 it appears that a tribe Suquitunia * were living in these districts, but it is impossible to know whether these objects belonged to them or no. It seems, from the accounts of the missionaries, that the tribes speaking Tacana and Lapachu they met in these parts did not even boil their food, but simply roasted it, which statement does not agree very well with the quantity of pottery found in the primeval forests. The clay figures might possibly be those idols mentioned by the missionaries, unless, as Ehrenreich † supposes, the latter were simply dance masks.

On my former travels in Chaco, in Argentina, I also found large dwelling-places in the primeval forests beyond the real Calchaqui territory, in districts at present very sparsely inhabited. Ceramic art was in this case also of a characteristic local type.

It would be very interesting to institute researches with a view of ascertaining whether very large ranges east of the Andes, at present inhabited by more or less wandering tribes, were not formerly occupied by a settled population of far higher standing than that now dwelling there. It would also be of importance to learn in what degree these Indians of the primeval forests have possessed any independent civilization, or how far they have been influenced by that of the fell. In Chaco I found shells (*Oliva peruana*) from the Pacific in a grave ‡ which proves that communication for purposes of barter existed from the shores of the ocean to the dense tropical forests of Chaco. In the

* Armentia, 'Relación Historica de lasmisiones Franciscanas de Apolabamba.' La Paz: 1903. 'Relación y Descriptión de las misiones y conversiones de infieles, Vulgarmente Llamados de Apolobamba,' etc. La Paz, 1898. Published by M. V. Ballivian.

† Ehrenreich, "Die Ethnographie Südamerikas," etc., *Archiv. für Anthropologie*, Neue Folge, Bd. 3, Heft I. Braunschweig: 1904.

‡ Erland Nordenskiöld, "Präcolumbische Wohn- und Begräbnisplätze an der Südwestgrenze von Chaco," *Kongl. Svenska Vetenskaps-Akademiens Handlingar*, Bd. 36, No. 7. Stockholm: 1903.

primeval forests of Rio Tuiche I found no object that can be considered derived from the Indians of the fell, but, having discovered no graves, I have been forced to content myself with investigating dwelling-places, which, as a general rule, give a poor result.

Let me now proceed to describe those forest Indians living in the immediate vicinity of the Andes and the Quichuas. As already mentioned in my introductory paragraph, of these tribes we visited the

FIG. 6.—GRINDING-STONE FROM THE FORESTS OF BUTURO.

Guarayo at Rio Tambopata, the Yamiaca at Rio Inambari, and the Atsahuaca residing between these two rivers.

It was no easy matter to go to these Indians, and perils beset our route both down the Tambopata when we followed the last unexplored portion of this river, and our march into the primeval forests between Tambopata and Inambari. However, it is not our adventures and sufferings that are to be described here, but the result obtained by our exertions.

The Quichuas and whites call the savages of the primeval forests "Chunchos." Yamiaca and Atsahuaca are tribe names or horde names the savages also give the rivers they live on. The signification of Guarayo is, on the contrary, very complicated. It is evident that this word at times simply means "enemy," but it also appears that it is sometimes used to designate just those Indians living on Rio Tambopata, Rio Heath, or the Rio Madidi, thus Tacana-speaking savage tribes. There are no Tupi-speaking Guarayo in the forests between the Rio Madre de Dios and the Beni. It would land me far too deep in the slough of detail if I attempted to give any comprehensive explanation of the use of Guarayo* as a tribal name. Let me denominate the tribe of Indians at the Rio Tambopata as Tambopata-Guarayo, leaving to the future the choice of a better name for them.

The tribes living beside the rivers Rio Inambari and Rio Tambopata are very small in number. The Yamiaca consists of from thirty to forty individuals, the Atsahuaca of about twenty-five. Of the Tambopata-Guarayo tribe I have seen about thirty or forty, but they are far more numerous. Each tribe has its own chief; this dignity does not pass by inheritance from father to son, however, but it seems that the chief warrior of the tribe is chosen as its head. Though these tribes are so small in number, several different languages are met with in these districts, as already mentioned by me. Thus the Tambopata-Guarayo speak Tacana; the Atsahuaca and Yamiaca speak Pano; while the Tuyoneiri living near the Yamiaca speak a third language. The Yamiaca mix many Tacana words in the Pano language they speak. The Tacana-speaking peoples are not widely disseminated, their territory being between the lower Rio Madre de Dios and the Rio Beni. Some of them are christened and civilized. The person who has done most to make them known is Armentia.† The Pano-speaking peoples live on the shores of Rio Ucayali, Rio Madre de Dios, and the Rio Beni, and the intermediate district. It was de la Grasserie ‡ who first made them one group. K. v. d. Steinen § has made the most important contribution to our knowledge of this group of languages.

Peaceable communication between the tribes, as also the capture of women, naturally conduce to the confusion of languages. Wars are of very usual occurrence, being chiefly undertaken for the purpose of capturing women or plunder. It cannot be stated that the Tambopata-Guarayo, Yamiaca, and Atsahuaca Indians have carried on warfare with their nearest neighbours to the west, the Quichuas, or the whites;

* Erland Nordenskiöld, "Beiträge zur Kenntnis einiger Indianerstämme des Rio Madre de Dios-Gebietes," *Ymer*, Heft III., 1905.

† Armentia, 'Navigación del Madre de Dios.' La Paz: 1887. Lafone Quevedo, "Arte y Vocabulario de la Lengua Tacana," *Revista del Museo de la Plata*, 1902.

‡ De la Grasserie, "De la famille linguistique Pano," Amer. Congr., p. 438. Berlin: 1888.

§ K. v. d. Steinen, 'Diccionario Sipibo.' Berlin: 1904.

there have simply been some surprises from the savages, which have scarcely led to any reprisals being taken by either the whites or the still more cowardly Quichuas. Nor have these Indians been subjected to any direct persecution by the whites on Rio Madre de Dios, but have simply had the unpleasant experience of hostile tribes penetrating closer to their territory. Their arms of warfare are the bow and arrow. They do not poison the arrow-tips. They are totally unacquainted with knives and clubs. Peaceable communication exists also between the tribes, and by this means Indians like the Atsahuaca, never previously visited by the whites, have obtained iron axes, machétes, etc.

All these Indians of the primeval forest are agriculturists, though they have no settled place of abode. They are people who till the soil, and yet are constantly ambulant. Each tribe owns fields spread over a large territory, which they visit in turn for sowing and reaping. The Yamiaca and Tambopata-Guarayo, living on the larger rivers abounding in water, move from place to place in canoes and on rafts. The Atsahuaca, living by rapid-flowing brooks, have no such craft, but, on coming to a river which they cannot wade through, they cross it by riding on a log.

The reasons why the fields often lie at a distance of several days' marches from each other are numerous. One of the chief causes has doubtless been the difficulty of finding ground that could be broken with ease. A couple of years ago all these savages were exclusively restricted to stone and bone implements, and it is not an easy matter to clear a glade in the dense tropical forests with such tools. Just for this reason the fields are invariably found in the "chucal," a kind of extremely dense bamboo thicket, where it is comparatively easy to break ground, as few large trees grow there. Another motive for these numerous fields has doubtless been that the Indians wished to have them spread over as extended fishing and hunting grounds as possible. Perhaps they also wished to have numerous fields, in case one or other was plundered by their enemies. As a rule the fields are not large, about 50 by 20 metres (164 by 65 feet) or so; but as they can break many fields in the same bamboo thicket, the entire area may be large. The largest field seen by me—it belonged to the Tambopata-Guarayo—was 150 by 75 metres (492 by 246 feet). In almost all the clearings bananas are cultivated, the plants being placed at a certain distance from each other, so that they give the impression of being planted in rows. Other plants are cultivated between them, those needing much sun, however, in fields where the banana is not grown, or the banana plants are quite small. Special care is devoted to the sugar-canes, they being fenced in and provided with supports.

Besides bananas, I have seen the following plants under cultivation: yellow and white mandioca, sweet potatoes, kalabasses, cotton, a narrow, very palatable variety of sugar-cane, and maize. Besides these, the Tambopata-Guarayo cultivate hualusa (*Colocasia esculenta*) and tobacco, the Atsahuaca aji, and the Yamiaca the pine-apple, which is obtained from the whites. Of all these plants the banana is the most important, then mandioca and maize. The Tambopata-Guarayo do not smoke the tobacco cultivated, nor do I believe it to be chewed or taken as snuff. The fields are common property, at any rate with the Tambopata-Guarayo and Atsahuaca, but there is apparently an exception made with respect to the sugar, so delicious to them. When carried into camp, the produce of the fields becomes private property.

FIG. 7.—ATSAHUACA HUT.

These Indians support life, not only by agriculture, but also by hunting and fishing. The Yamiaca and Tambopata-Guarayo are very ardent fishers; the Atsahuaca are the best hunters. Fishing is carried on with bow and arrow. For this purpose the Yamiaca have harpoon arrows. The Tambopata-Guarayo use wooden hooks. The Yamiaca and Atsahuaca have a way of catching fish by poisoning the water with a certain root. It would be interesting to touch upon the various types of arrow used for hunting and fishing, but would necessitate far too many details. Much labour is expended on these weapons, and, for instance, an arrow from Atsahuaca can always be distinguished from one from Tambopata-Guarayo. The spoils of hunting and fishing become common property, at any rate when any large kill or good catch is made. All these Indians own dogs; the Yamiaca have fowls they have obtained from the whites, but, as is the case with the wild birds these savages sometimes tame, they keep them, not for food, but for company.

As I have previously stated, these tribes have no settled dwelling-place, but own a number of huts at different places in the vicinity of their fields. The Tambopata-Guarayos and also the Yamiaca live in communal huts, *i.e.* several families live together in one hut, where each has its own domain and fireplace. In the Atsahuaca tribe each family inhabits a separate hut (Fig. 7). These huts are as simple as possible, the Atsahuaca contenting themselves with a protective roof of a few palm-leaves, while the Tambopata-Guarayo and Yamiaca set up an oblong round hut of the stems of an enormous reed (*Gynerium saccharoides*) stuck into the ground.

There are no large families. These Indians are monogamists, and from one to three children are seen in each family. In the very largest family I saw among these Indians—it was in the Atsahuaca tribe—there were but four children. In a portion of the hut, or in a hut of their own, each family has their fireplace, where the wood is spread fanwise, not only in order to save the fuel, but so that the members of the family may creep close to the warm wood. Fire is obtained in the usual way with wooden sticks.

The Tambopata-Guarayo have no other cooking-vessels than sections of bamboo, in which they steam their food. The Yamiaca and Atsahuaca possess crocks of a most primitive type. Among the Atsahuaca it is only the women who boil their food (K. v. d. Steinen * made a similar observation among the Bakaïri); the men invariably roast theirs. Both men and women carry in wood to the huts. Making pottery is "woman's work." The males of all these Indian tribes are clad in a shirt without sleeves, made of beaten bast or of the cotton they themselves cultivate. The females wear a square piece of the same material round their hips (Fig. 8), sometimes also wearing a similar square across their shoulders. Both men and women have the cartilage of the nose pierced, having a disc of mother-of-pearl inserted in it, or nowadays sometimes a coin. This perforation of the nasal cartilage has no connection with arriving at puberty, being undertaken long before that period. Some men also have the corners of their mouth

* K. v. d. Steinen, 'Unter den Naturvölkern Zentral Brasiliens.' Berlin: 1894.

perforated, having small wooden plugs in them for everyday occasions, but inserting feathers on high days. Among other adornments the men have frontals of gay parrots' feathers. The Atsahuaca women wear necklaces of monkeys' teeth, while with the Tambopata-Guarayo these are worn by men.

The Tambopata-Guarayo Indians paint their arms, legs, and faces red. The Atsahuaca adorn themselves with patterns in red and blue. None of these Indians are tattooed. All these Indians, in direct opposition to the Quichua, are extremely cleanly in their habits. Nevertheless, they fall a prey to various diseases. While I was with the Atsahuaca they suffered from dysentery; a woman attacked by

FIG. 8.—ATSAHUACA WOMAN AND BOY.

this disease was beaten with nettles (*Urera*, sp.) all over her naked body with a view to curing her. When this treatment had not the curative effect desired, her husband trampled on the various parts of her body, evidently with the intention of thus driving away the ailment.

These savages, more especially the Atsahuaca and Guarayo, were extremely kind and friendly towards us, built us huts, gave us fire, and presented us with different produce from their fields. The Atsahuaca offered me their most beautiful woman, Tamutsi, if only I would marry her and remain with them altogether. These savages of the primeval forest awaken much sympathy in me, though I know full well that they are doomed to extinction. The forests they live in are rich in indiarubber, so that very soon the whites will have taken possession of every scrap of their domain. Probably I am one of the very few who have been permitted to see any of the small primitive tribes living at the base of the Andes previous to their losing all their original customs and usages. They will soon become wretched objects, tapping indiarubber trees and drinking fire-water; this is the inexorable fate to which "los terribles chunchos" are hastening with incredible speed.

Before the paper, the Chairman (Sir Thomas Holdich): Baron Nordenskiöld, who is to address us to-night, is a member of a well-known geographical family. He is the son of the late Baron Adolf Nordenskiöld, who was famous as one of the most eminent geographers of the last century. It is not very long ago that we had the pleasure of hearing from his cousin, Dr. Otto Nordenskiöld, an account of Antarctic discovery. To-night the baron will take us to a part of South America which has been very little visited by white men—the eastern slopes of the Andes and those sources of the Amazon river which are buried in primeval forest. This part of the continent of South America offers many points of unusual interest, perhaps as much ethnographically as geographically, for it is undeniable that very many of the aboriginal tribes of South America are rapidly disappearing. There are tribes in the northern parts of South America, as in the south, that can now be numbered by tens which not long ago could be reckoned in thousands. It is for this reason that all the information we can obtain about them is so important. I will ask Baron Nordenskiöld to commence his address.

After the paper, the Chairman: I think we may well congratulate Baron Nordenskiöld on the excellence of his illustrations. They are most wonderfully clear, and most appropriate to the subject of his paper. We are fortunate to-night in having several gentlemen here who are more or less acquainted with the regions about which he has been telling us; amongst others the Belgian *Chargé d'affaires*, Colonel Don Pedro Suarez. I will ask him to address a few words to you.

Colonel Pedro Suarez: Kindly allow me to commence by thanking Baron Nordenskiöld, in the name of the Government of Bolivia and in my own, for the interesting lecture he has just given us on his troubles on the boundaries of Bolivia and Peru. As a Bolivian, I am always very grateful to those distinguished travellers who have honoured my country with even a hurried visit, which, however, frequently does not give them sufficient time to study personally the habits and customs of the country, and to a great extent they have to rely upon information they receive, which in the majority of cases is very misleading. From my own personal knowledge and experience, both in South America and in Europe, I have acquired a thorough acquaintance with the grading and export of indiarubber and other tropical products grown in the forests and on the banks of our great rivers. Our Governments as a rule spare no efforts to protect the natives, and when abuses crop up, as they needs must in those immense regions, the Governments put a stop to them as soon as they become known. I can proudly assert, speaking on behalf of my people, that the indiarubber and other products which I have mentioned are not stained with blood, nor have they been wrung from the helpless aborigines without giving them something of fair value in exchange, as is notoriously the case with the indiarubber coming from other parts of the world.

I am sorry to disagree with Baron Nordenskiöld in reference to the photos he has just shown us of some persons supposed to be Mojos Indians, and which in no way resemble the inhabitants of the Beni Department, which is the country of the real Mojos. Most likely the photos are of some Indians of a small village called Mojos, in the Department of La Paz, and the tribe is that of the Aimara Indians. As a member of the Bolivian Congress representing the Department of the Beni, I had occasion to investigate the reports that the Indians were robbed and ill treated on the indiarubber estates, and I only discovered three instances, two of which were by European settlers; therefore the information gathered by Baron Nordenskiöld in this respect is not quite correct.

Colonel CHURCH: The paper with which Baron Nordenskiöld has favoured us this evening is useful for purposes of comparison. The region, across the threshold of which he penetrated, is historic—the Inca Yupanqui lost a large army in it, and several expeditions which Hernan Pizarro sent to conquer it were driven back by the savages; but afterwards, during the last half of the sixteenth century and the whole of the seventeenth and eighteenth, the missionary fathers of the Mercedario convent of Cuzco, that of Moquequa, the Jesuit convent of Juli, on Lake Titicaca, and the Franciscans from La Paz penetrated to all parts of the valley of the Rio Beni and the southern portion of the basin of the Madre de Dios, and accumulated more ethnological data regarding the languages and the manners and customs, appearance and characteristics, of the savage tribes occupying the provinces of Caravaya, Caupolican, Apolobamba, and their bordering regions than has ever been collected since.

Juan Alvarez Maldonado, in his various expeditions from 1567 to 1587, did for geography what the missionaries afterwards did for ethnology: he traced the river Madre de Dios from its source to its junction with the Beni, and gave a very fair description of the south-western affluents of both of those great streams. In recent times, we all seem very fond of rediscovering what was discovered in South America centuries ago by its Spanish and Portuguese conquerors.

We delight, also, to pile up the names of savage tribes: every dirty little group or small family we call a tribe, forgetting that nine-tenths of them, at least, bear nicknames conferred on them by their scornful neighbours, or have the names of the *caciques* who lead them. Therefore tribal names are constantly changing.

In studying the tribes at present found in the region of which Baron Nordenskiöld's paper treats, account should be taken of the dislocation of aboriginal nations due to the Spanish and Portuguese invasion of South America and other causes. The Guarayos, for instance, are of Guarani stock. Their original habitat was probably the great flooded area of the upper Paraguay river; they were driven north into Chiquitos. Some of them occupied the country south of the junction of the Itonama and Mamoré rivers; but a large section probably possessed themselves of the valley of the Madidi branch of the Beni in Incarial times, and have become assimilated with the Toromonas and Araonas—Tacana tribes, a dialect of whose language they now speak.

The Chunchos are another tribe of interest. Their territory, at the date of the conquest, was the western side of the upper Beni as far north as the Tuiche river—say 14° S. lat., and east and south-east of them lay the region known to the Incas as Musu. The name *Chunchu* finally became generalized, until, in later colonial days, along the whole of the oriental frontage of Peru, it was synonymous with *savage*. Musu became Mojos, and has given its name to a vast area of north-eastern Bolivia.

During the Spanish conquest of Peru, many Quichua Indians, to escape terrible persecutions, fled down the mountains to the Beni valley; but in general they preferred to seek refuge among the Tacana tribes rather than remain with the Chunchus. The real reason why neither Inca nor Spaniard has been able to colonize the hot valleys to the east of the Andes with Aymarás and Quichuas from the mountains, is that these races, and their favourite animal the llama, rapidly pine away and die in the lowlands.

I do not believe that there ever was developed even an approach to an independent civilization in the region which is the subject of this lecture. The Tacanas may have been, in fact were, a little higher in the scale of barbarism than their neighbours of the lowlands; and their manners and customs, clothing, and rude arts were an improvement on the pure savage.

Dr. Evans: I think we ought all heartily to congratulate ourselves, especially those who are interested in anthropology, on the splendid work the lecturer has done in Bolivia and Peru—work which is all the more valuable, because not only has he investigated the remains of a wonderful civilization of the past, but he has done his best to preserve the details of the existing superstitions and customs of races that are fast disappearing, at any rate, so far as a separate existence is concerned. I am sure that in the future anthropologists will look back to the work that has been done by him and others such as he, and congratulate themselves that it was carried out before it was too late. But not only is it anthropologists who must be grateful to our lecturer to-night, but philologists also. He has recorded vocabularies and a large amount of grammar of a number of languages of which little has hitherto been known; and I shall be glad to put at his disposal the materials I have myself collected. It is most remarkable that in this small district such a large number of different languages is to be met with. It is possible that, as Colonel Church contends, the number of separate stocks of Indians in South America is very limited, but, however that may be, the multitude of languages is extraordinary. D'Orbigny told us there were twenty-seven different idioms in a population of less than 50,000 in Mojos and Chiquitos: on the same scale London ought to have 2700 languages. Now, it seems to me that where a people has a language of its own it is entitled to be considered a separate race, even though it originally came from a common stock.

The lecturer referred to a civilization which existed in the plains beyond the mountains to the north-east. In this connection I may mention that reports are still extant which describe the visit of two Franciscans to the Toromonas and kindred tribes of this region almost exactly a hundred years ago. They give an interesting account of the prosperity and harmony that then prevailed in the district, which appears to have been more populous and civilized than it is at present. We can only regret that the Indians are so fast disappearing; we should have been glad to see them multiplying and populating those vast forests that they have so long made their home, but, unhappily, it seems that it is not to be.

The main course of the dwindling of the indigenous races is not the rubber industry, though that has caused their transfer from one region to another. So far as my own observations went, the Indians appeared to be well treated. There are exceptions, however, and in the outlying districts away from the influence of the Government, things have before now been done which cannot be too strongly condemned.

Terrible havoc has been wrought by zymotic diseases, such as scarlet fever, coming from the old world. But it is, above all, the consumption of ardent spirits that appears to be bringing about the extermination of the Indians. The population of the village of Santa Cruz del Valle Ameno is now only one-fifth of what it was before the distillation of rum was commenced in the immediately adjoining low country. It seems impossible to keep the Indian from spirits, the consumption of which is one of his greatest pleasures. An Indian friend of mine at the isolated mission of San José de Chupiamonas told me that there were to be grand improvements there. On inquiry, these turned out to be nothing more or less than the erection of a still, so that sugar-cane juice could be converted into rum on the spot.

The CHAIRMAN: You will all agree with me that it is very kind of Baron Nordenskiöld to come all the way from Stockholm to read us such an instructive paper—one which has given rise to so much interesting discussion. I will ask you all to join with me in a cordial vote of thanks to the lecturer.

THE ECONOMIC GEOGRAPHY AND DEVELOPMENT OF AUSTRALIA.*

By J. W. GREGORY, F.R.S., D.Sc., Professor of Geology in the University of Glasgow.

I. POSITION AND CLIMATE.

THE economic geography of Australia is concerned with three main factors: First, the geological composition, which gives Australia its minerals, soils, and subterranean water-supply; second, its geographical position, which determines, through its climate and its commercial advantages, the use that can be made of its raw materials; and third, the quantity and quality of its labour.

The dominant fact in the position of Australia is expressed in its name of the "island continent." It has the sheltered position and possible homogeneity of an island, and the vast and varied resources of a continent. Its position has endowed it with a mild, beneficent climate, for most of it lies in the warmer part of the south temperate zone. The Tropic of Capricorn crosses the continent at its widest part, and, excepting North Africa, it is the widest mass of land crossed by a tropic. Its chief tropical areas occur in three great peninsulas, projecting northward into the warm seas of Malaysia. The southern half of the continent is more massive; so that most of the land lies outside the tropics, but confined to latitudes corresponding to those of Egypt, and reaching little further from the equator than Sicily. The middle line of the continent is along the parallel of 25°; its main mass lies between the latitudes of 18° and 35°; and the extreme range of the mainland is only from 10° 39′ S. at Cape York, to 39° 11½′ S. at Wilson's Promontory.

Australia has therefore, in comparison with its size, a very limited range in latitude. Its extension east and west, its insular nature, its uniform elevation, and its plateau structure give it a climate unique in its uniformity and regularity. Australia is robbed of the advantage of an insular climate by its size and its geographical

* Read at the Royal Geographical Society, March 19, 1906.

structure. Its length is 2400 miles and its breadth 1971 miles, and its longer axis is parallel to the dominant movement of the winds; so they lose their characters as sea-winds long before they reach the central regions. The plateau structure and low relief emphasize the contrast of the interior and the coast lands. Australia is a plateau-land, and its highest summit (Mount Kosciusko, 7256 feet) is barely more than half the height of the highest peak in any other continent; it is much lower than the mountains of New Zealand or New Guinea. Hence there is no steady rise to central mountains, leading, by the continual ascent of air to colder heights, to the gradual precipitation of its moisture as widely distributed rain.

The geographical contrast in Australia is not between north and south, but between the arid areas and those that are fairly watered. This is not a simple contrast between the interior and the coast lands; for the distribution of the rainfall is governed by the temperatures of the water in the surrounding oceans.

The eastern coast is washed by a warm current flowing southward; accordingly moist winds blow ashore from a warm sea to a colder land; and as they are forced to rise over the East Australian Highlands, they drop their moisture in abundant rains. But on the western and south-western coasts the winds come from a cold sea to a warmer land; the air is warmed as it crosses the land, so its capacity for moisture is increased instead of being lowered, and it sweeps inland as a dry and even parching wind. Hence we have the contrast between the arid shores of the Great Australian Bight with their 10-inch rainfall, and the eastern coast on the same latitude with a rainfall of 60 inches.

The climate of Australia is governed by the passage of a succession of atmospheric systems. They sometimes cross the continent along a southern path, and leave the interior open to warm, moist winds from the tropics. On other occasions they pass along a more northern track, excluding the moist, tropical breezes, and letting in the cold, rough winds from the Southern Ocean. A succession of anticyclones crosses the continent with remarkable regularity. Each takes, on an average, eight and a half days in its passage, and the variations in its path and progress determine the conditions of the Australian weather.

Australia is in an exceptionally favourable position for the study of weather and climate; and we may expect from her contributions to scientific meteorology worthy of her opportunities, when she realizes how hopeful are the prospects of seasonal weather forecasts, and what incalculable benefits they would bring. The variations in the anticyclones are affected, and perhaps caused, by changes in the Southern and Indian Oceans; and it is not until our knowledge of the circulation of the water in those oceans has advanced, that we can hope to understand that alternation of drought and deluge, to which Australia is subject.

II. Structure and Materials.

The utilization of Australian materials is largely determined by the climate, but their nature and distribution is determined by the geological structure of Australia. It is a plateau land; and it is a plateau of great antiquity and uniformity. It has, moreover, been so long isolated from the main stream of organic development, that its own fauna and flora are archaic and unique.

Australia was once a land of great contrasts in relief; when it had lofty chains of folded mountains of the Alpine type, the earliest of which extended from south-east to north-west, across the whole width of Central Australia; and at later times a great mountain chain ran north and south along eastern Australia, from Victoria to the Cape York Peninsula. The summits of both mountain chains were snowclad; glaciers flowed down their valleys and deposited the Cambrian and the Carboniferous glacial deposits.

These old mountain chains were worn down to their stumps before the end of the Palæozoic period. The great folds that formed them have not been renewed; and since Mesozoic times the structure of Australia has been determined by the foundering of earth-blocks, leaving high plateaus and forming wide lowland basins, long valleys, narrow coastal plains, and isolated cauldrons.

A. *Geographical Subdivisions.*

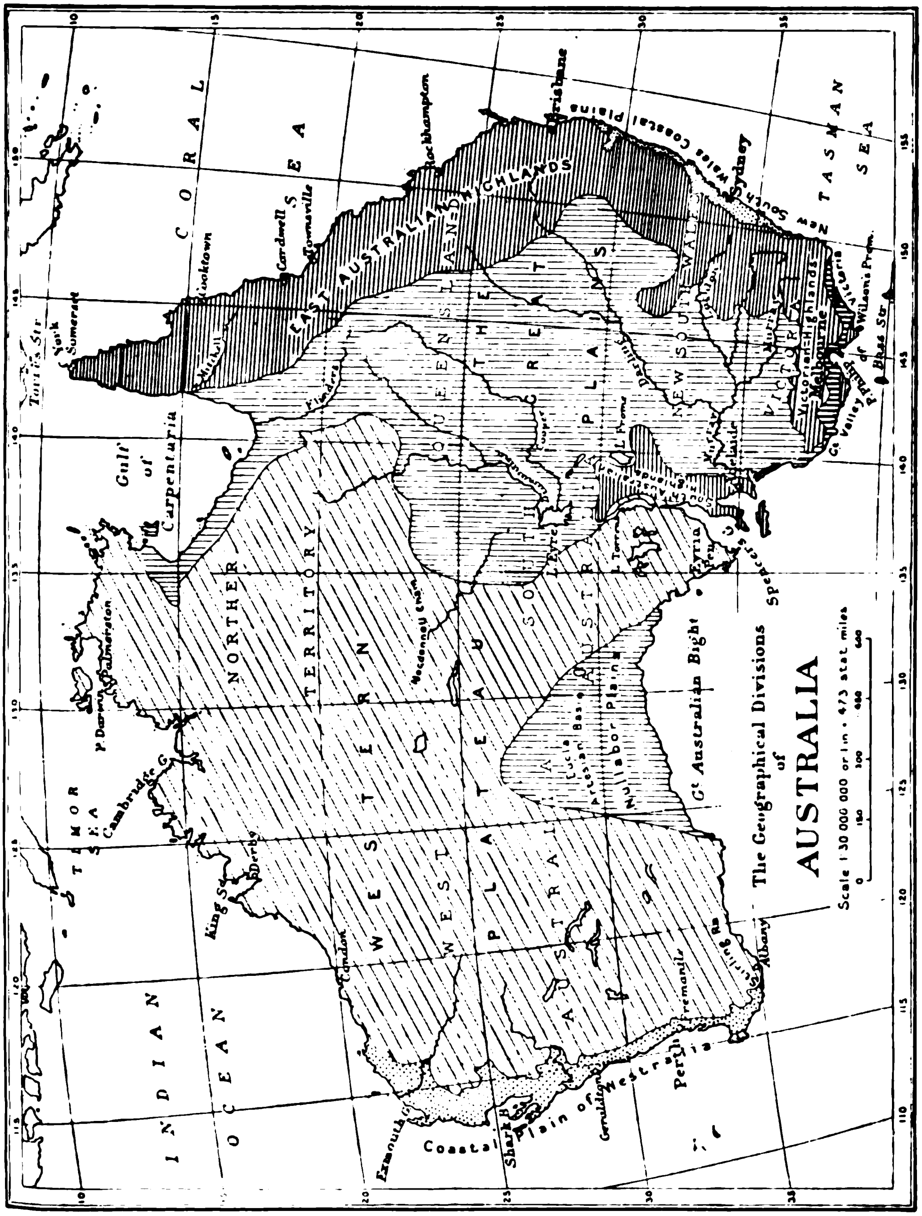
These vertical subsidences have broken across the old folded mountain lines, and have stamped upon Australia its present geographical divisions. They are three—

1. The East Australian Highlands, ranging from Cape York Peninsula, southward to Victoria. They are flanked to the east by the narrow, interrupted coastal plains of Queensland and New South Wales.

2. The Great Plains lie to the west of the East Australian Highlands; they extend from the Gulf of Carpentaria southward to the Southern Ocean, on the coasts of Victoria and eastern South Australia. These plains include the basins of the Flinders and Leichhardt rivers, Lake Eyre, and of the Murray and Darling.

3. The Western Plateau is a vast block of Archæan rocks, which forms the western half of Australia; it is bounded to the east by the remains of the old mountain chain that extended from Kimberley, through the Macdonnell Chain to the South Australian Highlands; projections northward and eastward, form the Arnhem Peninsula, the Barklay Tableland in Queensland, and the Barrier Ranges in New South Wales. The South Australian Highlands have been cut off from the Western Plateau by the formation of a rift-valley, the Great Valley of South Australia, including Lake Torrens and Spencer's Gulf.

The Western Plateau is indented by the basin of the Nullabor Plains, which run inland from the Great Australian Bight; and it is skirted



on its western and north-western margins by the coastal plains of Westralia.

The contrast between the East Australian Highlands and the Western

Plateau is the most marked in Australian geography. The surface of the Western Plateau is gently undulating, and consists of open, rolling, arid plains; the East Australian Highlands are a dissected plateau, which has been cut up into deep gorges and steep ridges, mostly covered by dense forest, passable only with difficulty. The difference between these divisions of Australia is due to the different effects produced by the denudation of plateaus in wet and arid regions.

The East Australian Highlands have been carved from a plateau in a well-watered land; the rain that falls upon them rushes in rapid mountain torrents down their slopes to the sea, or to the central plains; the powerful corrosion by the rivers and waterfalls had carved out deep canyons, which have been widened into valleys; and the old plateau has thus been reduced to a maze of gorges and a complex of narrow, sinuous ridges. The country, thus deeply dissected, clearly exposes its mineral wealth; and, as it is difficult of access, it is generally unsuited for agriculture, in spite of its often fertile soil and good water-supply. So it is necessarily left in the main to the pastoralist and the miner.

The Western Plateau has had a different history, and it is still a plateau; for it is in an arid region, where wind is the main distributing force. So the irregularities in the surface are levelled and the contours rounded, by the action of sandblast on the ridges, and the filling up of the valleys by wind-drifted sand and clay. The light rain has no powers of deep excavation; it only washes the loose soil down the hillsides into the hollows, where it accumulates in banks, breaking up the valleys into separate basins and clay pans. It is only near the plateau edge that the rivers have any powers of dissection, which even there are but slight. So the main part of the Western Plateau is being levelled, while the East Australian Highlands are being still more deeply sculptured.

Accordingly, in the western interior of Australia the mineral wealth is less well exposed; agriculture on a large scale is impossible; sheep raising is precarious; and even the existence of populous industrial communities is difficult, owing to the scarcity of water.

The Great Plains and the branch eastward therefrom along the Great Valley of Victoria, with their good turf, dry climate, low elevation, and mild temperatures, are best suited for sheep, and on them are the great sheep-runs that gave the first contribution to Australian wealth.

B. *Soils.*

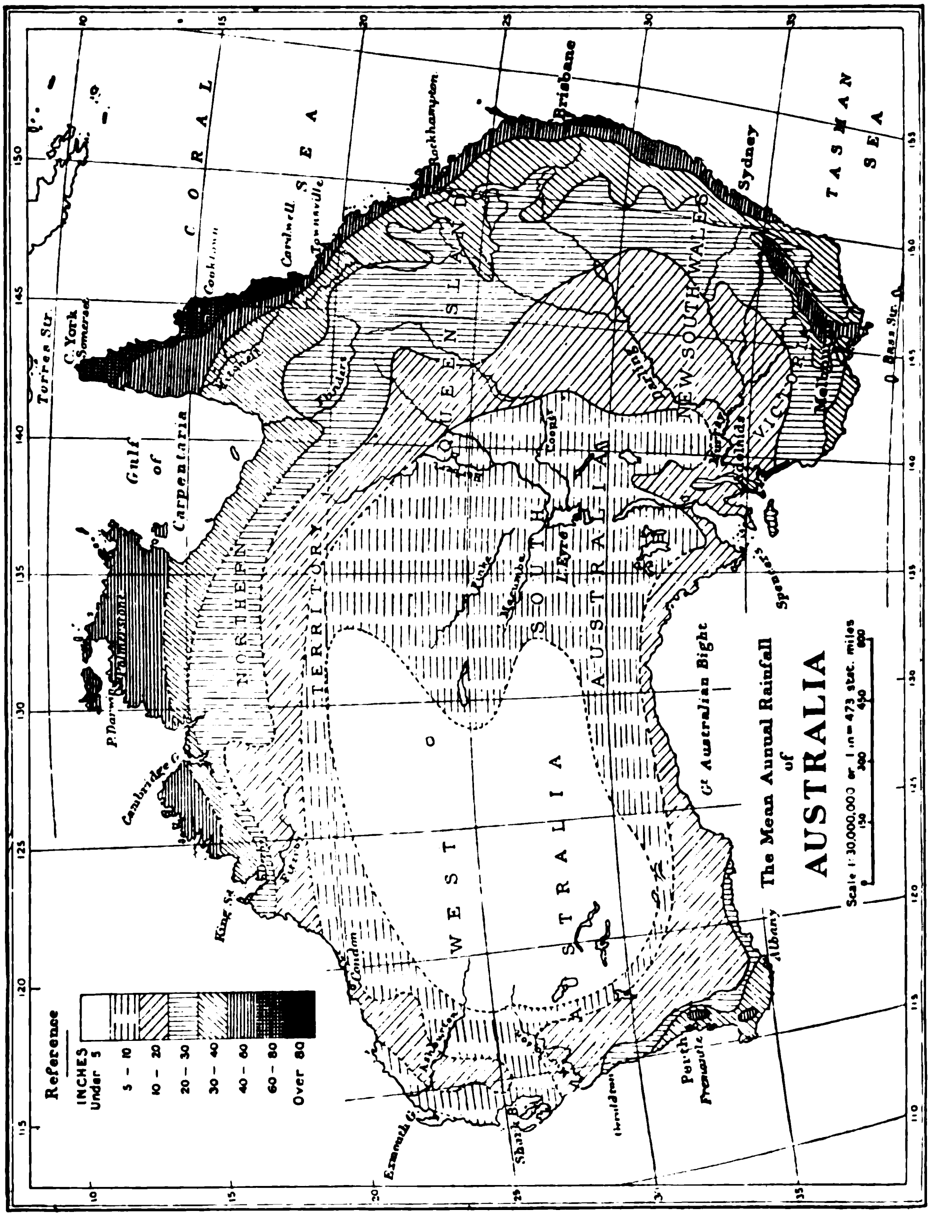
The soils of Australia are in unusually close dependence on the geological structure of the country. The soils are mostly sedentary, *i.e.* formed by the decay of rocks *in situ;* and the only drift soils are those due to wind on the plateaus, or to river deposits on the flood plains of the rivers. The widespread volcanic sheets, which occur near the coast in all the states, decompose to a rich soil—the "chocolate soil" of land agents' catalogues. This soil is rich in plant foods, lime, alkalies, and phosphates. The transported soils on the wide alluvial plains, and the sheets of wind-borne loam, are poor in phosphates; and the chemists who succeed in cheapening phosphatic manures can give the most effective help to the Australian farmer.

The Western Plateau, though barren through lack of water, has often a rich soil, for it consists of primary rocks, which contain abundant plant foods. In places where the grains of quartz accumulate, the soil is mere barren sand; but where clay is formed by the settling of wind-blown dust, or silt in a hollow after rain, the soil is rich in alkalies and phosphates. And as there is little vegetation to use up these plant-foods, they accumulate and form a soil of remarkable richness. Desert soils are nearly always rich; for they have slowly collected stores of soluble plant-foods, and their mechanical texture makes the soils light and warm.

C. *Water-supply.*

These rich rested soils now lie idle for lack of water. Once Central Australia was well watered, and then it was as fertile as a garden; but it has become arid. Its rains have dwindled, in places, to a miserable 3 or 4 inches a year, in a region where evaporation alone can suck up more than twice as many feet; so the rivers have ceased from running; their valleys have been blocked by barriers of earth; and the lakes thus formed have dwindled to mere shallow pools of brine, or even dried into sheets of poisonous salt crust. The centre of Australia—once a luxuriant garden—has now turned into the "Dead Heart of Australia," but it shows such clear evidence of its former fertility as to stimulate schemes for its revival. The shores of Lake Eyre are below the level of the sea; so the first idea was to flood its basin by a canal from Spencer's Gulf. This impracticable scheme was followed by a more fascinating idea. The most striking contrast between Australia and the other continents is that the interior is riverless. All of it has some rain; whither does this rain go? It does not flow in rivers to the sea, for most of the vast interior is either a basin of internal drainage, or of no drainage. Even its one great river, the Murray, discharges only a small proportion of the rain that falls upon its basin. Mr. H. C. Russell calculated that only 1·46 per cent. of the rainfall on the Darling basin above Bourke is discharged by the river past that town. What happens to the other ninety-nine per cent.? Russell rejected the idea that it could all be lost by evaporation. So he concluded it must percolate underground. If so, it must flow through some buried channel, and have some hidden outlet to the sea.

During calm weather there may be seen, in places along the southern coast of Australia, swirling columns of some liquid working its way upward to the surface. They are masses of fresh water surging up through the denser salt water of the sea. The idea occurred to Russell that these submarine springs were the mouth of the subterranean river,



which discharged the drainage from the Queensland hills. According to this conception, the essential difference between Australia and the other continents is that, whereas their rivers flow over the surface, the main river system of Australia flows underground. It seemed a beneficent and providential arrangement, whereby the water would be carried through Central Australia protected from evaporation as in a pipe. If only this pipe could be tapped at intervals, the water would be obtained where it was wanted, and the rested soils of Central Australia might again be as fertile, as when the fabled kadimakara revelled in the rich herbage around Lake Eyre. The idea was promptly tested. Suetonius Officer, a Melbourne landowner, sunk some wells on his station of Kallara, in the far west of New South Wales. He was rewarded by reaching water, which overflowed from the mouth of his wells. Under the stress of heavy drought, and guided by the geological insight of Dr. Jack, Queensland, in 1885, began the first bore to test the possible occurrence of deep-seated waters beneath its arid western plains. In 1888 the enterprise was rewarded by the bore, at the depth of 1645 feet, reaching water, under such high pressure, that a stream rushed to the surface and discharged at the rate of 291,000 gallons a day. This success led to an active search by boring, in areas where the geological surveys of the different States indicated that the deep well waters might be found. By the end of June, 1904, Queensland had 596 flowing wells, yielding 62,635,722 cubic feet a day; New South Wales, 248 wells; and South Australia, 20.

The opening of these wells naturally led to the hope that they might render widespread cultivation possible in the Great Plains. The water is enough for some intense cultivation around towns; it maintains permanent watering-places for stock, on routes that would otherwise be impassable. The wells supply some towns with their domestic water; one of the wells lights Roma with natural gas; and some of the wells may be used for the cultivation of lucerne to feed stock during a period of scarcity. But for extensive irrigation this well-water is quite inadequate. Moreover, the calculations as to the amount of this water available seem to me to rest on a wrong basis. It is generally believed that the wells are truly artesian, of the same nature as the flowing wells of Flanders, Paris, and London, where the water that falls on the adjacent hills, percolates underground into the deepest part of a trough-shaped fold of chalk; thence it is forced to the surface, up any bore-hole through the overlying clays, for the same reason that water poured into one side of a U-tube will rise up the other. The average rainfall on the Queensland hills is about 22 inches, or 319,000,000 gallons, of water per square mile. The area which receives this amount of water on the western slopes of Queensland and New South Wales is so large, that, if much of the rainfall could be caught, the amount available would be enormous. According to some estimates, it is calculated that 25 per cent. of this rainfall percolates underground, and is available for collection from the deep, water-bearing rocks. One distinguished geographer asserted that it is as idle to fear the exhaustion of this underground reservoir, as it would be to drain the ocean by pumping from it; and many responsible geologists have concluded that the amount of water discharged from all the flowing wells of the central basin of Australia, is so insignificant, compared with that which drains away wasted to the sea, that there need be no hesitation in increasing our demands on the supply, or even troubling to avoid waste. But the simple theory that the water rushes up these wells owing to the hydrostatic pressure of the water in the Queensland hills, seems to be contradicted by the evidence. I have recently discussed this question, and pointed out the facts, which seem to me to show, that much of this water is not rain-water which has worked downward; but it is plutonic water, which has risen from the deeper layers of the Earth's crust; and that the water rushes up the wells owing to the tension of its included gases, and the pressure of the over-lying sheets of rocks. We have at present no means of calculating the available supply, and there is every probability that it is not inexhaustible. Many of these wells have already reduced their yield, warning us that they derive their water from the accumulations of former ages. Politicians have proposed to limit the waste of water which now goes on, and I hope that the legislation proposed some years ago will be promptly reintroduced, so that this invaluable asset may be used to its fullest advantage.

D. *Pastoral and Agricultural Areas.*

The geographical divisions of Australia mark off the country into areas which are suited for industrial, agricultural, and pastoral occupation, and into the vast tracts of the interior, which are, at the present time, of no use for anything. The industrial districts are on the mining-fields and at the chief ports. The best coal-fields are in the coast lands of New South Wales, Victoria, Tasmania, and Queensland; and there are fields with inferior coals on the Western Plateau, and most of the states have deposits of brown coal, especially in the coast lands.

The difference between the pastoral and the agricultural lands is relative. It depends upon their accessibility by railway as well as on the rainfall. At first the western plains of Victoria were of value only for pastoral purposes; but as the railways extended across them, as towns grew up on their borders, providing better markets for perishable produce, and as a denser population afforded a better labour-supply, pastoral districts have become agricultural.

The four railway lines that traverse the north-western plains of Victoria have converted land, once barely of any value even for pastoral purposes, into the great granary of the state. And as the arid plains of the interior of the continent rest mainly upon rocks of primary composition, their soils are rich in food materials, and could be used for agricultural purposes, whenever there is an adequate water-supply and transport for the crops. The three northern peninsulas have areas of rich volcanic soils, and as they have heavy rainfall, these districts could, with adequate labour, grow valuable tropical products, such as cotton.

E. *Mineral Resources.*

The geological composition of Australia also determines the nature and distribution of its mineral wealth, which has yielded materials to the value of over £600,000,000.

Its most famous industry is its gold-mining, which dates from 1851. Gold had been found long before; the first definite record was by James McBrien, a surveyor in the Lands Department of New South Wales, who wrote in his field note-book * for February 15, 1823, that close to a gum tree, which he marked, beside the Fish river, he had "found numerous particles of gold in the sand in the hills convenient to the river."

This news was suppressed; and when, sixteen years later, Count Strzelecki found gold in the vale of Clwyd, he too was persuaded to conceal the fact, as the nervous governor feared its publication would have revolutionary political consequences.

It was not until 1851, that the occurrence of gold in mining quantities, and not as mere museum specimens, was made known by Hargraves; and the search in Victoria, roused by his results, led, on August 24, 1851, to the earliest discovery of first-rate mining importance—the gold-bearing gravels of Golden Point, Ballarat. The diggings there showed that Australia was one of the great goldfields of the world, and began the active mining, by which Australasia has contributed £500,000,000 of gold to the world's treasury.

The Australian goldfields are unusually varied in character, wide in their distribution, and stimulating in their many novel problems. Their new and peculiar difficulties have developed a courage, enterprise, and originality, which now enable the Australian miner to work ores of unprecedently low grade, and have led to inventions and new methods that help the miner in every mining country of the world.

1. *Surface Alluvial Deposits.*—Gold-mines are divided into two main groups, alluvial deposits and gold-bearing lodes; and though both of them have yielded the most easily accessible of their richest ores, the geological conditions of the Australian fields show that they are not exhausted. There remain supplies of gold that will keep Australian mining active for generations to come.

The alluvial deposits include surface gravels, sands, and loams, which contain grains and nuggets of gold derived from the decomposition of gold-bearing lodes.

* A photographic facsimile of this entry is given by E. F. Pittman, 'The Mineral Resources of New South Wales,' 1901, p. 1.

Such were those rich tom-tiddler's grounds, the alluvial diggings of Victoria, at Ballarat, Bendigo, and Castlemaine (the Mount Alexander diggings), and the gold alluvials of Westralia, begun by the discovery of Coolgardie in 1892. These rich patches were confined to the immediate neighbourhood of the lodes, and were soon worked out; but alluvial mining has continued on deposits more difficult to reach. Most of the older gravels are buried beneath sheets of clay. The miner finds them first at their outcrop, and when the shallow deposits are worked out, he has to dig shafts and follow the materials underground. Thus began the mining of the older, deeper gravels.

2. *Deep Leads.*—The available extent of the gold-bearing gravels in Victoria appeared to be greatly reduced by vast sheets of lava, some of which occur in the richest of the gold-bearing regions. These lavas hid, once it was feared for ever, the gold-bearing rocks beneath them. At Ballarat the mining of the surface gravels ended against the face of the igneous rock, that forms the Ballarat West plateau. The rock wall repelled the cosmopolitan army of miners, who were camped on the plain beneath, as successfully as the walls of Sebastopol were then resisting the allied armies in the Crimea. So the miners called the plateau Sebastopol. Its resistance was at length overcome. It occurred to some miners on the adjacent goldfield of Cresswick, who were faced by a similar obstacle, that perhaps the igneous rock was not a deep-seated block, like a granite, but might be a surface lava-flow, beneath which the gravels might continue. This idea was tested; it was found to be true, and this enterprise begun the deep-lead mining. The Ballarat miners at once renewed the attack on their Sebastopol; they mined under its walls, and found the gold-bearing gravels beneath it. Farther back from the edge they sank shafts through the surface lava; and during this work they discovered the quartz reefs at Ballarat West, from which the leads derived their gold.

Twenty years later, this system of mining received still greater extension. From the volcanic region of the central Highlands of Victoria, long bands of lava extend northward. About thirty years ago, Mr. Reginald Murray, then Government Geologist of Victoria, recognized that these long basalt plains were lava-flows filling up old river-valleys, and that, therefore, the gravels of these rivers have been preserved beneath the surface. The lava plains occur among the richest goldfields of Victoria, and therefore it could reasonably be expected that the gravels on the old river-beds would be rich in gold.

The mining of these gravels has required new methods. The exact position of the gold-bearing gravels has first to be proved by drilling lines of bores across the lava plains, to determine the course of these ancient river-beds, and the depths at which they occur. By extensive boring operations, in which the Victorian Government, with statesman-like foresight, has spent nearly £200,000, the course of many of the ancient river-systems has been determined. Thus the course of the ancient Berry-Moorlort-Loddon lead can now be represented on a map like a modern river, but the river-bed is buried under hundreds of feet of lava. The mining of these river gravels, after their course has been

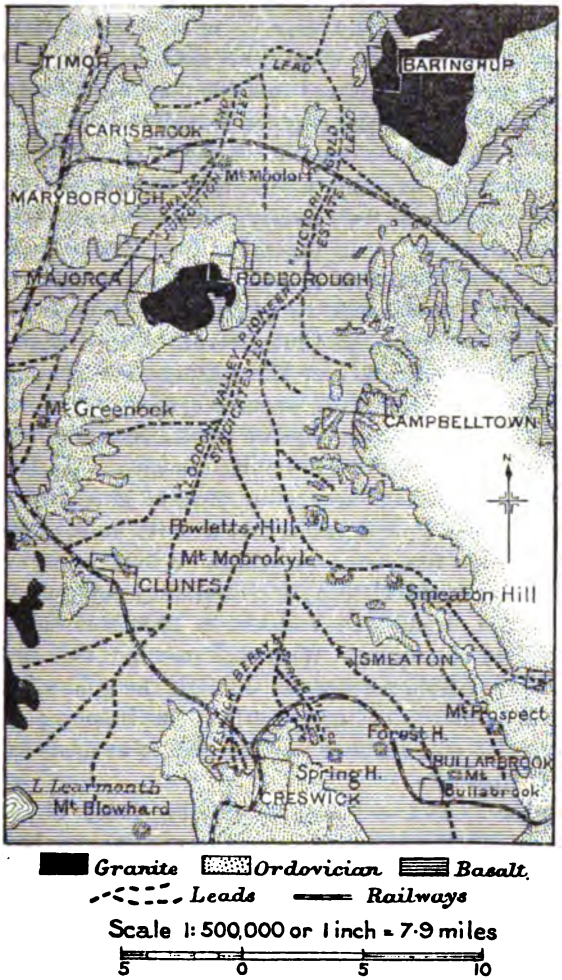


FIG. 3.—GEOLOGICAL SKETCH-MAP OF THE BERRY-MOORLORT-LODDON LEAD.
(*After Stanley Hunter.*)

determined, has especial difficulties; for the gravels occur below water-logged quicksands, which require to be drained before the miner can remove the gold-bearing layer. The pumping is often a long and costly task. Mines may have to pump millions of gallons a day for years before any gold can be got from them. Thus, according to a cable published on February 15, the two neighbouring mines, the Loddon Valley Goldfields and the Victorian Deep Leads, together pumped, in the month then reported, 250,000,000 gallons of water. This pumping may have to go on for years. But so rich are the gravels, and so cheaply can they be mined when once they are drained, that they often give handsome returns for the heavy cost of the years of patient pumping.

3. *Gold-dredging.*—Alluvial deposits of a different and poorer type occur further from the lodes, whence the gold is derived. Only a little fine gold is carried into them, and this fine gold may be scattered loosely through a thick bed of loam, clay, or gravel, instead of being concentrated on the bottom of the deposit. Some of these low-grade deposits are on the floors of existing rivers, and the gravels could only be obtained at a cost, which their scanty gold would not repay.

In 1891 it occurred to an ingenious New Zealand miner that the cheapest way of working these gravels would be to haul them up by a bucket-dredge, and then wash the gravels on the deck of the dredge. The system was tried on the Clutha river. The dredge was greatly improved by the application of the tailings elevator, invented also in New Zealand, in 1894; while another type, the suction-dredge, by a powerful centrifugal pump, pumps up gravel instead of water.

These dredges work with marvellous economy. In favourable conditions a dredge will haul up a cubic yard of gravel from the bed of a river, wash it, sort it, and extract from it its gold, at the cost of 2*d.* Hence, if a dredge recovers two grains, or four pennyworth of gold per cubic yard (or about $1\frac{1}{3}$ tons) of gravel, they pay well. The average gold yield of the dredges in Victoria in 1903 was only 2·25 grains, or 5*d.* of gold per cubic yard. With such economy, this system of gold-mining has spread from Australasia through the gold-mining countries of the world. But the system is still in its infancy; and this New Zealand invention will enable a vast increase to be made in the ultimate gold yield of Australia.

4. *Auriferous Lodes.*—The gold-bearing lodes of Australia are scattered through the older rocks of the continent. Every state has them; they are richest, in comparison to its area, in Victoria, and poorest in South Australia. These lodes are of many different types. The simplest are the gold-quartz veins formed along fault planes, and they are usually the easiest to work.

The Australian gold-bearing lodes are of unusual variety in their modes of occurrence; they occur in rocks of many different ages and of different kinds, volcanic, plutonic, sedimentary, and metamorphic. They occur as simple quartz veins along fissures and faults; as quartz veins ramifying in an irregular network, through fractured masses of slate and sandstone; as "saddle reefs" in contorted slates and quartzites, as at Bendigo and Hargraves; they occur as metasomatic or replacement lodes in slates; and as mineralized bands of schist, granite, slate, and volcanic tuff; in propylitized diorite dykes; and along faults beside which augite andesites have been altered to serpentines. They are distributed through rocks of many ages; they are most abundant in the Archæan schists, as in Westralia and Victoria, and in the Ordovician slates, as at Bendigo and Castlemaine; they also occur in the Silurian slates and sandstones of Victoria and New South Wales, in the Devonian and Carboniferous rocks of the East Australian Highlands, and in New Zealand in the Oligocene volcanic rocks of the Thames goldfield. Many of the mines are worked to great depths; they are working at 4250 feet at Bendigo, 2300 feet at Ballarat, and 2000 feet at Kalgoorlie. Nevertheless, in many of the fields the works are still quite shallow, though the ore-shoots probably often go down much deeper, and will yield good returns to mining in future.

5. *Silver and Base Metals.*—The mineral wealth of Australia also includes rich deposits of lead, silver, zinc, copper, and tin. Its most important copper-field is at Mount Lyell. There, thanks to the combined practical skill and high theoretical knowledge of its manager, Mr. Sticht, the difficulties which have long prevented the adoption of pyrite-smelting have been overcome, and the ores are being mined and smelted at the low cost of 13*s.* per ton. The chief mines of lead, silver, and zinc are at Broken hill, where the output of the mines lowered the price of silver; and, thanks to the ingenious device of separating the zinc ore from the rhodonite, by making each little grain of ore develop its own buoy of gas-bubbles, the vast stores of zinc are now available for the service of mankind.

6. *Coal and Iron.*—Perhaps more important in their ultimate influence than even the gold-mines are the vast coalfields and iron ores of Australia. The coal-fields are mainly in New South Wales; and they can safely be described as the greatest and best-placed coalfields in the southern hemisphere. They have been most worked where the coal-measures outcrop on the surface around Newcastle and up the basin of the Hunter river. But they extend to the south, buried by later rocks, and have been proved in a 10-foot seam at the workable depth of 2917 feet under Sydney.

In the other states, Victoria has a high-quality coal in Jurassic rocks; and coal of the same age occurs in Queensland, in the Ipswich district, and in South Australia, in Leigh's Creek. Tasmania has coalfields in the basins of the Mersey. Western Australia has coals in the Collie Field, of which the age is still uncertain. Vast deposits of brown coal occur all through Australia, especially in the Great Valley of Victoria; but though the amount there is enormous, no exact estimate is possible; for the bores prove the patchiness of the deposits, and as adequate assays were not made from all the cores, material that can only be described as carbonaceous shale has been included in the records as brown coal.

The iron ores of Australia are of high quality and wide distribution.

A report by a commission of the Federal Parliament has called attention to their amount; and with vast accessible supplies of good ore, suitable fluxes, and cheap coking coal, I am confident that in the future —with the possible exception of China—Australia will beat the world's record in the cheap production of iron.

III. Economic Development.

The economic development of a country with the geographical characters and position of Australia naturally passed through three stages. It could at first be most easily utilized for the raising of cheaply produced materials, which could stand long-distance transport without injury, were of sufficient intrinsic value to pay the cost of freight, and would return a sufficient reward for the expense and inconvenience of pioneer life. Australia was a wide land, with unbounded acres, but little labour. So it was particularly suitable for sheep-breeding, which could utilize the maximum of land with the minimum of labour. It was a sound instinct which led John MacArthur, in the early days of the Sydney colony, to devote his energies to the improvement of Australian sheep-breeding. Dissatisfied with the quality of the half-bred merinos, which were the best that could be got from the Cape, he tried to procure pure merino sheep from Spain. But their export was a capital offence, and MacArthur's efforts were foiled. But then came the Peninsular war; and it was characteristic of Australian methods that it seized this chance of getting the coveted Spanish sheep, and by careful breeding developed its high-quality wool.

The pastoral industry was the first that gave Australia its wealth, and the wool export from 1851 to 1903 alone, was, according to Coghlan, of the value of £610,000,000. Despite the havoc of the last drought, Australia has now over 73 million sheep, and has the greatest yield of wool of any country in the world. It has more sheep than the rest of the British Empire. During the development of this pastoral industry, Australia wanted capital to buy machinery and make roads and public works. So it inevitably adopted a free-trade policy, so as to produce, at the cheapest possible rate, as much material as possible for sale to Europe. This policy was reinforced on the foundation of the mining industry in 1851; for Australia wanted to import machinery, rails and railway plant, tools and clothes for its miners at the cheapest rate, while it employed its people in industries that gave a quicker return and used less capital than manufacturing.

Australian Manufacturing Industry.

But with the increase of population it has been possible to develop industries that produce higher-priced commodities, and yield higher profits than can be got from the sale of raw materials. At first manufactures were restricted to such articles as clothes and food, of which local production was necessary, or low-priced bulky materials, such as bricks and furniture, which could not afford long-distance transport. But with increased labour-supply, and the occupation of all the naturally cleared, accessible land, and the exhaustion of the most easily worked gold deposits, other industries became profitable. Diggers bought land and became farmers. Large sheep-runs have been cut up into dairy farms, and the calcareous loamy soils have been ploughed into wheat-fields. Australian agriculture has the advantage of the seasons alternating with those of Europe; so her summer produce and autumn fruits reach Britain when there is least local competition. The national ingenuity has helped the farmer as well as the miner; and much land that could not otherwise have been tilled has been brought under cultivation by the stump-jump plough, and the invention of the stripping harvester enables the wheat-fields to be reaped most economically.

Australia has, therefore, seen a great development both of her agricultures and manufactures. In 1903, according to Coghlan's* estimate of the value added by manufacturing processes to the raw materials (much of which would otherwise have lain waste), manufacturing made the greatest, and agriculture the second greatest, contribution to Australian wealth.

	£		£	s.	d.	
Manufactures: the value added to the raw material by manufacturing	28,528,000	or	7	5	8	per head of population.
Agriculture	26,792,000	"	6	16	9	" "
Pastoral	25,620,000	"	6	15	2	" "
Mining	23,838,773	"	6	1	9	" "
Dairy industry	7,130,000	"	2	5	0	" "

Part of the results from dairying, moreover, should be added to those from manufacturing, as its main product, butter, is made in co-operative factories, from milk raised by small dairy farmers.

(To be continued.)

THE GEOGRAPHY OF INTERNATIONAL FRONTIERS.†

By Major E. H. HILLS, C.M.G., R.E.

THE importance of clearly defined boundary-lines between the territorial possessions of rival nations is too obvious to require any labouring. That ill-defined boundaries are a fruitful subject of international

* It has not seemed necessary to include many statistics in this paper, as complete figures are given in that invaluable storehouse of information, Coghlan's 'A Statistical Account of Australia and New Zealand,' issued annually by the New South Wales Government. Published in this country by P. S. King & Son, Great Smith Street, Westminster.

† Address to the School of Geography, Cambridge, May 5, 1906.

dispute has been proved again and again and, in view of the fact that one such dispute is actually at this moment in a somewhat critical stage, we need not go outside the present time for an example in point. It follows, therefore, that the fixing of frontier lines is one of the most important acts of the government of a country and one that should not be undertaken without a due weighing of all the conditions and a due understanding of the geographical questions involved.

As will be readily understood I am here, and throughout this lecture, speaking more particularly of new frontier lines, such as we meet with in delimiting our African possessions, not so much of old-established frontier lines in highly civilized countries. The latter fulfil their objects if they are clearly marked both upon the maps and upon the ground, and are fully understood and accepted by both parties. For the settlement of new frontier lines the problem is a different one and calls for a more complete solution. In this case we are concerned, not only with the frontier as an accomplished fact, but also with the frontier in process of making, and the ease with which it can be surveyed and marked out upon the ground becomes an important factor. The time element often enters into the problem, generally complicated also by financial restrictions, and the question then to be answered is, not what is the best possible frontier line to select, but what is the best line that can be surveyed and laid out within a stated period of time and with a definite limit of cost?

As in most practical affairs, the solution must be of the nature of a compromise which renders it all the more important that the original agreement or treaty, wherein the proposed frontier line is first defined, should be drawn up in the most lucid manner and with the actual conditions of the practical problem clearly in view. Unfortunately, such treaties have been often drawn by diplomatists, whose knowledge of geography may be small and whose knowledge of practical survey work is *nil*. Hence much future trouble, which could have been avoided, or anyhow minimized, by more "clear thinking" at the outset. To assist in this "clear thinking" and to indicate briefly some of the more important factors ruling this problem of frontier definition, are the objects of the present lecture.

The conditions which the perfect frontier should fulfil may be postulated as follows:—

Firstly, it should be an actual barrier to the people on either side of it. This is a condition which obviously can only rarely be met.

Secondly, it must be clearly indicated upon the ground, so that the most ignorant can have no excuse for mistaking its position. To this end, it must either be marked by natural features or by artificial monuments or beacons. In the latter case, the relative facility with which the ground can be surveyed and the beacons erected in position with the requisite accuracy becomes a fundamental point.

Thirdly, it should be stable, not liable to secular changes.

Fourthly, if lying in an inhabited district, it should, wherever practicable, respect existing ethnological or tribal boundaries. In giving weight to this condition, it is necessary to guard against attaching undue importance to such boundaries when only of a temporary character or when dealing with tribes known to be of wandering habits.

All frontiers are capable of division into two main classes: natural frontiers, such as rivers and watershed or crest-lines; and artificial frontiers, comprising conventional lines upon the Earth's surface, parallels of latitude, meridians of longitude, and "straight" lines between fixed points. In the latter category we must also include frontiers defined "by reference" to existing conditions, such as frontiers following existing provincial boundaries, tribal boundaries or roads, or defined as passing within a certain distance of a town or village.

Let us take these various types *seriatim* and see how far they fulfil, and in what respects they fall short of, our ideal conditions.

River Frontiers.—The advantages accruing from the selection of a river as a boundary-line are, in the first place, that its position is quite obvious, and, in the second place, that it requires no survey operations to delineate it. In the case of an unknown river such operations are interesting for the purpose of laying down its course upon our maps, but are not necessary for the delimitation of the frontier.

An example of the economy of time and labour arising from this quality of the river frontier occurred recently in the course of the delimitation of the boundary between the republic of Liberia and the British colony of Sierra Leone. Starting at its northern end this frontier was defined by a certain meridian line until it met the Mannah river, which it then followed to the sea. Roughly about two-thirds of the line was along the meridian and the remaining one-third along the river.

Owing to the densely wooded nature of the country the survey proved extremely difficult and the traverse of the north and south line and the erecting of the necessary beacons, necessitated many months' hard work. When the boundary commission reached the river their work was finished and they travelled to the coast by the shortest route. Had it been necessary to traverse and survey the whole river another season's work and a further expenditure of several thousand pounds would have been involved. At the same time, though this river was not traversed by the commission and its actual course, between the point where the meridian cuts it and the coast, is unknown, it forms a valid boundary, the existence and position of which is known to every native in the locality. Furthermore we may note that the beacons erected along the straight portion may easily, unless well cared for, become overgrown and obliterated, while the river remains visible so long as rain falls and water flows.

Per contra, we must reckon it a disadvantage that a river, by the easy means of communication and transport it offers, rather connects than separates the races on its two banks. For this reason it is comparatively exceptional for large rivers to be accepted by old nationalities as boundaries.

All rivers are liable to secular changes of their course arising from the denudation of one part of their banks and the accretion at others, and in certain exceptional cases, notably that of the Yellow river, they have broken into entirely new channels. In such circumstances it becomes important to decide whether the frontier-line shall follow the new course of the river or remain immutably fixed in its old position. The accepted ruling in this case follows what I believe is the ordinary practice of English law, viz. that any slow, continuous change of course carries the frontier with it, while a *per saltum* change into a new channel leaves the frontier in the old channel, even if that be completely deprived of water. In defining a frontier as following a river it is necessary to state the precise line to be taken, which may be either the *medium filum*, or midstream, the line midway between the two banks, or the thalweg, the bottom line of the valley or line of deepest channel of water. Of these the mid-stream is the most stable in position; many tropical rivers, for instance, change their actual channels repeatedly, while their whole bed, only filled at times of extreme flood, lies between banks not liable to any but slow change. On the other hand the thalweg is most readily identified and can always be found so long as there remains a trickle of water in the channel. Modern practice is in favour of the selection of the thalweg for this reason. If one of the nations concerned claims the whole waters of the river, with all navigation and other rights, the boundary can be defined as following the river-bank or even a line at a certain minimum distance from the bank.

It should be noted that the definition of a frontier as a line parallel to a river is not a satisfactory one as such a line may, when following internal bends or angles, cut itself. In all cases the use of vague terms such as the "course" of a river should be studiously avoided.

Watershed Frontiers.—In discussing the merits of the watershed-line as a boundary we must, in the first instance, note that the word "watershed" has an unfortunate double meaning in the English language, *i.e.* it is sometimes used as signifying the basin or drainage area of a river, and sometimes the crest or water-parting line separating two contiguous river-basins. The latter seems to be the only legitimate use of the word, but as it is commonly used, whether in error or not, as a synonym for basin, it is preferable in formal documents to avoid the word altogether, and write in its place "line of water-parting."

When lying in high ground the water-parting line forms, on the whole, the most satisfactory frontier that can be found; it is readily identified, requires no survey to delimit its position and is perhaps, of all geographical features of the Earth's surface, the one least liable to secular change. When raised above the snow-level, so that it cannot be crossed except at certain definite passes, such a line forms an ideal barrier between nations.

When drafting the description of such a frontier, care must be exercised that no misunderstanding can arise as to which water-parting line is intended to be taken and to this end it is always advisable to enumerate the precise river-basins that the line is to separate. Much confusion has arisen in the past by looseness of definition due to imperfect geographical knowledge. Thus the long-standing dispute between the republics of Argentina and Chili had its origin in an assumption that the continental divide, separating the waters which flow into the Atlantic from those flowing into the Pacific, was coincident with the general crest-line of the highest peaks of the Andes. Apart from the difficulty that the Andean range has nothing which can be described as a general crest-line, the continental water-parting is at places very far removed from the mountain region and runs out into the comparatively flat ground of the pampas. The claims of the two republics, one demanding a frontier along the continental divide without any deviation, and the other a line along the highest peaks of the Andes, following, as far as possible, the principal north-and-south "backbone" of the range, were quite incompatible, and were finally submitted to the arbitration of His Majesty the King.

In flat ground, on the other hand, the water-parting line forms a less desirable boundary. The advantage of ready identification is lost, and the actual position of the line can only be found by somewhat refined levelling operations. Hence, if used as a frontier it requires beaconing thus losing part of its character as a "natural" line. In an extreme case the water-parting line may even lie in a lake or marsh and thus become indeterminate. As an example of this we may cite the case of Lake Amucu, on the watershed between the Rio Branco and the Essequibo, which is reported to drain in both directions.

A somewhat similar example occurs at the confluence of the Zambezi and Shiré rivers where the two main streams are connected, at some distance from their actual junction, by a channel called the Ziwa-Ziwa river. The direction of flow of water in this channel was a subject of difference of opinion between those who had visited it but there seems good reason for supposing it to vary with varying climatic conditions. If this really be the case, and the water in the Ziwa-Ziwa flow at times from the Zambezi to the Shiré and at times in the contrary direction, we should have the phenomenon of the Zambezi-Shiré watershed shifting its position with the changing seasons.* There are doubtless other cases of flat marshy ground situated on the separating line between river-basins the drainage of which is liable to seasonal change. The supposition that a water-parting line is always well defined and is immutable in position is thus unsupported by the facts and frontier treaties based upon such lines must be drafted with due caution. In many cases it would be preferable to depart from the watershed where the latter enters upon an area of level country and to substitute straight lines. The excessive amount of curvature and winding of a watershed in such an area is an additional reason for this simplification.

Artificial Frontiers.—In this term we include all lines which, not being natural features of the Earth's surface, must, if used as frontiers, be marked out by artificial means—boundary posts, monuments, cairns, or beacons. All such frontiers have, therefore, the common objection that they must be minutely surveyed and beaconed throughout their whole length. This preliminary work once over and the positions of the beacons or frontier-marks fully accepted by both parties they lose their chief defect. The slight initial disadvantage under which they labour often ultimately acts to their advantage by compelling careful delimitation and survey and removing the temptation to leave the settlement to a mere paper definition.

Frontier definitions based upon parallels, meridians and straight lines are very tempting to diplomatists on account of the fatal facility with which such lines are ruled upon a map and are embodied in a treaty. In making use of such lines it is very important to bear constantly in mind the relative accuracy with which their positions are known. Thus in an unsurveyed country the position of a meridian, or, in other words, the longitude of any given place, is liable to much larger errors than the position of the parallel or its latitude. Repeated instances have occurred of the danger of accepting meridian-line boundaries in little-known country. Thus the 30th meridian of east longitude, in the neighbourhood of Lake Albert Edward and the Ruwenzori mountains, was given a position on the maps about 80 miles in error at the time when a frontier agreement was drawn up between this country and the Congo State.

A somewhat striking example of the disadvantage of a meridian frontier has lately come to light in the case of the Anglo-Congolese

* The water-parting line between two rivers terminates at the point where their waters first meet. Thus if the Ziwa Ziwa flows from the Zambezi to the Shiré, the first point where Zambezi water meets Shiré water is the junction of the Ziwa-Ziwa and Shiré. If the flow in the channel is in the reverse direction the meeting-point of the waters is the Ziwa Ziwa-Zambezi junction.

frontier in the neighbourhood of Lake Bangweolo. The agreement between Great Britain and the Congo State of May 12, 1894, defined this section of the frontier as follows: "The thalweg of the Luapula up to its issue from Lake Bangweolo. Thence it shall run southward along the meridian of longitude of the point where the river leaves the lake, to the watershed between the Congo and Zambezi."

When this agreement was drawn the existing maps showed the course of the river as lying well to the westward of the meridian drawn through the point where it leaves the lake. Later surveys have, however, shifted the relative positions of river and meridian with the effect of moving the stream so far towards the east that it now intersects the meridian line in two, if not in four, places. A delimitation of this boundary in strict accordance with the treaty is therefore impossible, in that it would result in islands of inaccessible territory cut off between the straight line and the river-bends. A new set of negotiations are therefore imperative, a necessity due to the unfortunate wording of the original agreement.

Boundaries following parallels of latitude are unobjectionable. Existing frontiers of this nature, *e.g.* the 49th parallel between Canada and the United States were laid out by astronomical observations and are substantially in error owing to the variation of local attraction. At the present time such a frontier would be laid out by triangulation so that this particular source of error would be eliminated. A recent example of this class of boundary is the Anglo-German frontier west of the Victoria Nyanza which follows the parallel of 1° south and was delimited by a triangulation survey extending about 20 miles on either side of the line.

A meridian-line boundary would now be laid out in the same way.

The case of a frontier following a straight line between two points on the Earth's surface gives rise, unless the positions of both points are quite accurately known, to grave difficulties in delimitation. Long lengths of such a frontier are most undesirable in a new or rugged country and necessitate a detailed triangulation extending over a wide belt. Alternatively such a line can be delimited by traversing it twice, once to determine the relative positions of the terminal points and a second time to mark the line on the ground.

Many frontiers of this class have been delimited in Africa and there are some still waiting demarcation. Thus the eastern boundary of Nigeria, separating that colony from the German Kameruns, is for the most part a series of straight lines. The southern section running from the "rapids" on the Old Calabar or Cross river in the direction of the town of Yola, lies in a very difficult country and has not yet been surveyed. The northern section from Yola to Lake Chad was surveyed about three years ago.

The agreement which established this frontier was that between

Great Britain and Germany of November 15, 1890. The fact that a lapse of nearly sixteen years after the signing of the treaty still finds much of the line undelimited cannot be considered a subject for congratulation, and without throwing too much of the blame for this delay upon the wording of the treaty, we cannot fail to see that a frontier definition based upon fixed points, viz. the "rapids" of the Cross river, Yola, and the intersection of the southern shore of Lake Chad with a certain meridian, the exact positions of none of which were at the time known within limits of many miles, was hardly satisfactory.

In connection with this particular frontier, we may further observe that the "shore" of a lake is often liable to great alteration in different seasons and is in many cases too variable a line upon which to hang a frontier definition. This is certainly markedly the case with Lake Chad.

In parenthesis, it may be noted that there are at least four lines joining two points upon the Earth's surface which can with almost equal justice be described as "straight."* The difference in length between these four lines is inconsiderable but the difference in position or maximum deviation one from another is by no means negligible.

In at least one historical instance it has been tacitly assumed that a line ruled upon a map with a straight ruler represents a straight line upon the Earth's surface; whereas it is obvious that the true curvature of such a line will vary with the system of projection of the map. However it does not appear that any ambiguities of this nature have ever given rise to frontier disputes and the point is only mentioned as illustrating the unsuspected difficulties which may trip up the incautious.

While a long length of straight line is not a very good selection for a frontier there is little or no objection to short lengths of such lines as, for instance, would arise if a frontier is taken as running from peak to peak of a mountain range. Provided always that the lines can be beaconed in such a manner that the ordinary native has no excuse for a mistake as to which side of the frontier he is on, a succession of straight lines, being simpler in plan than the watershed line, may sometimes be substituted for it with advantage.

Another class of artificial frontier is that described by reference to existing artificial conditions, such as a frontier defined as following the

* If A and B are the two points, the lines are—

(1) The intersection of the surface with the plane containing A and the normal at B.

(2) The intersection of the surface with the plane containing B and the normal at A.

(3) The "curve of alignment" in which, at any point, a plane can be drawn containing A and B and the normal at the point.

(4) The geodetic, or shortest line between the two points, which is not, in general, coincident for any part of its length with (1), (2), or (3).

limits of occupation of a certain tribe or the boundary of a certain province. The inevitable vagueness of such a description will naturally restrict its use to any but cases where land values are small and where the country is undeveloped or sparsely inhabited. Even in such cases it would almost always be preferable to substitute a more rigorous definition. Thus the long misunderstanding between this country and Portugal as to Barotseland, where we claimed the whole district subject to the king of that country, has been a direct result of the vagueness with which the limits of our claims, depending upon such a shadowy thing as the rule of an African potentate, were presented, both to our own minds and, *à fortiori*, to those of our rivals. As a more recent example of the evil of indefiniteness we may note that at the present moment the Foreign Office would be extremely pleased to be informed what is the true northern limit of the province of Sinai.

In connection with the question of tribal boundaries, more particularly in Africa, there is a further difficulty that arises owing to the fact that tribes and village communities often own outlying patches of land, similar to the detached portions of many British counties. To deviate a frontier so as to enclose all such fragments of land would obviously be impossible so that, to avoid hardship to the natives, the general custom has been to allow them a certain time—say one year—during which they can freely choose on which side of the frontier they wish to live and, when the choice has been made, to give them grants of land as compensation for what they have lost.

A frontier defined as running at a certain minimum distance from an existing road, or skirting an existing town or village, requires no elucidation.

A last class of frontier definition, one that we may hope never to see used in the future, is that which defines it as a line drawn on a certain map. If the map is on a sufficiently large scale and is based upon an accurate survey there is much to be said for this form of definition, but the case is far otherwise when the map is one on a small scale and relates to country imperfectly known or incompletely surveyed. Thus, in the convention between Germany and the Congo State of November 8, 1884, Art. VI. reads, "The German Empire is ready on its part to recognize the frontiers of the territory of the Association and of the new state which is to be created as they are shown in the annexed map." The map was not even published with the treaty but was the same one as that attached to the ninth protocol of the Berlin Conference of 1884–5. It was on a scale of about 150 miles to the inch, and, as may readily be imagined, it was, in the light of our present knowledge of the interior of Africa, very far from being even approximately accurate. It would be impossible to mark out the frontier from it now.

While definition by map alone is generally inadvisable it need hardly be pointed out that the objections to this practice are multiplied many times when the number of copies of the map is so limited that a complete destruction of them is possible. The "ancient limit" of Egypt was laid down on a map which accompanied the Sultan's firman to successive Khedives and, as far as is known, the sole extant copy of this map was destroyed by Ismail when deposed from the khediviate. In this case there is little doubt from contemporary evidence as to what the ancient limit was, but the absence of any official and authoritative description of it is nevertheless much to be deplored.

Unfortunately the average map has no indication of the reliance to be placed upon its accuracy and in consequence features whose positions are dependent upon travellers' vague reports are often treated as of equal value with those based upon real knowledge and accurate surveys.

The maker of frontiers must keep a clear mind as to the true value of the features with which he is dealing, and thus avoid an error such as was committed when the fine mountain of Kilimanjaro was surrendered to Germany in exchange for the mythical Mfumbiro. When we realize that at the time the treaty was made (1890) Kilimanjaro was quite well known and had been visited by numerous Europeans, while Mfumbiro had only been seen by three white men, none of whom had approached it within 40 miles, the nature of the mistake is evident. Finally, we must remember that once our frontier has been accurately and completely described any redundancy in definition carries with it possibilities of doubt and confusion. Thus the agreement between France and Liberia of December 8, 1892, fixed their mutual boundary from the coast as following "the thalweg of the river Cavally as far as a point situated about 20 miles south of its confluence with the river Fodedougou-Ba at the intersection of the parallel of 6° 30′ N. lat. and the meridian of 9° 12′ W. long." It will be observed that the same point is here located in two totally different ways, first as a point on a certain river, and secondly as the intersection of a named parallel and meridian. Recent surveys, as might naturally have been predicted, have shown that these two definitions are quite inconsistent with each other.

In concluding this lecture, which has, I am afraid, treated the subject in a somewhat inadequate and sketchy manner, I should like again to draw your attention to its national importance. There was a time when Great Britain was not burdened with troubles of land frontiers, except in the case of India and Canada. Now, however, owing chiefly to the partition of Africa among European powers, this happy time has passed and, for good or ill, we are involved in responsibilities from which our insular position long kept us clear. When we remember the fact that we have at this moment in Africa alone about 5000 miles of frontier common with France and 3500 miles common with Germany we cannot be accused of pessimism if we frankly recognize that these long lines, large sections of which traverse country still almost unexplored, contain the germs of future misunderstandings. To avoid and guard against such misunderstandings is the function of the diplomatist and to aid him in this task he must call to his assistance the scientific geographer or, better still, must himself be the scientific geographer when, relying upon his own knowledge alone, he will be able to uphold the interests of our country and to safeguard the peace of future generations.

A PLEA FOR THE INVESTIGATION OF BIOLOGICAL AND ANTHROPOLOGICAL DISTRIBUTIONS IN MELANESIA.*

By Dr. ALFRED C. HADDON, F.R.S.

The Melanesian islands constitute a fairly well-marked biological province. Many of the islands are of large size, while most of them have a greater area than the majority of the islands of the Pacific, and there is reason to believe that these are vestiges of an ancient land-mass that probably became submerged in the Mesozoic period. The islands of Melanesia have yet to be studied from a purely geomorphological point of view, and the geology of most of them is practically unknown.

Probably botanists are not satisfied with their knowledge of the flora of the district as a whole, or of particular portions of it; and there must be many problems of plant structure, distribution, and œcology that require detailed investigation on the spot. The same remarks apply to the zoologists. Botanists, zoologists, and general biologists would welcome an opportunity for extensive and intensive study of the morphological, distributional, or biological problems of plants and animals in Melanesia.

There are many anthropological problems in Melanesia that require investigation in the immediate future, since the dying out or modification of arts, crafts, customs, and beliefs that is now taking place, and the shifting and mixing of populations, will soon render their solution difficult or even impossible. On the other hand, there are many districts never yet visited by a white man, and many islands of which science has no ken.

The Melanesians are mainly a dark-skinned, woolly-haired, dolichocephalic people, but there is much variation in these and other physical characters. For example, the skin may be nearly black or of a coppery tinge, the woolly hair may be more or less completely unravelled among certain individuals in many places, and the cephalic index varies from extreme dolichocephaly to well-marked brachycephaly. It is generally

* Research Department, June 8, 1906.

admitted that this somatic variability is explicable on a theory of Polynesian admixture; but it has yet to be proved whether (to take one character only) the brachycephaly is entirely due to this factor, or whether it is the result of variability in the stock itself, or it may be the expression of a distinct variety of the Melanesian race. The Polynesians themselves are by no means a pure race, and their constituent elements require elucidation. Dr. Volz (Volz, W., 'Beiträge zur Anthropologie der Südsee,' *Archiv für Anthropologie*, 23, 1894) has argued, only from craniological evidence however, that there is a primitive Australian element in the West Pacific and even in New Zealand; and he divides the Melanesian and Polynesian races into several "branches" and "types." The further elucidation of these problems can be effected only by a very large series of physical measurements and observations extending over a wide area.

The psychology of backward peoples has been greatly neglected, and the opportunity of a well-equipped expedition would do much to encourage students to undertake this research.

A good deal is known about the arts and crafts of the Melanesians in a general way, and attempts have been made to synthesize our knowledge, the most satisfactory of these being that of Dr. Gräbner (Gräbner, F., "Kulturkreise und Kulturschichten in Ozeanien," *Zeitschrift für Ethnologie*, 1905, pp. 28–53), who has published half a dozen maps illustrating the distribution of a large number of cultural objects and of certain customs. He distinguishes in Western Oceania a primitive west Melanesian culture, followed by an eastern Melanesian culture; later came the proto-Polynesian culture drift, and finally cultural elements from the southern Polynesians. Generalizations such as these naturally depend for their value upon the accuracy and completeness of the observations upon which they are founded, and a systematic survey of the island groups as a whole would lead to trustworthy results. An investigation of this kind would verify existing data, add an immense number of new facts, and localities could be ascertained for unlocated specimens in our museums, and the uses of doubtful objects could, in many cases, be discovered.

Although data exist for the study of many languages of Melanesia, a great deal remains to be done in the collection and study of fresh matter; and the folk literature has yet to be recorded.

By a combination of these two lines of inquiry, the physical and the cultural, the nature, origin, and distribution of the races and peoples of the West Pacific could be elucidated.

There are other aspects of the anthropology of Melanesia that are of equal importance, to which brief allusion must be made.

The sociology of the Melanesians has been studied by various writers, chief among whom is Dr. Codrington (Codrington, R. H., 'The Melanesians,' Oxford, 1891). We know that mother-right is generally distributed, but in many places it has been partially or totally replaced by father-right. Melanesia is peculiarly suitable for studying the stages of this transition, and it requires local knowledge to determine whether the passage has taken place spontaneously, or whether it is due to racial influences. If the former be the case, it is important to discover the causes that have led to this transformation and the steps that mark its progress. With this is associated the evolution of the family and the distribution and inheritance of property. Melanesia is also a favourable area for tracing the emergence of government, as all stages occur between the regulation of public affairs by a conclave of elders and the establishment of a powerful chief with more or less autocratic powers. What is required at the present day is intensive studies of restricted areas, but these areas should be carefully selected so as to procure the maximum of results with the least expenditure of time and energy. It is only by careful regional study that the real meaning of institutions and their metamorphoses can be understood.

All the manifold beliefs and usages that are grouped under the term "religion" require detailed local study, and much information is desirable concerning the remarkable development of secret societies in Melanesia.

The study of the decorative art of Melanesia is practically untouched. It is absolutely necessary to make investigations of this nature on the spot in order to discover what is the significance of the various designs and patterns, and to accomplish this in a satisfactory manner it is necessary to have exceptional facilities for getting about.

It is superfluous to extend this plea, as all ethnologists will agree that this work requires to be done, and that without delay, a conclusion which must also be obvious to those who have not previously given attention to the subject. The presence of Government officials, missionaries, traders, and of returned indentured labourers, tends rapidly to modify or destroy the old customs. Much has already disappeared in many places; we are yet in time in many others if we do not delay.

For fifteen years I have been convinced that the best means of accomplishing the end in view is to organize a prolonged expedition to the Pacific with the absolute control of a suitable vessel. The vessel must be a steamer built for comfort and stability rather than for speed. The permanent scientific staff on board should be the director, doctor, photographer, at least two stenographers, who should also be typists, and, if possible, an artist. The director should reside permanently on board, but should he for any reason elect to remain temporarily on shore, he must appoint a deputy, who must remain on the vessel, and during this time the latter is to have full powers and sole control.

Accommodation should be provided for a number of investigators, but these would not necessarily form part of the permanent staff. They would be conveyed to the district which they were to study, and be removed therefrom when it was time to leave. The director would arrange with each investigator when the vessel would return, and the investigator would be left with all the apparatus, food, and "trade" that he required.

The general routine would be as follows: an anthropological investigator would be expected to work on the general lines laid down by the director, due regard being had to his special aptitudes, and he would be expected to make such arrangements that, when the vessel returned, a large number of natives would be ready to be measured and photographed. While taking photographs himself of anything of a temporary nature, he would not be expected to photograph permanent objects, as the expedition photographer would be put at his disposal on the return of the vessel, the object being, of course, to save the investigator all unnecessary labour. Arrangements should also have been made for dances or ceremonies (actual or rehearsals) to take place during the steamer's visit, in order that they might be adequately photographed and cinematographed. The investigator would orally amplify his rough notes, and dictate them to the stenographers; and, as far as possible, all notes should be typed in duplicate before the departure of the investigator, and a revision made of them before finally leaving the spot. During the time that the steamer was at the district of an investigator, all those on board would be required to help that investigator according to their several abilities. The investigator should inform the director of any tradition of migration, or of trade routes, or other cultural transmission, so that these clues might be followed up by the steamer at the earliest opportunity.

Should there be a student who desires to make a general survey of the distribution of any series of customs or objects, he would naturally remain on board, or be landed for a shorter or longer time, as he desired; special arrangements would have to be made between him and the investigators of special districts.

The foregoing remarks apply to anthropological investigators, but suitable arrangements could be made for geological, meteorological, geographical, botanical, or zoological investigators.

Americans and foreigners should join the expedition on the same terms as British subjects. Investigators might be of either sex.

(An estimate of the probable cost of such an expedition and other practical details were laid before the meeting, but it is not deemed expedient that these should be published just now.)

It is only by an expedition of this kind that the anthropology of Melanesia can be studied in detail and as a whole. It would be an expensive undertaking, but the results obtained would amply justify the expenditure of time, labour, and money, and the data so obtained would constitute a mine of information for the present and future generations of students of man.

Before the paper, Sir GEORGE GOLDIE: I shall only say a few words. I should like to express my sympathy, personally and generally, with Dr. Haddon's plan. When he suggested it to me, it appealed to me very much, and I think it is in consequence of that conversation that he has brought forward the paper. Geographers quite recognize the functions of geography in such a question. Of course, there are a great number of sciences—biology, anthropology, and so forth—which deal each with its own field and its own special division of the phenomena that occur on the surface of the Earth, but when these sciences come into relationship with each other and with past, present, or probable future land forms or distribution of land and water, geography alone can solve the problem; so that Dr. Haddon's expedition would be, although very technical in its aspect, on the whole a geographical expedition.

After the paper, Dr. HERBERTSON: I have not heard anything of Dr. Haddon's proposals until this afternoon, and it is rather difficult to say anything very much to the point on the spur of the moment. One has only to look at that great depth of ocean lying to the east of New Zealand to see that there must be fascinating problems in this Melanesian area; and doubtless what one has read about the changes of coast-lines in works such as those of Prof. Agassiz in dealing with the islands of the Pacific, and books like Guppy's, points to the fact that very much valuable work has to be done in this region before we can come to decided opinions as to its past. And from that geomorphological point of view, I think such an expedition would give rise to excellent results.

Mr. CHISHOLM: All I can say is, I have not the slightest doubt that such an expedition as this would certainly lead to valuable results, and I express the hope that Dr. Haddon will be successful in raising the money for the purpose.

Dr. SELIGMANN: In reference to what Dr. Haddon said about undeveloped government in Melanesia, I believe that we may have a condition of government even lower than that by the old men of the village. It was very forcibly borne in on me that at times the old men only voiced the opinion of the community, and if they tried to influence it to any considerable extent, they would have been disregarded; I do not say no notice would have been taken of their advice, but it would not have been acted upon—things would have come to a deadlock, and this has happened once or twice. With regard to the vessel that Dr. Haddon spoke of, it must be remembered that no vessel is ideal for the Pacific, every vessel draws a foot more water than is possible for somewhere you want to go. It will be a necessary thing to get the smallest possible draught which is compatible with stability. On the recent Daniel's expedition we found a paraffin-launch of immense success. We were on a sailing-boat, and what I saw of it fully persuaded me that a steamer was the only thing. Even working a small district of islands, we came to the conclusion that a steamer would have been far more valuable than a sailing-boat; and certainly, if I ever went on another expedition, I should try for a steamer, even if I had to pay £5 a ton for coal dumped on the beaches. I was also struck with what Dr. Haddon said about the value of women, and that no one had studied the women's customs from the women's standpoint. This opens up another difficulty, and that is interpreting. I have never found any New Guinea woman, with the very partial exception of native wives of traders, who would have been able to translate into English. I should think that was a possible difficulty, and it is difficult to see how it could be even partially met. As regards what might be expected zoologically in the way of new specimens, I think a very great many new things would be found. I may give you one particular instance. We were in no sense a zoological expedition, but when we collected a few specimens of fish simply to have them identified, because they were tokens, and some of them turned out to be new species. I should finally like to heartily express my sympathy with Dr. Haddon's idea, and the hope that he will be able to carry the scheme through.

Mr. Myres: I should like to mention one or two points. The first is the very great desirability of carrying out such an expedition before it is too late; the second point is, if such an expedition should take place it should be arranged so as to interest a large number of people in it, and so as to ensure that the material collected would illustrate not merely the nature of the native races of the area, but at the same time the physical environment in which those races and their culture have come to be what they are. The other thing I should like to mention is that the area that Dr. Haddon proposes seems to be eminently suitable for the purpose, and even if his estimate were to be considerably exceeded, as such estimates are always liable to be, a sum of anything between £60,000 and £100,000 would undoubtedly be regarded, a hundred years hence, as having been well spent.

Mr. Ray: I was very much interested in Dr. Haddon's paper. I may say I am in full sympathy with Dr. Haddon in regard to his proposal for such an expedition, but one of the difficulties is the question of interpretation. The missionaries learn the languages to a certain extent, far enough to be able to produce a gospel translation, and when that is published they rarely go any further. Very few of them take down native stories, and no native literature is preserved.

Mr. Thomas: Although I have no practical experience of expeditions, I am sure I very strongly agree with Mr. Ray in what he says with regard to the importance of language, but if the expedition is to last as long as five years, it seems to me the question of the absence of interpreters would be to some extent got over. I imagine the investigators would have acquired the language and be able to act as their own interpreters long before the termination of the expedition. Dr. Haddon did not say anything about the destination of the collections. I think that they should all be collected together in one building and be accessible to students. I am especially interested in social organization and questions of that sort, but I really do not think that any anthropologist can have the slightest doubt of the importance of such an expedition, and of the extreme importance that such an expedition should go early rather than late. To take the example of Australia. The extent to which European influence spreads is probably very much underestimated. Now, in the north-west of Australia there are areas where probably no white men have ever been, but right through these areas, instead of natives using the stone implements which they formerly used, the first expedition found that they possessed iron implements. That illustration alone shows how quickly European influence makes itself felt; and in the same way customs become merged and many other details of social organization are liable to be influenced, when Europeans have been only comparatively slightly in touch with the people. That applies, of course, to many other parts of the world besides Melanesia. It seems to me that, for anthropological purposes, it is of great importance that such an expedition as this for the detailed study of such questions should set out as early as possible.

Captain Wilson-Barker: There is very little I can say about Dr. Haddon's paper. I quite think that such an expedition would be extremely useful and extremely valuable, because there are many other sciences that might be included in the expedition than Dr. Haddon has alluded to. I need hardly say we want a lot of oceanographical and meteorological information from that part of the world. It is a region of the world, meteorologically speaking, which is a monsoonal region, and I think very little of it has been investigated as regards the storms and the general meteorological conditions. With regard to the vessel, I think there would be no difficulty about getting a suitable one. The draught of water is always rather a difficulty. I quite sympathize with Dr. Haddon and the other gentlemen who spoke about the draught; that very often is a difficulty. Of course you could have a motor launch, and then go almost anywhere you liked. It would be quite possible to get a suitable vessel for going about in that way at, comparatively speaking, a small cost.

Major Darwin: I should like to say how warmly I should wish to support this proposal of an expedition by Dr. Haddon. I am reminded of a story which is perhaps not inappropriate. It is of the very best business man I ever knew in my life. He made a vast fortune, and I asked him one day what was the secret of his success. He said, "I found my man first, and my job afterwards." We have Dr. Haddon, and he ought to be employed on an expedition of this sort. There is only one other point I should like to make. We have heard something of the difficulties, and they are, no doubt, great; but I should like to ask Dr. Haddon if he does not think that the difficulties will increase as the time goes on, rather than decrease? And if the difficulties are likely to increase, then they seem to me to be absolutely no argument whatever against attempting this expedition.

Colonel Church: I do not think that I can say anything of any value to-day, except to give my very hearty approval to the idea of such an expedition.

The Chairman (Sir Thomas Holdich): Before asking Dr. Haddon to reply to some of the points which have been raised in the course of the discussion, I should just like to ask him one question. The anthropological point of view is the one naturally which he has emphasized most in his plea for this expedition. I should like to know whether he considers, from information which he has already obtained —because perhaps he is better acquainted with that part of the world than most anthropologists—whether he considers that the tribe of Melanesian people as a whole are diminishing in numbers or increasing; that is to say, can they wait, or should their sociology and their evolution all be investigated at once? Because there are parts of the world where the aboriginal people are rapidly disappearing; I may particularly mention Patagonia—where in the course of another ten or twelve years we may confidently expect that some of the tribes will have disappeared absolutely, and there will be no further opportunity of investigating their manners and customs. That is the only point I should like information upon. Now I will ask Dr. Haddon to reply to some of the points raised in the discussion.

Dr. Haddon: First of all, sir, with regard to your point, I do not know that the people are actually disappearing to any great extent from most of the islands, but owing to the Government and the trader and the missionary and the indentured labourer, who is coming back from Queensland and elsewhere, native customs and beliefs are getting terribly upset. Your point is one I am particularly keen about. We should look at all these things from a business point of view, and not do merely what is worth doing, but what is most worth doing at the present moment. I think, on the whole, one is quite justified in regarding Melanesia as a field that ought to be studied immediately. Of late years one so constantly hears people say, "Why don't you send an expedition to this place or that place; the people are all dying off?" If we did that, we should have to send expeditions over the whole world, and it is impossible to do that. I am interested in Melanesia, and one can only work in the corner one knows about or is most interested in. I may say that of course I have considered very carefully the *personnel* of an expedition of this sort, but that is a matter for future discussion. Captain Wilson-Barker has already met Dr. Seligmann's difficulty of the depth of the steamer, as a motor launch could go anywhere. Mr. Ray spoke about the difficulty of the language. Well, he states that some missionaries only imperfectly know the languages, and he says they are not improving in this direction. Well, what are we going to wait for? How are we going to know these languages? I am quite certain if we wait till we know more about the languages we shall never do anything at all. As to accuracy, accuracy depends upon the investigator and the spirit of the investigator. You can get accurate information from very imperfect material if you go the right way to work. I am aware of these difficulties, but the job has to be done, and the difficulties do not lessen by time; it will become more and more difficult, and the sooner we do it the easier it will be.

Mr. Thomas spoke about the collections; their destination must depend upon the source from which the money comes. If there are collectors of all nationalities, as I hope there will be, each man who works a particular area will necessarily require specimens for his country; and I think the way out of the difficulty would be that the expedition has the first claim on all the specimens, and when the expedition is finished with them, the second set of specimens might go to the countries of the investigators. That seems to me to be the only practical way. With regard to what Captain Wilson-Barker said on the question of oceanology and meteorology, the expedition would welcome any one who would come and do scientific work, only it could not undertake to do much surveying work, as men's lives and healths are at stake, and the work of the vessel must necessarily depend upon the exigencies of the individuals connected with the expedition. But apart from that, such an expedition as the one proposed would be only too pleased to advance any science that it possibly could. Of course, as Major Darwin said, there are always difficulties, and the difficulties will naturally increase with time. I think I have gone into most of the suggestions that have been made. Personally, I feel convinced that it is a necessary thing to do, and I also feel convinced that it should be done immediately.

The CHAIRMAN: I think Dr. Haddon may rest satisfied that he has carried the meeting entirely with him in considering that he has amply justified his plea for an expedition to Melanesia. Apart from the question of anthropology, I understand there may be uncharted islands in that part of the world which will give the expedition at once a geographical interest; but geology, botany, and even, as Captain Wilson-Barker has suggested, meteorology and oceanography, are all surely more or less within the scope of an expedition of this character. Whilst we all of us wish him all success in his scheme, I think at present we can do no more than thank him for giving us a very interesting paper and raising a useful discussion.

The following letter has been addressed to Dr. Haddon by the President, Sir George Taubman Goldie :—

"Royal Geographical Society, 1, Savile Row, W.

"DEAR DR. HADDON,

"I have brought to the notice of the Council of the R.G.S. your proposal to lead an expedition to Melanesia, put forward by you in your recent address to our Research Department, and I am desired to say that they fully recognize the immediate importance of the work which you are willing to undertake, as well as your undoubted and exceptional qualifications to assume charge of such an expedition.

"The funds of the Society do not at present admit of their giving financial assistance, nor indeed have you suggested that they should do so, but you have the warmest wishes of the Society for your success in obtaining the necessary funds.

"Yours sincerely,

"(Signed) G. T. GOLDIE.

"June 11, 1906."

NOTES TO ACCOMPANY LIEUT.-COLONEL MAUNSELL'S MAP OF EASTERN TURKEY IN ASIA.*

IN Oriental countries there are many obvious difficulties in the way of detailed or accurate surveys, and maps have therefore to be compiled from reconnaissance work and less perfect data than in countries whose Governments themselves undertake the surveys. A great deal can be done by fixing positions with a 6-inch sextant and half-chronometer watch, which can be utilized to check the ordinary reconnaissance done by compass and time distance.

In the western portion of Turkey in Asia many of the large towns have been fixed sufficiently accurately by previous travellers and surveys, and further observations tend to show their positions are very closely correct. Sivas, Erzingan, Kharput, Malatia, Karahissar, and Tokat are instances of this; further positions were fixed in relation to these, and reconnaissance work undertaken through the lesser-known parts of the country. In the Sivas district and in the Taurus ranges much work was done by Sir Charles Wilson and the military officers under him in 1881, and this has been utilized. The Black sea coast districts are very mountainous and intricate for survey work. The actual coast-line can be obtained from the Admiralty charts, and inland as far as the coast ranges—some 40 or 50 miles—work has been obtained from mining engineers and others engaged in the construction of new roads inland. The intricate country of the Dersim, in the bend of the Euphrates below Erzingan, has been filled in from surveys by the late Sir Herbert Stewart, with some recent additions.

The Russian survey, 5 versts to an inch, of the Trans-Caucasus Province has been utilized for all the frontier districts about Erzerum, Alashgird, and Bayazid, which were surveyed during the occupation at the close of the 1878 war. For the country round Lake Van, the principle of fixing points by latitude and azimuth was utilized as far as possible, the prominent peak of Ararat, already fixed on the Russian survey, and lying nearly north of Van, being found most useful. A base line for a triangulation was roughly measured by the same means. The latitude of Van Consulate was observed and its position fixed by an azimuth to Ararat, this forming one end of the base. The summit of

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* Map, p. 208.

the Pir Reshid Dagh, some 40 miles to the north, was fixed in a similar manner, and formed the other end of the base.

Many prominent peaks could be fixed from this base—the great cone of Sipan Dagh north of the lake, Varak Dagh over Van town, and several points in the high ranges south of the lake, and even the Maratokh Dagh, far away beyond Bitlis, also, such is the extraordinary clearness of the air on this elevated plateau.

By using a large prismatic compass, an approximate triangulation was thus begun and systematically extended, principally south-westwards to Diarbekr, which town was ultimately fixed, and also southwards into Hekkiari, the Bohtan district, and the wild country round the headwaters of the Great Zab. The sextant and chronometer was also utilized to fix positions, in support of the triangulation, Van being treated as a fixed point.

To fill in the detail of the country between the points thus fixed, a network of reconnaissance surveys was undertaken and the blanks gradually filled up. The country round the basin of the upper waters of the Great Zab, the Nestorian Christian country, and the valley of the Bohtan, all mountainous districts in which scarcely any survey work had been done since Layard's time, have now been filled in to a great extent, although gaps still exist.

Much new work has also been done in the country between Diarbekr and Bitlis, and it is curious that this open country between the foot of the hills and the Tigris has been hitherto so imperfectly mapped.

The upper and middle courses of the Batman river, the largest tributary of the Tigris, sometimes containing as much water as the parent stream itself, have now been traced, and the three streams which rise in the mountains of Sassun and combine to form the Batman have been defined.

Probably the difficulty hitherto experienced in tracing the course of these streams lies in the fact that before entering the Tigris plain they have to force their way through an extremely narrow deep rift in a limestone plateau; the junction of two of the more important streams takes place here, and the rivers, although containing a great volume of water, are almost lost to view as they traverse the plateau, and it is not until the very edge of the rift is reached that it can be discerned at all. All this country north-east of Diarbekr would well repay detailed study, and it has many ancient inscriptions and remains awaiting examination.

The rocky districts of the Tor Abdin, near Mardin, as well as much of the Hekkiari country on the other bank of the Tigris, is from reconnaissances by Sir Herbert Chermside.

The country round Kharput and Lake Geuljik, as well as the great gorges of the Euphrates below Kharput, are from Mr. Ellsworth Huntingdon's surveys.

The country along the Turko-Persian frontier is taken from the detailed surveys made by a joint commission many years ago, which extended over a strip of country along the supposed frontier, but never actually delimitated it. All the country along the lesser Zab in its middle and lower portions is new, and is the result of several reconnaissances and a raft journey down the river. Some positions were fixed here also by sextant and chronometer lent by the Society. More recent work in the Kurdish hills and Tigris plain, by Captain Mark Sykes, has also been included.

The expanse of desert round Baghdad, with its ancient remains and traces of the many canals which formerly fertilized the country, is from the surveys made at the close of Chesney's expedition to that part of the country, and which still very accurately represent the ground.

F. R. M.

THE SURVEY OF INDIA.*

A GREAT deal that is contained in the Survey of India report for 1903–4 might almost be called ancient history, so long has this report been delayed in publication. It is chiefly interesting when read by the light of subsequent recommendations made by the special committee which was convened to inquire into questions of Survey administration, and which has proposed certain radical reforms. That committee concerned itself mainly with the question of maintaining an accurate and up-to-date topographical map of India and of the Indian border, and in relegating cadastral or fiscal surveys to local centres of civil administration. It is therefore interesting to observe, from the map illustrating the progress of imperial surveys, that there is really very little of the Indian peninsula left to map topographically, that little being a section of Rajputana desert. The province of Madras also exhibits certain blanks, but this is because the completed Madras surveys are not reckoned as imperial. The future *rôle* of the Indian Survey (apart from the scientific work of the department) will be that of constant revision and improvement in existing topographical mapping, ample provision having been made for the extension on larger scales of the existing geographical mapping of trans-frontier regions.

The total outturn of detail survey for the year under review amounts to 58,464 square miles, including 24,100 square miles of geographical surveys, under which latter heading are included 6000 square miles of the Aden mission under Colonel Wahab; 35,000 square miles of the Seistan mission under Sir H. MacMahon; and 18,000 square miles of Tibet between British territory and Lhasa. Another 40,000 square miles was, however, added by Major Ryder on his return journey from Lhasa

* 'General Report of the Survey of India, 1903–4.' Serial No. 9. Professional Papers, Survey of India. Report on United States Surveys.

to India *viâ* Shigatse and Gartok. This is an addition to our geographical knowledge of which Colonel Gore, R.E. (late Surveyor-General), may well be proud. Beyond the ordinary details of satisfactory progress in the topographical, forest, and cadastral branches of the department, together with an account of the work of the map-producing offices, this report is notable for two or three unusually interesting chapters. We have, firstly, a record by Captain Tandy, R.E. (the only one published, as far as we know), of the strenuous work of the Aden party, dealing with a part of Southern Arabia on the borderland between Turkish and British domination, which illustrates, not only a geographical region which is absolutely new to anything like scientific survey, but incidentally shows what may be expected from Turkey in negotiating boundary questions if British claims are not properly backed up by force. Then there is the narrative report of Major Ryder, R.E., on his Tibetan surveys and explorations, covering another large area of country which has hitherto been known to us only from the researches of Indian native explorers, of whose work, by the way, Major Ryder speaks very highly. Next we find another new and most important geographical record in the only topographical map of Nepal that has ever been published, showing the conformation of the mountains in a wide section of the Himalayan system. This is the work of Captain Wood, R.E., who claims the proud distinction of being the first English surveyor who has been permitted to take observations in Nepal. It is a most valuable document, for it sets at rest the disputes which have arisen about the position of Mount Everest, proving that peak to be far removed from others which have been confused with it, and placing them all in their true relative positions. It also indicates that the great snowy range of the Central Himalaya (sometimes mistakenly called the Indian watershed) possesses no continuity through the width of Nepal from west to east. The group of mountains of which Everest forms the centre, and the contiguous group dominated by the peaks known as Gaurisankar, at any rate, form no part of it. The position of certain passes leading into Tibet north of Katmandu can now be located with a fair approximation to exactness, even if we do not know much more of those leading from India to Katmandu than we knew before. A series of admirable profiles of the Nepalese hill ranges adds greatly to the interest of this report. Finally, we have, in addition to the detailed account of the scientific work of the department and the progress made in principal triangulation (which is at present restricted to the Salween series in Burma) in astronomical, pendulum, tidal, levelling, and magnetic investigations, a most admirable note by Lieut.-Colonel Burrard, R.E., F.R.S., on the value of the scientific branches of survey operations. If any *apologia* for the State maintenance of such branches of the department were necessary, Colonel Burrard's treatise (which is also issued in independent form) would surely set at rest the criticisms of the most strenuous financial reductionist. The clearness and directness of Colonel Burrard's remarks appeal to the unscientific as well as to the scientific reader. The booklet deserves a far wider circulation than is to be found in the official ring of Indian public opinion. In it we have the true relationship between the scientific and the practical in survey matters clearly defined. They are absolutely inter-dependent. Practical work must have a scientific basis; scientific work is useless except in relation to practical results. Geodetic measurements of the highest class are as necessary for topographical purposes as for mathematical deductions dealing with the dimensions and figure of the Earth. "Areas" and not "arcs," we are reminded, are the best basis for such deductions. This is perhaps not altogether new, but it is a most valuable reminder at the present time. The bearing of astronomical observation on Earth-measurement, and of investigations into the variations in the force of gravity; the value of accurate levelling and the errors induced by the neglect of it; the importance of registering tidal fluctuations and the phenomena of Earth magnetism, are all impressed upon us in plain and untechnical language such as "he who runs may read." Incidentally we learn something of the relative value of the triangulations of different countries, and it is satisfactory to note that, judged by the standard of precision in relation to length, the triangulation of England is only surpassed in accuracy by that of Russia and India. The triangulations of France and Prussia figure lowest on the list, and may be regarded as level with those of South Africa and the United States. This will be a surprise to those who have looked to the latest methods and modern improvements as sure indications of superior results. Probable errors induced by various factors (notably refraction) in determining altitudes may also alter some of our accepted theories on the relative heights of mountains. It is probable, for instance, that Mount Everest is higher by 140 feet than the height (29,000 feet) at present assigned to it, and that we shall eventually find that Kanchinjanga, and not K^2 (Godwin Austen), holds second place in the world's altitudes.

These are matters which will not particularly affect the world's geography, but the displacement on the Earth's surface of many points supposed to be unalterably fixed, due to the deformation of the Earth's figure, may have a very practical issue when the surveys of adjoining countries and the boundaries between them are co-ordinated. Much scientific work, however, remains to be done both in India and elsewhere before it is worth while to formulate final corrections.

In a separate volume to the Indian Survey Report we have a report by Colonel Waterhouse on the United States Surveys. It is a useful compilation, dealing chiefly with methods and instruments which are well worth study, but not adding greatly to our previous information concerning the actual surveys in existence in North America, or their objects. Many a useful hint might be taken from American methods. For instance, we learn that under those most difficult of all conditions, where principal triangulation has to be extended through forest-covered country, a system of "double" towers has been devised by our ingenious cousins, from the summits of which observations can be taken without involving the enormous expense of line clearing. These towers are built of "sawed timber," and so expert are the American linesmen at erecting them that it took only seven men to erect seventy of such towers (they are removable, and can be utilized at frequent points) in less than seven months. The towers averaged 42 feet in height. It is in matters affecting economy of labour that the Americans can give points to the surveyors of most countries; in all the familiar applications of the best-known instruments for base measurement, for observing, or for map-making, they adopt the methods usually recognized as most efficient in India. It is rather significant that the art of phototopography occupies but little space in the report, whilst, on the other hand, the use of the plane-table appears to be extending.

T. H. H

RECENT RESEARCH ON LAKE CHAD.

The more or less effective occupation of the shores of Lake Chad by the three Powers whose spheres touch its waters, has resulted in important additions to our knowledge of its geographical features, some of which have already been alluded to in the *Journal*. The work of the surveyors employed by Colonel Destenave, after the arrival of the French on the southern and eastern shores of the lake, gave the first approximately correct idea of its present extent and general configuration, which subsequent more minute surveys have not seriously modified. But the lake possesses so singular a character in many respects, and the question of its recent history presents so interesting a problem, that the fresh observations which have been for some time accumulating are only to be welcomed by geographers, while they still leave room for further study before all the uncertainties connected with the past and present character of the lake can be considered as done away with. On some points of detail the statements of different observers are not quite easy to reconcile.

Of the many officers, especially French, whose work has contributed to the general result, none perhaps possesses a more intimate knowledge of the lake than Lieut. Audoin, who presented his observations in a generalized form in *La Géographie* for November last. This naval officer, who had already done much good survey work among the labyrinth of islands and channels of the eastern side, besides effecting a complete circumnavigation of the lake, was named as one of the chief coadjutors of Captain Tilho, when, on the conclusion of the work of the Anglo-French boundary commission under Colonel Elliot and Commandant Moll, he was charged with the execution of a complete survey. Captain Tilho has given an account of his work in the March number of *La Géographie* for the present year, which contains an elaborate large-scale map of the lake, embodying the results of all the surveys accomplished up to date. The Germans, whose territory touches Lake Chad only in the south-west corner, have naturally had fewer opportunities for study of the lake as a whole; but a useful *résumé* of the history of its investigation, from the time of Denham onwards, has been contributed to the *Mitteilungen aus den Deutschen Schutzgebieten* (1905, part 4) by Lieut. Marquardsen, a member of the German section of the commission for the survey of the boundary between the Kamerun and Northern Nigeria. This writer, by combining his own observations with those of his predecessors, presents an instructive view of the general character of the lake, though, as his personal acquaintance with it seems limited to the western and south-western shores, some of his generalizations, based in part on earlier work, may need modification. The painstaking survey of the Alexander-Gosling expedition has already been put before readers of the *Journal*, so far as its results are available, and it, too, is an important help to a knowledge of the present hydrographical conditions.

One of the elementary questions to be solved is that of the actual limits of the lake proper, both at low and high water, but this is complicated by the apparently rapid changes to which it is at present subject, both from season to season and from year to year. The view held by Lenfant and others, that it is rapidly drying up, is shared by Lieut. Audoin, while Captain Tilho also believes that great changes have taken place since Nachtigal's time. That these are still in progress seems shown by the fact that Lieut. Alexander found an almost impassable barrier of vegetation stretching across the open water shown on the earlier French maps as running down the west side. It is unlikely that this barrier can exist only at low water, and Captain Tilho found a distinct tendency for the northern and south-eastern basins to become separated by the progressive formation of sand-banks and the growth of vegetation on them. It is possible that too much trust may be placed on early maps as indications of the state of things during the middle and end of last century, for even Nachtigal's acquaintance with the lake was insufficient to enable him to show its limits with more than an extremely rough approximation, while he recognized that a large part of its area was taken up by the islands of the Budduma, and that at low water but a small part of the whole was covered. In any case, there seems no doubt that any extension of the banks and islands causes a net diminution of the water area, and not a mere displacement from east to west, as has sometimes been thought possible, for it is certain that the western shore-line, which is the best-marked of the whole, has not shifted west as a result of growth of land on the east.

With regard to the supposed difficulty of fixing the precise boundary-line between lake and land, Lieut. Marquardsen says that it has been exaggerated, as the normal high-water line is well marked by a belt of vegetation, and even in dry seasons only the outer fringe of this is killed by the drought. The apparent difficulty occurs chiefly, not at the period of high water, which is some time after the bulk of the rains is over, but during the rains themselves, when all the depressed portions of the surrounding country are filled with rain-water, which has really nothing to do with the lake. This would explain the ease with which an exaggerated notion of the extent of the latter may have been formed by the earlier explorers. Still, the evidence of a net diminution in the past few years seems incontrovertible. Lieut. Audoin, who gives an excellent description of the archipelago of islands on the east side, and the varying nature of these as one progresses farther from the permanent shore, says that islands not long ago distinct have now coalesced, and that the different names borne by parts of the same island are survivals from a former state of things. The regular arrangement of the islands and intervening channels in lines at right angles to the direction of the north-easterly winds proves the former to be of the nature of dunes, which have encroached upon the lake. This character is, indeed, taken by Lieut. Marquardsen as a proof that the eastern portion of the lake occupies what was once part of the desert, but he does not seem to allow sufficiently for the rapid advance of the dunes in the direction of the wind, which would enable them to invade the old lake-floor during dry years and in the dry season.

Lieut. Audoin makes an attempt to elucidate by mathematical calculations the existing hydrographical conditions. His figures are based on observations extending over some time, but the hypothetical element seems too large to justify very full confidence in the results. In a mean year he calculates the gross amount of water-supply to the lake as 15,768,000,000 cubic metres, which, on the assumption that the total area is 17,000 square kilometres (the other writers place it at 20,000 or more), would cause a rise of level (were none lost by evaporation or infiltration) of 1·40 metre. About half of the supply only is received during the period of the rise, within which same period the loss is calculated to bring about a vertical fall of 0·15 metre, so that the net rise while the waters continue to mount is placed at only 0·55 metre. The net loss during the rest of the year is placed at 0·70 metre, so that the conclusion arrived at is that on the whole year there is at present a net loss of 0·15 metre. Lieut. Audoin says that these suppositions are borne out by observations and by the statements of natives, but still more extended researches are certainly necessary (as he himself allows) before the conclusions can be regarded as definitely established.

In any case, it is impossible to decide, from existing data, whether the apparent desiccation is continuously progressive or whether we have to do merely with periodical fluctuations. That the latter may be the case is the conclusion drawn by Captain Tilho from the statement of a native chief, who showed Captain Hardellet various lagoons then full of water, but which his father, when a boy, had seen dry. "All these lands," he said, "were then Kanem; afterwards Allah sent great rains, the waters rose, and Kanem retreated far to the north."

Lieut. Audoin regards the drying up of the Bahr-el-Ghazal as possibly a consequence of that of the lake as a whole. He thinks, however, that even when it existed it may have been nothing more, at least in its western part, than a series of lagoons similar to those on the Kanem shore, and that the motion of the water was merely a surface current varying with the direction of the wind, such as may be observed in many of the channels of the lake. Captain Tilho does not venture a theory as to the character of the Bhar-el-Ghazal, though believing, with Nachtigal, that the lake water may be drained away long distances by underground channels.

Among the many interesting points discussed is that of the colour and composition of the lake water. While Lieut. Marquardsen (judging, it seems, from his experience in the south) says that it is fresh, Captain Tilho maintains that this is by no means the case except near the mouths of the two principal rivers. At a distance from these, *e.g.* in the stagnant lagoons of the archipelagoes, it is sometimes so charged with salts that even cattle refuse to drink it. However, by digging a pit near the borders of the lagoons, potable though slightly brackish water may be obtained. In the case of other swamps in this region, it is often found that the water in the centre is the most saturated with salts, which, on the drying up of the swamps, are deposited in the order of their crystallization, those rich in chloride of sodium occupying the periphery, while a deposit of natron will be found in the centre. In portions of the lake a regular gradation of colour from within outwards may be noticed, passing from grey through yellow to bright green and blue. Full information is given on the *régime* of the winds in the basin of the lake, the variations of the seasons, and the like. The changes of level, which have been thought to partake of the nature of a tide, are brought about simply by the agency of the winds, their periodicity being due either to the diurnal change in the direction of the wind (noticeable during the prevalence of the north-east winds) or to its variation in intensity. Where the shore is flat the amount of fluctuation may reach as much as 10 to 15 centimetres (4 to 6 inches), and the water may encroach considerably on the land. Besides the hydrographical observations some excellent survey work on the lake-shores has been carried out, and the methods are described in detail by the several writers, but into these limits of space forbid us to enter.

EARTHQUAKE ORIGINS.

ONE of the most suggestive contributions which have been made to the understanding of earthquakes has come from an unexpected quarter. In a series of articles, published in Prof. Gerland's *Beitrage zur Geophysik*,* Major E. G. Harboe, of Copenhagen, has developed a new and almost revolutionary notion of earthquake origins. Without going back to the very earliest seismology, it may be said that when an earthquake was first recognized as due to wave motion, propagated outwards from an origin, this origin was regarded as restricted in size, comparable to a point, and called a centrum, or centre. From this was derived the term epicentre, a word which is still used to define the surface immediately over the focus or origin of an earthquake; and though its inventor, Robert Mallet, showed that the origin of the Neapolitan earthquake of 1857 was a fissure, and the epicentre, consequently, an area of some size, yet the idea that both focus and epicentre of great earthquakes are small, in comparison with the area over which the shock is felt, remained. This idea was supported by the fact that there was always a central area of maximum violence, the pleistoseismic area, and from this outwards the violence gradually diminished in every direction, so that the isoseismals, or lines of equal violence, formed a fairly regular series of ovals. In no case was the actual course of an isoseismal free from irregularity, but as it was found that the violence of the shock depended to a great extent on local variations in the configuration of the ground, and to a greater degree on the nature of the underlying rock or subsoil, we had come to look on the diminishing violence of the shock as due to the dissipation of its energy as the disturbance spread out over a continuously increasing area.

There has, however, always been one great difficulty in the application of this interpretation, in the impossibility of getting any sort of agreement between the course of the isoseismal and coseismal lines, the latter being lines of simultaneous arrival of the shock. Exact agreement is not to be looked for, both being more or less influenced by the nature of the rock through which the earthquake travels, but an approximate coincidence there should be if the disturbance travels outwards from a central origin. Seismologists have cut this Gordian knot by rejecting as bad all those time records which do not fit in with the accepted explanation, and there was justification in this, for it has been found that little dependence can be placed on most of the supposed times of arrival, since records from one and the same place usually vary by many minutes; yet it went against the grain to reject, as worthless, observations which bore every appearance of having been made with care, just because they did not fit in with preconceived notions, and Major Harboe's interpretation, if accepted, relieves us from this necessity.

Basing his conclusions on a study of those great earthquakes of which fairly complete accounts have been published, and using the times at which they are said to have reached different places, he has come to the conclusion that the dimensions of the seismic area and of the focus do not differ very largely, and that

* Vol. 4, 1901, pp. 406–420; 5, 1902, pp. 206–238; 6, 1903, pp. 309–348; 7, 1905, pp. 379–410.

the latter consists of a set of fissures, along which the disturbance either originated simultaneously or spread with great rapidity, and from which the wave motion was propagated outwards. In this way he explains the very divergent estimates of the rate of propagation of earthquakes, for it is evident that if two places are both situated on one of the lines of origin, the difference in time between them gives the rate at which the disturbance has spread along the origin; if they are both on a straight line at right angles to this, the difference gives the rate at which the wave motion is propagated, and in every other case we have a combination of the two. The rate at which the disturbance spreads along the origin appears to be subject to great variation, and is usually high, but the rate of propagation of the wave motion seems to be much the same in every case, and is estimated at about five-twelfths of a kilometre, or about one-quarter of a mile, per second.

One of the greatest difficulties in the way of accepting this explanation has been the apparently conclusive results of the 'seismic triangulation' near Tokio, from which Prof. Imamura obtained, in 1902, a mean rate of propagation of 3·18 ± 0·05 km. per second. In his last published paper Major Harboe deals with this, noticing that only eight earthquakes in all are utilized, of which four gave usable seismograms at all four stations, three at only three stations, and one at but two. For two of these detailed records have been published of the times at which they reached the meteorological stations of Japan, and it is shown that these times cannot be made to fit in with the rate and direction of propagation deduced from the triangulation. Interpreted on Major Harboe's lines, it appears that in each case a branch of the origin passed through the triangle of stations near Tokio, so that the times at which the disturbance affected each of the stations do not refer to a single system of wave motion, travelling across the field of observation, but to two distinct sets of waves, spreading outwards from a common origin; on this interpretation the records from the meteorological observatories fall into line, and the discrepancies between the observed and calculated times are minimized.

We cannot say that Major Harboe has proved his thesis, but it must be confessed that he has impugned the title of the current explanation to general acceptance. The old theory must be put on its defence, and the decision between the two be left to future investigators of coming earthquakes, for the investigations of the past have been carried on so exclusively in the light of a single hypothesis that many facts must necessarily have been overlooked, which will stand out prominently in the light of the new interpretation.

R. D. O.

REVIEWS.

AFRICA.

The Problem of South Africa.

'The Africander Land.' By Archibald R. Colquhoun. London: John Murray. 1906. Pp. xv., 438. *With Maps.*

It is hardly possible to review this interesting book as a geographical work. It is, in fact, a treatise on the unsolved political problem of South Africa, in which the author bases his statement of the manifold difficulties of the case, together with his suggested solutions of them, upon the personal observations for which he has had peculiar opportunities. He challenges geographical criticism at the outset, however, by his desire to apply the term "Africander" alike to the British and Dutch inhabitants, instead of to the latter only, and to coin the name "Africanderland" for the territory of a "South African nation." The book has a further geographical claim in the presence of certain simple, but satisfactory, coloured maps, of a character met with too infrequently in works of this kind. They include even a physical map, the introduction of which, though it may have little direct connection with the actual words of the text, must always be laudable. The presence of this map especially, out of the series, points to the group of geographers to whom the book will be of chief interest, namely, those who have already an intimate knowledge of South Africa. For these the maps will serve to keep their previous knowledge clear in their minds while they graft upon it the peculiar economic and administrative difficulties which are so clearly set forth in the text. Mr. Colquhoun's historical facts, his remarks on the ethnographical distinction between South African races, both white and coloured, are adduced, one might almost say, incidentally, as things familiar to his reader. If they are so, then the reader will appreciate a statement of arguments which, while not seeking to be impartial, is studiously moderate.

AMERICA.

Central Plains of the United States.

'Preliminary Report on the Geology and Underground Water Resources of the Central Great Plains.' (U.S. Geol. Survey, Professional Paper, No. 32.) By N. H. Darton. Washington: 1905.

The report covers an area of about half a million square miles, comprising the greater part of South Dakota, Nebraska, and Kansas, with the eastern portions of Colorado and Wyoming. It is a region in which the present water-supply is insufficient even for domestic purposes, and hence the great interest and importance of the question of the underground resources. The great central plain of North America, having been subject to no folding movements, presents a general tabular surface, traversed by broad shallow rivers flowing from the Rocky mountains, and cut up by the narrower, deeper valleys of the lateral drainage. The surface of the area under consideration is mainly covered by the late Tertiary deposits of Miocene and Pliocene age, laid down in thin but extensive beds of sands and clays on the relatively smooth foundation of the older rocks. These consist of an almost regular succession of the earlier sedimentary strata right down to Middle Cambrian, sandstone of that age, underlying nearly the whole area of the central plains. Various layers of porous rock alternate with sheets of impermeable shales or limestones, and are therefore in a favourable position to contain water. Tilted in the west by the great uplift which raised the Rockies, these older sandstones outcrop along the mountain slopes, and are covered with a thick mantle of younger deposits in the central plains, so that the water contained in them is here subject to great pressure, and a good artesian flow may be obtained. The Dakota (Cretaceous) sandstone, for instance, which is the most important of the water-bearing formations, has its intake zone at an altitude of from 4000 to 6000 feet, while the region of outflow is only 1000 feet above sea-level. The surface pressure of its waters in South Dakota is over 175 lbs. to the square inch.

The basal sandstone of Cambrian age certainly contains water, which has been reached by deep wells in the lower Missouri valley, but in the central region it lies too deep for investigation. The Ordovician rocks are chiefly limestone, and therefore not likely to contain water, and, dipping steeply, they are soon carried beyond reach from the surface, and the same is true of the Carboniferous formations. The Jurassic sandstone of Wyoming contains water of some importance, which is tapped by several wells, but the Dakota water-horizon is the most widely spread and most useful in the region of the Great Plains. The thickness of this stratum varies from 150 to 300 feet, resting on Red beds and Carboniferous limestones and shales, and overlain by a great mass of clays and shales. Its outcrop is along the uplifts of the Black hills, Bighorns and Rocky mountain Front ranges, and in the Arkansas valley in South Colorado, where it receives great volumes of water both from the rainfall and the insinking from the streams. In parts of Dakota the supply has been largely utilized (chiefly for irrigation) by means of artesian wells of a varying depth from 500 to 1000 feet, but in the centre and west of the state there are wide areas still untapped, and the pressure is so great that flows can be obtained in all but the very highest land or in the south-east corner, where the head is lost by the sandstone reaching the surface. In North and Central Nebraska, and Wyoming, on the other hand, the mantle of Tertiary deposits is so thick that the Dakota water-horizon is too deeply buried to have any economic value. In Nebraska, indeed, the underground geology is not well known. But in Kansas, again, this water-supply is not far below the surface, and has been utilized to some extent; while in East Colorado an uplift east of the Rocky mountains brings it within easy reach of the well-driller in the Arkansas valley, where there is an excellent flow.

Mr. Darton's report furnishes the fullest details both of the general geology and of the number and condition of all the existing wells in the region surveyed, and is finely illustrated with photographs and sections. It is accompanied by two maps on the scale of 20 miles to an inch, one showing the geology and the other the distribution of the underground water, the depth of the Dakota sandstone below the surface, the regions of artesian flows, and other details. Both maps are contoured.

POLAR REGIONS.

History of Spitsbergen.

'No Man's Land: A History of Spitsbergen from its Discovery in 1596 to the Beginning of the Scientific Exploration of the Country.' By Sir Martin Conway. Cambridge: University Press. 1906.

This is a work of solid value, embodying a large amount of research among printed and unpublished documents, and much of the information presented would not be met with in literature that is readily accessible. During his study of the early history of Spitsbergen, undertaken originally in connection with his own explorations, but since continued from the intrinsic interest of the subject, Sir Martin Conway has been able to throw new light on many obscure points, but as he has already discussed the chief of these in the *Journal* at various times, it is unnecessary to speak of them at length here. The value of the book to students consists in the large body of information brought together within convenient compass, and the connected story of some of the most romantic episodes in the history of geographical discovery, which it supplies. Apart from the work of pioneers like Barentsz and Hudson, it deals fully with the early whaling enterprise of English, Dutch, and other nations, and the strenuous rivalry to which it led—a subject which can vie for interest with many narratives of fiction.

Among the many questions connected with the gradual increase of geographical knowledge of the group, the author's verdict on the controversial subject of the discovery of the islands in the extreme east, known to the Swedes as Kong Karls Land, deserves special mention. Sir Martin Conway allows, with Prof. Nathorst, that the supposition of the discovery of this group from the south in 1617, under Edge's auspices, is untenable, but he does not therefore abandon the claim that the Wiche's Land of Purchas really represents Kong Karls Land. The English work of that year was evidently devoted chiefly to the route up Wijbe Jans water, near the head of which the high latitude spoken of (or something near it) must really have been attained. There seems no question that North-East Land was sighted (and named after Sir Thomas Smith) from some point of vantage in this direction, and, as Sir Martin Conway points out, the nearest island of the Kong Karl Land group could almost equally well have been seen on a clear day. The theory that Edge island had been discovered by Joris Carolus in 1614 may not be so readily accepted, but this question is discussed elsewhere in the present number of the *Journal*.

A particularly valuable feature is the extensive bibliography—quite the most complete that has yet been brought together. The confused nomenclature of the Spitsbergen coasts has received careful consideration, and the identification of the old names with actual features is thoroughly satisfactory. It may be noted that Sir Martin Conway rejects, and apparently with justice, the idea that the Sir Thomas Smith's inlet of Fotherby and the English was Hinlopen strait, it being really identical with Wijde bay. The reproductions of early maps, many of which have already appeared in the *Journal*, are a great help in tracing the history of Spitsbergen cartography, while the copy of the Admiralty chart (with modifications as regards nomenclature) supplies a much-needed guide to the modern knowledge of the group, the representations of which, in generally accessible maps, are as a rule most inadequate. Many of the quaint cuts in the earlier narratives are also reproduced.

HISTORICAL GEOGRAPHY.

Early English Travel in the East.

'The Journal of John Jourdain, 1608–1617.' Edited by William Foster, B.A. Cambridge: Printed for the Hakluyt Society.

It is meet and right that the Society bearing the honoured name of Hakluyt should bring the Journal of John Jourdain, "smothered and buried in dark silence," to light and preserve his memorable exploits "from the greedy and devouring jaws of oblivion." In the spring of 1608, the year that the English made their first permanent settlement in America, John Jourdain, a merchant of the then port of Lyme Regis, in Dorsetshire, sailed for the East in the *Ascension*, one of the two ships that were sent by the East India Company in quest of trade in the East. The expedition is known as the company's fourth voyage. After nine years' wandering, and having had his full share of the hardships and hazards incident to the life of a traveller, he returned to England. He kept a careful journal, and from it we receive impressions, not only of lands then unknown, but also of the perils which beset his path, and of the courage and dignity of his character. The original diary has not come to light. The manuscript used for the purpose of this volume is a contemporary copy.

On July 14, 1608, the company's two ships, *Union* and *Ascension*, came to an anchor in Table bay. Here the ships stayed two months to make "the pinnance bigger (for which they had brought out the materials) and higher than in her first bulke for the better passenge the Cape and more servisable for busynes." Time hung heavy on their hands, for Jourdain writes, "Haveing little buysines, for recreation my selfe with other of the marchannts would take our walke to the topp of the hill called the Table, which before wee retourned found it to bee a weerysome journey." He considered the Cape "to be very healthful and commodious for all that trade the East Indyes," and foresaw that the soil was sufficiently rich to invite colonization. "As alsoe if it were manured, I am of opinion that it would beare any thinge that should bee sowen or planted on it, as for all kinde of graine, wheate, barlye, etc., besides all kinde of fruite, as orenges, lemons, limes, and grapes."

After the ships had remained for more than five months in Table bay, the pinnance was completed and launched, receiving the name of the *Good Hope*. On the evening of September 19, the fleet sailed from Saldania road, and the next night "there blewe soe much winde with an over growne sea," that the *Ascension* "lost companie of the *Union* and pinnance." The *Union* they never saw again. The *Ascension* proceeded up the East Coast, touched at the Comoro islands and Pemba, and after "finding the winde variable as before" and tacking "too and again divers times," on January 19, "aboute nine in the morninge we descryed high land. At three in the afternoone wee sawe other ilands, which wee made to bee four ilands." They were the Seychelles, and now for the first time we have published the interesting account of them given by Jourdain in his journal. He sums up his impressions as follows: "It is a very good and refreshing place for wood, water, coker-nutts, fish, and fowle, without any feare or danger, except the allagartes, for you cannot discerne that ever any people had bene there before us."

On February 1 the *Ascension* again set sail, and on the night of April 7, "about ten wee anchored in 18 fathome water within two leagues of Aden Castell." The *Ascension* was the first British ship, as Mr. Foster informs us, "to visit a place that was destined to become an important outpost of the British Indian Empire." Owing to sundry disputes having arisen between Alexander Sharpey, the commander, and the governor, a Greek renegade, the *Ascension* proceeded to Mocha, and Jourdain, accompanied by two companions and two European renegades who acted as interpreters, set forth out of Aden towards Sana. The journey is mainly interesting on account of it being the first ever made by Englishmen in the interior of Yemen. The route from Mocha to Sana is now comparatively familiar ground. The editor makes no mention of Cruttenden's 'Narrative of a Journey from Mokhá to Sana,' made in 1836. It is interesting to compare Jourdain's account of Sana with Cruttenden's narrative, written two centuries later. Jourdain writes, "It is a very firtill cittie for all provision of victuall and fruite, and reasonable cheape. A wholesome and pleasant place to dwell in, and a temperate aire, neither too hott nor too cold; but upon the waye in the mornings it is as cold as in England." Cruttenden states: "The climate of San'á is too dry to be healthy; there is rarely any dew at night, and the wind produces a feverish feeling in the hands and feet.... The thermometer during our stay reached 75° at the highest, and 55° at its lowest point between July 26 and August 20."

From Sana Jourdain and his companions travelled to Mocha, and set sail for India on July 26. A month later, when they were sailing across the Gulf of Cambay for Surat, the *Ascension* struck on a sandbank and was lost. The next night "we were all embarked in the two boats, vizt. in the longe boate 62 persons, besides store of luggage, and in the skiffe 13 persons," and they, fortunately making the mouth of the Ambika river, landed at Gandeve, 28 miles south-east of Surat. "The Governor welcomed us in the best manner, entreatinge us to rest our selves while they made ready such victualls as was to bee had, which was rice with butter and fruite, for the Governor is an Abramane [Brahman], whoe doth never eate of any live thinke, and therefore he prayed us to pardon him, that it was against his lawe."

There is nothing more striking in the early travels of Englishmen in India than the marvellous kindness with which they were treated by the natives. From Surat Jourdain proceeded to Agra, where the Mogul court was at the time, and had an interview with the Emperor Jehangir. "Wee gave the Kinge a peece of gould of our Kinges quoyne, which he looked earnestlie upon and putt it in his pockett." On July 28, 1611, Jourdain and Sharpeigh left Agra and returned by way of Ahmedabad to the coast. In the middle of October, Jourdain, disguised as a native and accompanied by a native broker, slipped through the Portuguese guards, made his way to the beach, and was taken on board the *Peppercorn*. The latter part of Jourdain's voyages and adventures lay among the East India islands. But the sand has run out. It appears to us that the plan of Mr. Foster's work and the manner in which he has carried it out entitle him to praise of an exceptional kind. The introduction gives a clear summary of the events recorded in the journal. The notes are the results of time and attention bestowed on the different subjects, treated by one who has an absorbing interest in the subjects themselves. Hence their value. They are not manufactured for the occasion, but come from a full mind.

G. W. FORREST.

THE MONTHLY RECORD.

EUROPE.

Some Alpine Tarns.—For several years past Prof. Garwood has devoted a part of each summer to the detailed examination of a group of Alpine tarns, occurring in the Canton Ticino, with a view to elucidating their special character and mode of origin. A particular interest attaches to these tarns, inasmuch as they include, besides some corrie-lakes and others due to the damming of valleys by loose materials, a group of lakes recognized by Prof. Bonney as undoubtedly occupying true rock-basins, and possibly due to excavation by ice. A careful study of them was thus of great importance in connection with the vexed question of the amount of erosive work capable of being effected by ice. A point which also called for investigation was the fact that, besides these lakes in the Airolo district, others further west, such as the Engstlensee and the Trubsee, likewise lay along the outcrop of certain Mesozoic limestones. The work of sounding the lakes was rendered difficult by the altitude at which they lie, and the absence of boats from most of them; but this was got over by the construction of a sounding-machine capable of being used from the banks, while, as it was self-registering both in regard to the position and depth of the soundings, the results were likely to be far more accurate than those obtained in the ordinary way with boats. Prof. Garwood gives a detailed description of the lakes, and the conclusions to be drawn from his examination of them, in the *Quarterly Journal* of the Geological Society (vol. 62, part 2, May 23, 1906), his paper being accompanied by topographical and contoured maps, and by excellent reproductions of photographs. The most important of the lakes are those of the Val Piora, the largest of which is Lago Ritom, but those examined include several groups near the Val Levantina; the St. Gotthard lakes; and the Lago d'Elio, just within the Italian frontier. Prof. Garwood divides the whole into four groups, under two main headings, viz. (1) those entirely or partly dammed by loose material, and (2) true rock-basins. Some of the first category may be in part rock-bound, but the main interest centres in those of the second category, where this character is definitely established. The chief lakes of the Val Piora, which fall under this heading, are shown to lie along the junction of soluble Calcareous rocks with gneiss or schists, and the axes of greatest depth coincide very closely with these lines of junction. There is nothing to indicate that ice took any real part in the formation of the lakes, but everything points to solution having been the operative agency. There are, however, four rock-basins, forming group 2 of this category, which are more difficult to explain. Like the rest, they lie along the junction of two different rock-types, and, though probably due to differential weathering, their occurrence in their present position seems to have been determined by structural lines of weakness. But even if ice played its part, its action was apparently not of the nature of digging, but of the removal of less resistant, possibly more weathered, material. The general conclusion is that the lakes of the Canton Ticino so far examined, with the possible exception of the rock-pools of the St. Gotthard hospice, do *not* seem to be due to ice-erosion in the generally understood sense.

The Snowfall of March 23, 1906, in Central Europe.—Like the winters for some ten years past, that of 1905–1906 was marked by the smallness of the snowfall in the whole of Central Europe, and the great fall which occurred on the threshold of the present spring was on this account the more remarkable. From statements by Dr. R. Hennig (of the *Naturwissens. Wochenschrift*) and Dr. A. Swarovsky (Vienna), the following particulars respecting it may be cited. The magnitude of the bad weather consisted less in its intensity than in the abnormal area (for the season of the year) over which it extended, and this feature constitutes an essential part of its specifically geographical character. From East Germany, North-West Hungary, and the Adriatic on one side, and from Denmark and Great Britain on another, the snowfall reached as far as the south of France and Spain. The intensity was also unusual in many places. Even from Spain came reports of a fall of over 3 feet in depth, as also reports to the same effect, but more trustworthy, from the Rhine country, Thuringia, and South Germany. In Thuringia the snowfall was accompanied by storms; and in the Rhine territory, more particularly the Eifel, there was in addition a temperature as low as 12·2° Fahr. In the South-Eastern Alps, moreover, according to the records of the Hydrographical Central Bureau in Vienna, it snowed uninterruptedly on the 22nd and 23rd, the snowfall being here and there attended by violent storms. Here, too, the new snow accumulations, especially in South Tyrol, Carinthia, and Krain, reached depths of from 2½ to 3½ feet; while in Klagenfurt and at several other places a fine sand, shading from yellow-brown to blood-red, was mingled with the snow layers. Occasion for this abnormal meteorological occurrence was afforded by the peculiar character of the situation, and the shifting of the atmospheric pressure. While an extended maximum rested over North-West Europe from the 20th onward, a sharply pronounced minimum of atmospheric pressure proceeded from the Gulf of Genoa over the plain of Lombardy (where it occurred early on March 23) northwards across the Alps, where, on the morning of the 24th, it rested with its centre somewhat above Berlin. This line of advance, the well-known "Zugstrasse Vb" of von Bebber, is always associated with severe bad weather—in winter, snow-storms; in summer, cloud bursts and inundations. The normal course of this portentous "Zugstrasse" proceeds from Lombardy or the Adriatic by way of Vienna and the Germano-Russian frontier to the neighbourhood of St. Petersburg. This time its more westerly route involved in bad weather West Germany and even Western Europe. Under the analogous weather-phase of March, 1894, which however followed a normal course, Posen, Silesia, Moravia, and Lower Austria suffered especially, and lay buried for days under snow-masses. The huge snowfall in Vienna on May 15 and 16, 1885, must also be referred to the "Zugstrasse Vb." Vienna and the adjoining territories, all lay on the eastern edge, or quite outside, of the storm during the great snowfall of March 23.

The German Coal Trade.—A paper by Dr. Otto Becker in the Annual Report (1905) of the Frankfurt Geographical and Statistical Union gives a concise summary of the history of the German coal trade. Mediæval Germany's wealth of forest is witnessed in Vrîdank's saying (thirteenth century), "Dem rîchen walt es lützel schadet, ob sich ein mann mit holze lâdet" ("the rich forest little grudges a man his load of wood"). The first coal-mine worked in Germany was in the neighbourhood of Gachen. There, in the earlier half of the fourteenth century, pit coal was the fuel most in use. Withal, however, the consumption of coal in Germany throughout the Middle Ages was very limited and confined to districts of surface mining. With the foundation of smelting works in the sixteenth and seventeenth centuries, such grew to be the consumption of wood that the Landgraf of Hesse forbad their further erection. A forest ordinance of the Brunswick Lüneburg lands prohibited the use of charcoal. Of like purport was the mandate of the Duke of Brunswick in 1586. An electoral ordinance of 1654 recommends the coal-pit on the Saar. Till the beginning of the eighteenth century pit-coal consumption was customary only in the industries. Its domestic use was tabooed as prejudicial to health. Inflammation of the lungs and pneumonia in Liège and London were attributed to coal consumption, and smiths dwelling in Zwickau were forbidden the use of coal. House-stoves and hearths were all constructed for wood fires. The coal trade, moreover, long continued shackled by arbitrary restrictions. The Electorate of Saxony, *e.g.*, was forbidden to export coal (1743–1822), while the provinces Cleve, Moers, and Mersk, lay, from 1766 to 1814, under interdict of the import of coal. Any one convicted of implication in such malpractice not only forfeited coals, horses, and waggons, but was liable to imprisonment. In Prussia the Royal Mining Office alone prescribed the working and output of each mine and the selling price of output. Steam, however, proved mightier than the will of princes. Towards the end of the eighteenth century the Saarbrücken Colliery had planted branches in France, Lorraine, and the Palatinate; coals were stored in three places in Westphalia; Saar coal magazines arose on the Mosel, Rhine, Zahn, and Main. Then followed metal rails, deep mining, steam-boilers, and steam-engines, and the requisition of wood for railway sleepers, involving wholesale consumption of coal. As one illustration of the growing magnitude of the coal industry, it is pointed out that, whereas on January 1, 1879, there were in Prussia 38,649 steam-boilers and 35,960 steam-engines (not including army and navy), on January 1, 1901, there were 94,927 steam-boilers and 99,296 steam-engines. Of all the goods carried by rail in the empire, coal constituted, in 1897, 35 per cent., in 1903, 38 per cent. The article includes a tabular view of Germany's different coal districts and their respective outputs from 1881 to 1890, and every year since down to and including 1900; of the export and import of coal and coke from and into Germany and its several regions; and a comparison of the coal-production of Germany with that of all other coal-producing lands.

ASIA.

The Dead Sea Levels.—Observations of the fluctuations of the level of the Dead sea have now been taken for several years by Dr. E. W. G. Masterman, who has recorded the results from time to time in the *Quarterly Statement* of the Palestine Exploration Fund. The last report, which appears in the number for July, 1906, records an unusual rise, following on a rainy season of exceptional intensity. Up to the date of the latest observation (in April last) 37·95 inches of rain had fallen, and the level had risen 34 inches since the date of the autumn observation. The figures given for the years 1901–1905 show that the extent of the rise is not always proportional to the rainfall, for whereas a rainfall of 15·94 inches was followed in 1901 by a rise of 14·5 inches, in the following year a rainfall of 20·04 inches caused a rise of only 6 inches—the smallest within the six years since the observations were commenced. In 1905 a rise of 23 inches had followed on a rainfall of 37·32 inches, so that a wet cycle would seem to have lately set in. A thunderstorm, accompanied by deluges of rain, was experienced on the occasion of the recent visit, having, it is said, been of a severity unknown before at Jericho in the month of April. Evidences were everywhere visible of the violence of the flood that traversed the wadies.

The Navigable Waterways of India.—An article by R. B. Buckley, C.S.I., in the *Journal of the Society of Arts* (vol. 44, No. 2780) summarizes the data respecting the navigable waterways of India. Twelve thousand miles of irrigation canals, supplemented by 30,000 miles of distributory channels, yearly water 20,000,000 acres of crops. Of this mileage, constructed during the last sixty years primarily for irrigation, about a quarter has been made navigable. In Madras province navigable canals radiate seawards from the head works at Bezwada, traversing the flat and fully cultivated delta of the Kistna. A like system of canals traverses the Godavery delta. These two systems are connected together by a navigable channel, and both with the Buckingham canal. The Madras coast is thus provided with a continuous canal system over 1000 miles in length, connecting the Godavery and Kistna deltas with the southern districts. Again, in Bengal, Madras, and Lower Burma there are, not counting one or two minor canals in Madras, 1225 miles of navigable canals not used for irrigation. In immediate contact with tidal creeks and rivers communicating with the Bay of Bengal, their brackish waters are unavailable for irrigation. The circular and eastern canal connecting Calcutta and Barrisal, 737 miles long, consists in great part of improved natural tidal channels. The Orissa coast canal consists of a tidal canal, opened for traffic in 1887, which connects the Hugli with the Russelpore river, and of a continuation which connects the Russelpore with the Matai river. Inland water-communication has thus been established between Calcutta and Orissa. The rivers emanating from the Himalayas, and having, therefore, permanent snow-reserves to draw upon in the hot, dry weather, are most available for navigation. Those, on the other hand, dependent on the rainfall of the snowless hills and plains shrink during the dry season, sometimes to exhaustion. All, however, rise greatly during the monsoon. Carrying in the flood season 750,000 cubic feet per second, the Kistna for three months carries only 100 cubic feet. The article includes an account of the shipping capacities and actual navigation of the rivers of India, the burden of traffic borne by them, the respective parts played by rail and river in the carrying trade, the relative importance to India of the utilization of its canals for irrigation or navigation, or both.

Obrucheff's Expedition to the Tarbagatai, Central Asia.—The substance of a letter from the well-known geologist, V. A. Obrucheff, giving some account of the latter's recent expedition to Central Asia (*Journal*, vol. 26, p. 669), was printed in the second number of *Petermanns Mitteilungen* for the present year, with introductory remarks by Dr. Max Friederichsen. The latter points out the interest of the region examined from the point of view of physical geography, as it forms the border between the later arc of the Altai (according to Suess) and the older arc which has its centre in the Baikal region, and which is marked by disjunctive dislocations having their outcome in troughs and "horsts." Obrucheff's work has shown that the region explored forms the extreme member of this system towards the north-west, since, although folding is seen to a considerable extent, it is rather fracture that has been effective in determining existing morphological features. The traveller, who was accompanied by his two sons, and (at the outset) by two other students, went south from Chuguchak and explored the country towards the Barlyk range and Ebi Nor; afterwards devoting his attention to the eastern section of the Tarbagatai in the direction of Zaizan Nor. The geological formations included marine Devonian and Carboniferous, the latter having the greatest extension. The so-called "Hanhai" strata, a typical Central Asian formation, also occurred, and yielded fossils, the paucity of which has hitherto caused great uncertainty as to their age. It was found that the Tarbagatai is not directly connected with the Saur range, as has been supposed, but is separated by a deep cleft (probably a rift-valley). There is, therefore, no true mountain knot at this spot. Traces of former glaciation were met with in the Saur, where in former days each of the southern valleys must have been occupied by a glacier 6 to 9 miles long. At present there are only patches of *névé*, or small saddle glaciers, high up on the mountain-sides. Extensive moraines and cirques bear witness to the former extent of the glaciation, which must have been still greater on the northern side. In the Tarbagatai it was probably less. The traveller said that another summer's work would be necessary to complete the examination of the region.

AFRICA.

Exploration of the Sahara.—Mr. Hans Vischer, of the government service of Northern Nigeria, who holds the Society's Diploma in Surveying, left Tripoli on July 9 with the intention of crossing the Sahara, and, if possible, exploring the Tibesti highlands *en route*. The journey is devoid of political significance, and has the approval of the French and Turkish authorities.

The Duke of the Abruzzi's Expedition to Ruwenzori.—Telegrams received in Italy early in July announced that the Duke of the Abruzzi had successfully accomplished the ascent of the highest summit of the Ruwenzori range, and was on his way back to Entebbe. It is not stated what altitude was obtained for the peak ascended, and further details will be awaited with much interest.

The Distribution and Haunts of the Okapi.—According to news received in May * from the Alexander-Gosling expedition, a complete specimen of the okapi had been procured on the Welle river, while interesting information as to its habits had also been obtained. It is generally found singly or in pairs, and frequents the muddy banks of small streams, where grows a large-leafed plant on which it commonly feeds. The animal may be found feeding until 8 a.m., but then retires to the seclusion of the forest. It is very quick of hearing, which makes it difficult of approach. The geographical distribution of the okapi is discussed in a recent number (April, 1906) of the *Proceedings of the Zoological Society* by Dr. Einar Lönnberg, from statements made to him by his compatriot, Lieut. Karl Eriksson, through whom the first skin was obtained by Sir Harry Johnston. He thinks that it occurs practically over the whole of the equatorial forest, from the Ubangi and Welle in the north to a little beyond the Chuapa in the south. Its regular pasture-grounds were thought to be open glades in the forest watered by rivulets with shallow water. Although the flats are sometimes covered by water, the ground is firm, which accounts for the shape of the hoofs. The name okapi (with the accent on the second syllable) is used only by the small tribe of Wambobba, with whom the Wambutti who brought the first specimens happened to have been associated. The name in most of the Congo languages is "dumba."

Herr Frobenius in the Congo Basin.—A third letter from this traveller (*Journal*, **26**, 672; **27**, 629) is printed in No. 6 of the Berlin Society's *Zeitschrift* for the present year. The German ethnologist had extended his researches into the region south-east of Luluaburg, on either side of the Sankuru or Lubilash, which, though partially explored by Wissmann, Le Marinel and others, was still imperfectly known. Its ethnology is of special interest from the fact that the region is a borderland between the South African plateau and the Central African

* According to a later account, the expedition was making its way to Gondokoro, but had reported the melancholy tidings of the death, on June 13, of Captain Gosling, the second member of the party to succumb to the hardships encountered.

forest basin, and that the physical characters seem to have had considerable effect on the movements and distribution of the native tribes. After leaving Luluaburg, the traveller visited the great falls of the Lulua, which he proposes to name the Richthofen falls, since the native designation is constantly changing, being that of the last individual to lose his life at the spot. To the south the country rises very gradually, and beyond 7° S. lat. the river-valleys become less and less marked, the forest also retreating to a distance from the streams. A characteristic of this region are the upland bogs, the existence of which seems to have been a surprise to the traveller, though they would seem to be only the counterpart of the "sponges" of which Livingstone said so much. The native tribes show an astonishing degree of mixture, but Herr Frobenius thinks that some definite facts can be made out as regards their history. He came upon traces of the Mundekete, who, in the Portuguese records of the sixteenth century, are said to have made a victorious progress from the south. The legends of these people state that representatives of the older Baluba stock were then in the land, and the traveller deduces from this that the great dispersion of the Bechuana race (to which stock, he says, the Baluba belong) must have taken place before the sixteenth century. His observations will also throw light on the history of the builders of pile-dwellings in this part of Africa.

Fixed Positions in Nigeria: Captain Ommanney's Expedition.—Captain R. Ommanney, R.E., and Captain G. F. Evans, R.E., have returned to England on completion of the telegraphic longitude work for which they were sent to Northern Nigeria last autumn. Landing at Lagos in the middle of November, 1905, the expedition worked up the telegraph-line *viâ* Jebba to Lokoja, and then along the line which goes through Zungeru and Zaria to Kano. Working eastwards, Leri and Bauchi were fixed, and on the return journey the telegraph-line along the river Benue was used to determine the positions of Ibi, Keffi, and Loko. In all, the longitudes of fifteen important towns in Southern Nigeria were determined with reference to Lagos, the longitude of which had already been fixed by cable from Cape Town. Captain Ommanney is much to be congratulated on the success of his mission, which involved a march of about 2000 miles and much arduous work. The arrangements for the expedition were made jointly between the War Office and the Colonial Office, and the High Commissioner, Sir Frederick Lugard, gave the expedition his constant support and encouragement, without which a successful issue could not have been attained.

Railway Construction in Nigeria.—Official correspondence relative to schemes for improvement of Lagos harbour and the extension of the Lagos railway into Northern Nigeria has been issued as a blue book, with five plans. The contents include an account of six months' soundings and work afloat in the Lagos lagoon, which extends from Porto Novo eastwards for 250 miles; a general report on a scheme of railways for Lagos and Nigeria; researches by Sir Frederic Lugard in the country north of the lower section of the Benue, viz. from Loko to its junction with the Niger, and also that between Lokoja and the mouth of the Kaduna; a reconnaissance from Ibadan to Illorin and Jebba; divergent views on two alternative routes, west and east, for the proposed railway from Ibadan to Illorin; a general concurrence of opinion on Oshogbo as the objective of the first extension from Ibadan, and on Kano as the objective of the Lagos line; a description of the country north and east of Old Calabar and up the valley of the Cross river, tending to the determination of Old Calabar as the terminus of the railway on the east side of the Niger; a survey of the country on the line Egbom—Jebba—Illorin; and a survey carried out in 1903–4 for a railway from Niger to Kano, the total length of the ground covered measuring 1204 miles.

So much research and discussion on the part of experts and men of authority cannot but contribute materially to the elucidation of this region of West Africa. The following is the population of Nigerian towns as given in Mr. Grey's itinerary of his march from Jebba to Kano: Gwari, 5000, reduced by warfare from 20,000; Karechi, 6000; Zaria, 50,000 to 60,000; Lokoro, 4000; Kotokori, 5000; Anchow, 5000; Farki, 8000 to 10,000; Bebeshi, 25,000; Kano, between 100,000 and 200,000. These figures exclude all minor villages and all towns and villages not upon the route, and amount to about 2000 per mile from Gwari to Kano (140 miles).

African Telegraph Lines.—An article in the *Zeitschrift für Kolonialpolitik*, etc. (Heft 12, Jahrg. vii.), takes stock of telegraphic communication in and with Africa. The principal network in South Africa comprises a length of 22,000 miles, five-sixths the total mileage in Italy, one-fourth that in Germany. The Algeria-Tunis lines, stretching from the Moroccan frontier to near Tripoli, and sending out runners south as far as the Sahara, measure 9400 miles. In West Africa, again, 7000 miles of telegraph line, mainly French, having Timbuktu for its northernmost point, serve the various possessions from the Senegal to Dahomey. Of about the same length as the West African is the Egyptian network, which, including branch lines to Eritrea and Abyssinia, now reaches south to Fashoda, Harrar, and Adis-Abeba. Besides these four larger systems, the lines of the French Congo and Congo State, more than 1500 miles long, include a coast-line from Libreville to Massabi and an inland line to Brazzaville. Thence a river-cable across Stanley Pool now links French Congo with the Congo State and the line from Boma to Coquilhatville. German East Africa has a coast line from Tanga to Mikindani, a central line from Dar-es-Salaam to Muanza (completed 1904), and a line from Tanga to Wugiri—more than 1200 miles in all, with Kilimanjaro for objective. In British East Africa a line runs from Mombasa to Lamu; another to Entebbe. Other African lines include those running east and west of Tripoli; in Portuguese East and West Africa; in German South-West Africa and Kamerun; and from Lagos to Saki, Tebba, and Loko. To connect the great telegraph networks there are projected, and already so far advanced as to ensure realization, a trans-Saharan line, a line from Cape Town to Cairo, a line from the Congo mouth to Dar-es-Salaam. The article sets forth the actual situation and outlook of these three projects, and shows how the different African lines communicate with those of the world at large.

AMERICA.

New Expedition to Mount McKinley.—We learn from the *Zeitschrift* of the Berlin Geographical Society that Dr. F. A. Cook has once more started for the region of Mount McKinley, the highest summit of North America, which he hopes to explore under the auspices of the Philadelphia Geographical Society. He is accompanied by Prof. Herschel-Parker, of Columbia University.

Dr. Hauthal on Former Glaciation in the Andes.—Dr. Rudolf Hauthal, whose contributions to South American geography are well known, and who, after fifteen years in Argentina, has been appointed curator of the Hildesheim Museum, has, before leaving South America, carried out some interesting researches into the glaciation of the Andes of Bolivia and Peru (*Petermanns Mitteilungen*, 1906, No. 6). He states that he has ascertained that the same climatic differences which are now observable in different parts of the region in question prevailed also during the Ice Age. Where rainfall is now scanty, he found that glaciation during the Ice Age was also less extensive. He holds, like Dr. Hans Meyer (*Journal*, vol. 25, p. 333), that increase of glaciation was due to extra-terrestrial cosmical causes. The character of the glaciation in different latitudes bears this out, for while in Patagonia the ice took the form of a vast ice-cap, in Bolivia great glaciers descended from certain centres, filling up the valleys leading down to the plains. He claims to have ascertained also that the main summits of the Bolivian cordillera (Illampu, Illimani, etc.) are laccoliths of granitic character.

POLAR REGIONS.

The Danish Expedition to East Greenland sailed from Copenhagen under the leadership of Mr. Nylius Ericksen on June 24, intending to proceed direct to its destination after touching at the Færoes to take on board dogs and horses. It is proposed, besides filling up the gap in our knowledge of East Greenland between Cape Bismarck and Independence bay, to make a push for the pole early in 1907, and in the following year to attempt the crossing of Greenland from east to west over the inland ice.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

The Magnetic Survey of the Pacific.—The *Galike*, the vessel engaged in the magnetic survey of the Pacific ocean under the direction of the Carnegie Institution, started from San Diego, California, for her second cruise, which was to occupy the remainder of the year, on March 2 last. Some of the former staff having been obliged to return to their official duties, the command has now been entrusted to Mr. W. J. Peters, who was second in command of the second Ziegler expedition to Franz Josef Land. The route sketched out leads by Fanning and the Samoa group to Fiji, and thence to Yokohama and the Aleutian islands. Fanning island was reached on March 31.

Monthly Charts of Thermal Anomalies.—The subject of the curves of equal thermal anomaly, *i.e.* of equal deviation of the temperature of any locality from the mean temperature of the latitude in which it lies, has lately been taken up by Dr. Hopfner, who supplies monthly charts of the course of such lines in the second number of *Petermanns Mitteilungen* for the present year. Similar charts (to which, however, Dr. Hopfner does not appear to refer) were worked out by Dr. Spitaler some years ago, both for the year, and for the months of January and July, and were given in the same periodical in 1887 and 1889. Besides tracing the curves for the other ten months, Dr. Hopfner's charts show certain differences in points of detail, as is not surprising considering the sources of error which must unavoidably enter into such an investigation, but the general results of course agree. As is natural, the continents as a rule show an excess of temperature in summer and a defect in winter, while the reverse is the case with the oceans. This does not, however, hold universally, for, as Dr. Hopfner points out, certain regions show either an excess or defect throughout the year. Thus the continent of Europe is always warmer than the mean for its latitude. The chart for the year brings out clearly the relation between ocean currents and anomalies of temperature, regions of excess of temperature being naturally associated with warm currents, the reverse also holding good. The influence of the distribution of land and water is likewise seen in the differences between the north and south, and the east and west, hemispheres. Thus in the south it is the continents that are, broadly speaking, too warm, the oceans too cold, on the year's average, while in the north a reverse tendency is observable.

GENERAL.

Professor Davis on the Scope of Geography.—Prof. Davis returns to this question, an answer to which he has been in search of for some time, in the

Journal of Geography for April of this year. Not content with arriving at a conclusion by the deductive method, he has taken up the question on inductive lines by examining a large number of statements to be found in the best geographical text-books, with a view to finding out what general, unifying principle runs through them. The result will, of course, be to show, not what is the inherent characteristic of geography, but in what light it is generally understood by its votaries, who may themselves show divergent tendencies, or whose statements may require to be judged (as Prof. Davis does not hesitate to do in certain cases) by an external standard. The induction is therefore not entirely rigorous, but all the same the result is of interest. Stripped of accessories which, though naturally associated with the subject, are not of its essence, the statements analyzed are marked as a whole by containing at least two kinds of elements, one of which stands in a more or less distinctly causal relation to the other, and Prof. Davis finds in this idea of causal or explanatory relationship "the most definite, if not the only, unifying principle;" and this, he thinks, should be recognized and acted upon. However important this principle may be in regard to the educational value of the subject, it is difficult to accept it as the main criterion in deciding what geography is, seeing that it must to some extent be shared with other sciences. Prof. Davis allows that of the two elements one is usually of the nature of inorganic control, and the other of organic response, but even with this limitation the field will seem to many unjustifiably wide. The idea of location or distribution, to which Prof. Davis concedes a position of secondary importance only, is surely indispensable for the determination of what relationships are in fact geographical. Thus, the relation between the chemical constituents of a soil and the crops grown on it is hardly geographical, unless it is shown that such constituents may vary with location or some influence directly or indirectly the result of location. Or, again, the relation between temperature and the ebullition of water would not concern geography, were it not that it also varies with change of location. On the other hand, it may be doubted whether Prof. Davis is justified in his dictum that of the elements in the chain of causation one at least must be organic and one inorganic; for although the study may gain its greatest value when this is the case, it will hardly be conceded that an inquiry into the distribution, say, of glaciers, in their relation to climate, is not geographical. At all events, the discussion bears rather on what may conveniently and with most profit be studied as geography, than on the inherent essence of the subject.

Demographical Research in Uncivilized Countries.—A schedule has been drawn up by the International Statistical Institute, which is intended to serve as a guide to those who may be in a position to undertake demographical research in uncivilized countries. The principal points on which information is desired are grouped under thirty-five sections, while useful hints are given whereby the inquiry may be carried out to the best advantage. It is suggested that, where possible, enumerations of the population of suitably selected areas may be made, and forms are drawn up for the record of the data on the basis either of the household or the individual. When such inquiries are carried out by individuals, it is asked that the returns may be sent to the office of the Institute at Rome.

The Wall-maps at the Vatican.—In the May number of the *Rivista Geografica Italiana*, Prof. F. Porena makes what he calls a "confession" in regard to some of the well-known maps painted on the walls of the "Logge di Raffaelo" at the Vatican. The restoration of the decorations of these galleries was entrusted by Pope Pius IX. to Allessandro Mantovani, who, in 1875, took in hand the maps in question, which occupied a portion of the Central "Loggia." They were then in a deplorable state, having been virtually destroyed up to a man's height, while the inscriptions describing their contents were quite illegible. The only means of restoration which suggested itself was having recourse to the atlas since generally known to geographers as Lafreri's (cf. *Journal*, vol. 26, p. 130). To Prof. Porena was entrusted the task of supplying the missing portions, and in the absence of any indication of the original titles, these also were taken from the same atlas. It was only some years later that Signor Porena discovered, in a work of Padre Taja published in 1750, a reproduction of all the original inscriptions, but on making this known to Mantovani it was thought better to leave things as they were. His associates in the work having since died, Prof. Porena has thought it best to explain the circumstances of the case, and has thus removed the possibility of mistakes and confusion, which might otherwise have been caused in future by the fictitious titles.

Gold Production in Ancient and Modern Times.—A paper by M. M. Zimmermann in the *Bulletin* of the Lyons Geographical Society, vol. 20, 2nd and 3rd parts, examines with all available lights, uncertain and wavering as in many cases these are, the sites of ancient and mediæval gold production. The sites outside the limits of the ancient world are, in most cases, only to be conjectured from the testimonies of authors read in the light of modern discoveries. The data available have to do chiefly with three regions: Caucasia and Armenia, Central and North Asia, and the mountains of upper Indus. The antiquity of the exploitation of the gold regions which found an outlet at the mouth of the Phasis seems attested by the legend of the golden fleece. Its long continuance as a gold-producing region seems witnessed by Strabo's report that in Swanetia the torrents sweep along with them gold, gathered by the natives by means of hurdles or fleeces, whence the fable of the Golden Fleece may have arisen. Researches in the years 1850–52 led to the discovery, in the beds of some affluents of the Kura, of ancient works for exploiting the once auriferous banks. Funerary remains in Ossetia are notable for the predominance of golden ornaments dating from the sixth to the eighth century A.D. As regards the country of the Agrippéans, Issedons, and Arimaspes, who snatched the gold from the griffons, conjecture is divided between the Siberian steppes, the foreland of the Altai mountains, where Humboldt locates them, and the western basin of the Tarim, to which Richthofen relegates the Issedons. In fact, a wide domain of Siberia and Central Asia bears traces of the hunt for gold. The entire region of the Russian Altai and the Yenisei mountains is strewn with mining works. The paper next enters into a searching elucidation of the Derdæ of Strabo and the Daradræ of Ptolemy, who rescued the gold from giant ants; the country of Ophir, Ethiopia; the gold exploited directly by the Mediterranean peoples; the Roman exploitations registered, *e.g.*, in Ariège (Aurigera); the workings in Upper Egypt, whence is derived the oldest known map of auriferous regions, drawn over sixteen centuries B.C. by an Egyptian cartographer; and lastly the workings in Iberia. It is shown how, in the Middle Ages, more particularly from the tenth to the sixteenth centuries, gold-mining works were carried on and currents of exchange of wide range maintained, such as bear comparison with those of antiquity, and how, down to the gold discoveries in the New World, the Sudan was probably the chief source of supply to Europe.

OBITUARY.

Colonel M. S. Bell, V.C., C.B.

Colonel Mark Sever Bell, v.c., c.b., whose death occurred on June 26 last, was born in Sydney, New South Wales, in 1843, and received a commission in the Royal Engineers in 1862. Soon after he left for India, where he did distinguished service, both as soldier and explorer. He was in command of a company during the Bhutan expedition (1865–66), and was present at the Monar Bridge affair, receiving the medal and clasp. Two years later he took part in the Hazara campaign, and with his company made a remarkable march of 600 miles. During the Ashanti expedition of 1873–74 he acted as special service officer, and shared in the battles of Amoaful and Ordasu. He was also present at the capture of Kumasi. It was at Ordasu that he was awarded the V.C. His first notable piece of exploration was a visit to the Karun river and Kum (described in *Blackwood's Magazine*, April, 1889). During the Burma campaign of 1886–87 he was employed on the Intelligence Staff, and did some useful survey work. His next exploit was to traverse Central Asia from Peking to Kashgar, a distance of 3500 miles. In company with Lieut. (now Sir F. E.) Younghusband, he started from the Chinese capital, but soon afterwards diverged, his companion being the first Englishman to cover the Alashan route to Barkul and Kashgar, and thence by way of the Mustagh pass to Kashmir and India; while Colonel Bell was the first to traverse what he called "the Great Central Asian trade-route" by way of Si-ngan-fu and the provinces of Shensi and Kansu to Hami, Karashahr, and Kashgar. In 1887 Colonel Bell was gazetted aide-de-camp to Queen Victoria, and in 1893 his services were further recognized by the award of the C.B. He was also the recipient of the MacGregor Gold Medal, presented by the Indian United Service Institution, and on one occasion was complimented for his geographical exploits by Lord Curzon in the following quaint words: "His extraordinary travels over almost the whole Asian continent, though little known to the public, entitle him to be considered the territorial Ulysses of this age."

That this eulogy was not undeserved will be apparent from an inspection of the Society's Library catalogue, where, under Colonel Bell's name, will be found nearly a dozen works of his dealing with China, Afghanistan, Persia, Central Asia, Turkey, and Asia Minor, mainly from the point of view of the military strategist. Curiously enough, not one of these appears in the British Museum catalogue.

Captain George Bennett Gosling.

We deeply regret to record the death of Captain G. B. Gosling, of the Rifle Brigade, Lieut. Boyd Alexander's companion and valued coadjutor on the expedition from Nigeria to the upper Nile, to which reference has so frequently been made in the *Journal*. Besides bearing a substantial share in the expenses of the expedition, Captain Gosling had throughout been one of its most active members, and had taken an important part in the survey work which formed one of its main objects, and which devolved almost entirely on him after the death of Captain Claude Alexander and the return of Mr. Talbot. The interesting information respecting the okapi to which reference has been made above (p. 181) was, we believe, largely obtained by him. Captain Gosling was the fourth son of the late Robert Gosling of Hassobury, Essex, and was born on August 26, 1872. He was educated at Eton and Sandhurst, entering the army in February, 1892. He served for some time in India, and took part in the Tirah campaign of 1897. He went out to South Africa in 1901, and was severely wounded. Although not engaged in actual exploring work previous to joining Lieut. Boyd Alexander, he had done a good deal of big game shooting in Kashmir.

Israel Cook Russell.

In Prof. Israel Russell America has lost one of her foremost geographers, to whom, with two or three others, has been especially due the great advance made in the scientific study of the subject in the United States within the past dozen years. He died at Ann Arbor, on May 1 of this year, after but a short illness, at the comparatively early age of fifty-three years. Born December 10, 1852, he was educated at New York University and at the School of Mines, Columbia University, and after accompanying the United States Expedition to New Zealand to observe the Transit of Venus in 1874, became assistant professor of geology at Columbia University in 1875. For some years after 1878 he was connected with the United States Geological Survey, and thus gained the wide knowledge of field-geology which he afterwards applied with so much effect to the study of more purely geographical questions. His special interest in these had its first important outcome in his expeditions to Mount St. Elias in 1890 and 1891, by which the physical features, and especially the glaciers, of the great mountain were for the first time studied in detail by a fully qualified expert. The series of works on the lakes, glaciers, and volcanoes of North America, which appeared from his pen in 1895–97, were further valuable contributions to the physical geography of the continent, while his work in this direction found a fitting culmination in the volume on North America, which appeared only two years ago in the 'Regions of the World' series. Of his more strictly geological works, that on the geological history of Lake Lahontan was undoubtedly the most valuable.

Russell had been professor of geology at the University of Michigan since 1892, and among his more recent services was his expedition to the West Indies to study the effects of the volcanic catastrophes of 1902. His death will be a serious loss to the cause of geography in the United States.

Nathaniel Southgate Shaler.

Another well-known American geologist, Prof. N. S. Shaler, died less than a month before Prof. Russell, on April 10, 1906. Shaler was born on February 20, 1841, and had therefore completed his sixty-fifth year. Educated at the Scientific School at Harvard, he was more or less connected with that university throughout the greater part of his life, becoming professor of palæontology in 1869, and of geology in 1888, and holding the latter office until his death. While known as a successful and inspiring teacher, he did no less important work in the field, having been at the head of the Kentucky geological survey from 1873 to 1880, and having subsequently been associated with the work of the United States Geological Survey. His interests were exceedingly wide, and his writings included many with humanity as well as nature as theme. In 1885 he contributed the volume on Kentucky to the American Commonwealth series, in which the history and development of the state were dealt with, and in 1894 he brought out, with the co-operation of other writers, a large work dealing with the United States as a whole under many different aspects, political, social, and economic. Several of his more recent writings were concerned with social questions.

CORRESPONDENCE.

Joris Carolus and Edge Island.

In an article published in the *Journal* for June, 1901, and reprinted in a revised form in his book 'No Man's Land,' lately issued by the Cambridge University Press, Sir Martin Conway discusses the voyage of Joris Carolus to Spitsbergen in 1614, and comes to the conclusion that, though no specific claim to that effect was ever made by him, the Dutch navigator is to be credited with the original discovery, in that year, of the island since known as Edge island, from its reputed discoverer, Captain Thomas Edge, who reached it two years later.

The chief authority for this idea is the map drawn by Carolus,* on which certain lands are represented to the south-east of Spitsbergen, coupled with the fact that Carolus is known to have been bent on discovery during the 1614 voyage, and that his movements after August 9 have not been recorded. These considerations certainly point to the possibility that Edge island was discovered in 1614; but before definitely transferring the credit from Edge to Carolus, ought we not to consider whether the map in question is incapable of any other explanation?

On this map, two land-masses are drawn, separated by sounds from the western main island of Spitsbergen and from each other. While the more westerly is marked "Onbekende Cust," that to the east bears the name Marfyn (or Morfyn?), a corruption of the Matsyn of earlier maps, itself based on vague information respecting a "Matthew's land" in the Novaya Zemlya region. Now, if Marfyn really represents Edge island, it is placed some 18° too far east (relatively to the main island), while if the "Onbekende Cust" is considered to represent Whale's Head of Edge island (why, in this case, should it be called "onbekende"?), the extension in longitude of that island becomes no less than 30°, instead of the 4° which it has in reality. May it not be that the two lands in question are merely copied from earlier maps of the type represented by Hoeius' map of 1600, and that of Hondius in Pontanus' History of Amsterdam' (1611), in which there is an indication of land (without name) between Matsyn and Spitsbergen, corresponding with Carolus' "Onbekende Cust," except in so far as the latter has received an extension of area?

That cartographers did not scruple to give a fairly detailed representation of lands inserted from hearsay, need not be insisted on,† while even as regards its form, Marfyn seems suggested by the earlier delineations of Matsyn. Again, even granting that Matsyn was generally connected by cartographers with Spitsbergen rather than with Novaya Zemlya, this would seem to supply an additional argument *against* the identification of Marfyn with Edge island, for if such a connection was commonly supposed to exist before the date of Carolus' map, this explorer would merely be following precedent in showing the coasts as he did, and there is no need to suppose personal knowledge on his part. Later identifications of Marfyn or Marsyn with Edge island would naturally be suggested by his own map.

Besides the strange silence of Carolus in regard to his supposed discovery, the fact that he was said to have "advanced his voyage towards the north pole,"

* Reproduced in part in the *Journal*, vol. 17, p. 625, and in 'No Man's Land,' p. 331.

† An instance is the fictitious Y* des Géants in the Southern Indian ocean in Desceliers' map of 1546, which is shown with various rocks and shoals round its coast. If it be said that this really represents Zanzibar, shifted from its true position, equally well might Marfyn represent some real, but misplaced, portion of the Novaya Zemlya coast.

together with his (unjustifiable) claim to have reached 83°, evidently imply that he based his title to reward on work to the north, rather than the south-east, of Spitsbergen.

EDWARD HEAWOOD.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1905–1906.

RESEARCH DEPARTMENT.

May 11, 1906.

"Some Problems on the Physical Geography of the Seistan Basin." By Colonel Sir Henry McMahon, K.C.I.E., C.S.I.

June 8, 1906.

"A Plea for the Investigation of the Biological (Floral and Faunal) and Anthropological (Racial and Cultural) Distributions in the Pacific." By Prof. A. C. Haddon, F.R.S.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *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. (Mém.) = Memoirs, Mémoires.
Ann. = Annals, Annales, Annalen.	Met. (mét.) = Meteorological, etc.
B. = Bulletin, Bollettino, Boletim.	P. = Proceedings.
Col. = Colonies.	R. = Royal.
Com. = Commerce.	Rev. (Riv.) = Review, Revue, Rivista.
C. R. = Comptes Rendus.	S. = Society, Société, Selskab.
E. = Erdkunde.	Sc. = Science(s).
G. = Geography, Géographie, Geografia.	Sitzb. = Sitzungsbericht.
Ges. = Gesellschaft.	T. = Transactions.
I. = Institute, Institution.	Ts. = Tijdschrift, Tidskrift.
Is. = Izvestiya.	V. = Verein.
J. = Journal.	Verh. = Verhandlungen.
Jb. = Jahrbuch.	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—Dent-Blanche. *C. Rd.* 142 (1906): 527–529. **Argand.**
Sur la tectonique du massif de la Dent-Blanche. Note de Émile Argand.

Alps—Structure. *B.S. Belge Géol.* 19 (1905): 377–440. **Van de Wiele.**
Les théories nouvelles de la formation des Alpes et l'influence tectonique des affaissements méditerranéens. Par le Dr. C. Van de Wiele. *With Map.*

Austria—Herzegovina. *La G., B.S.G. Paris* 13 (1906): 91-102. **Daneš.**
La région de la Narenta inférieure. Par Dr. V. Daneš. *With Illustrations.*

Austria—Karst. *G.Z.* 12 (1906): 47-49. **Oestreich.**
Zur Hydrographie des Karsts. Von Karl Oestreich.

Balkan Peninsula. **Fraser.**
Pictures from the Balkans. By John Foster Fraser. London: Cassell & Co., 1906. Size 8 × 5½, pp. xii. and 298. *Map and Illustrations. Price 6s. Presented by the Publishers.*

Baltic—Bornholm and Gothland. *M.G. Ges. München* 1 (1905): 482-484. **Günther.**
Bornhohm und Gotland. Von Prof. Dr. S. Günther.

Denmark—Tides. *Oversigt K. Dansk. Vidensk. S. Forh.* 1905 (1906): 505-531. **Paulsen.**
Communications du service maréographique de l'Institut météorologique de Danemark. Par Adam Paulsen. *With Map and Illustrations.*

France. *B. Musée Océanograph. Monaco*, No. 67 (1906): pp. 32. **Guérin.**
Notes préliminaires sur les Gisements de Mollusques comestibles des Côtes de France. Le Golfe du Calvados. Par J. Guérin. *With Map and Illustrations.*
Papers on other sections of the coasts have previously appeared.

France—Auvergne. *C. Rd.* 142 (1906): 239-241. **Glangeaud.**
Reconstitution d'un ancien lac oligocène sur le versant nord du massif du Mont-Doré (lac d'Olby). Note de Ph. Glangeaud.

France—Brittany. *C. Rd.* 142 (1906): 468-470. **Cayeux.**
Les tourbes des plages bretonnes, au nord de Morlaix (Finistère). Note de L. Cayeux.
On vegetable remains intercalated among the sands.

France—Dauphiné. *La G., B.S.G. Paris* 13 (1906): 139-141. **Vidal, Offner, and Rabot.**
Les Colonies de plantes méridionales dans le haut Dauphiné. Par Charles Rabot. *With Map.*
Summary of a memoir by MM. Vidal and Offner in the publication of a local scientific society.

France—Hydrology. **Gosselet and Demangeon.**
La G., B.S.G. Paris 13 (1906): 136-139.
L'appauvrissement des sources dans les pays de plaines du nord de la France. Par A. Demangeon.
Analysis of a paper by M. Gosselet in *Ann. Soc. Géol. Nord.*

France—Savoy. *B.S. Neuchatel. G.* 16 (1905): 17-48. **Girardin.**
Les Glaciers de Savoie. Étude physique. Limite des neiges. Retrait. Par Paul Girardin. *With Illustrations.*

France—Water-power. *La G., B.S.G. Paris* 13 (1906): 141-146. **Bresson and Rabot.**
Les forces hydrauliques dans le Calvados, l'Eure et le Maine-et-Loire. Par Charles Rabot. *With Maps.*
From a paper by M. Bresson in the *Annales* of the Ministry of Agriculture.

Germany. *Verh.* 15. *Deutsch. Geographentages Danzig* (1905): 173-184. **Hahn.**
Bericht der Zentral-Kommission für wissenschaftliche Landeskunde von Deutschland während der Geschäftsjahre 1903 bis 1905. Von Prof. Dr. F. Hahn.

Germany—Agriculture. **Schwabach.**
Agriculture in Germany. Foreign Office, Miscellaneous, No. 645. 1906. Size 9¾ × 6¼, pp. 22. *Price* 1½*d.*

Germany—Coasts. **Lehmann.**
Verh. 15. *Deutsch. Geographentages Danzig* (1904): 151-158.
Die Gesetzmässigkeit der Alluvialbildungen an den deutschen Ostee-Küsten. Von Dr. F. W. Paul Lehmann.

Germany—Dunes. *Verh.* 15. *Deutsch. Geographentages Danzig* (1905): 159-172. **Solger.**
Ueber fossile Dünenformen im norddeutschen Flachlande. Von Dr. F. Solger. *With Maps and Diagram.*

Germany—East Prussia. **Braun.**
Das Frische Haff. Von Dr. Gustav Braun. (Sonderabdruck aus der Zeitschrift für

Gewässerkunde, vii. Band. 3 Heft.) Size 9½ × 6¼, pp. [19]. *Sketch-maps and Diagrams. Presented by the Author.*

Germany—Lakes. *Verh.* 15. *Deutsch. Geographentages Danzig* (1905): 201–204. **Seligo.**
Ueber Temperaturbeobachtungen in westpreussischen Seen. Von Dr. Seligo.

Germany—Meteorology. **Hellmann.**
Ergebnisse der Niederschlags-Beobachtungen im Jahre 1902. Von G. Hellmann. (Veröffentlichungen des K. Preuss. Meteorologischen Instituts.) Berlin: A. Asher & Co., 1905. Size 13 × 10, pp. l. and 244. *Map. Presented by the Institute.*

Germany—Thuringia. **Schlüter.**
Die Siedelungen im nordöstlichen Thüringen. Von Dr. Otto Schlüter. Berlin: Hermann Costenoble, 1903. Size 10 × 6½, pp. xx. and 454. *Maps and Plans. Price* 16*s.* 3*d.*

Dr. Schlüter is known as one of the most persevering students of the geography of settlements, and the present work may serve as an excellent instance of the methods of such study, in the case of a particular region.

Germany—Vistula. **Bindemann.**
Verh. 15. *Deutsch. Geographentages Danzig* (1905): 184–200.
Die Veränderungen der Mündungsarme der Weichsel. Von — Bindemann. *With Maps.*

Germany—West Prussia. **Schubert.**
Verh. 15. *Deutsch. Geographentages Danzig* (1905): 205–206.
Wald und Niederschlag in West Preussen, Posen und Schlesien. Von Prof. Dr. Schubert.

Germany—West Prussia. *Deutsch. Rundschau G.* **28** (1906): 218–221. **Mankowski.**
Dünenwälder auf der Halbinsel Hela. Von H. Mankowski.

Greece. *G.Z.* **12** (1906): 38–47. **Sapper.**
Inseln des ägäischen Meeres. Eine landschaftliche Skizze. Von Karl Sapper. *With Illustrations.*

Greece—Eleusis. **Philios and Gatliff.**
Elevsis, her Mysteries, Ruins, and Museum. Translated from the French of Demetrios Philios, Director of the Excavations (1882–1894), by Hamilton Gatliff. London: Sidney Appleton, 1906. Size 7½ × 5, pp. viii. and 80. *Plan and Illustrations. Price* 5*s. net. Presented by the Publisher.*

Holland—Waterways. *Ts. K. Ned. Aard. G. Amsterdam* **23** (1906): 316–319. ———
Drentsche Hoofdvaart en N.W.-Kanaal. Door J. B. R.

On the recent low water-level in some of the canals in Holland.

Italy—Anthropology. *Riv. G. Italiana* **12** (1905): 553–559. **Giuffrida-Ruggeri.**
Differenza di statura fra coscritti e reclute nelle diverse regioni d'Italia, a proposito di un tipo mediterraneo di alta statura. Dott V. Giuffrida-Ruggeri.

Italy—Anthropology. ———
Antropometria militare. Risultati ottenuti dallo spoglio dei fogli sanitarii dei militari delle classi 1859–63 eseguito dall' Ispettorato di Sanità militare per ordine del Ministero della Guerra. Incaricato della direzione dei lavori Dr. Ridolfo Livi. 2 Parts, and Atlas to Part i. Roma, 1896–1905. Size 12 × 9, pp. (part i.) 420; (part ii.) viii., 180, and 228. *Diagrams. Presented by the Ispettorato di Sanità militare, Rome.*

Italy—Florence. **Allen and Cruickshank.**
Grant Allen's Historical Guides. Florence. New edition, revised and enlarged by J. W. and A. M. Cruickshank. London: E. Grant Richards, 1906. Size 7 × 4½, pp. 304. *Price* 3*s.* 6*d. net. Presented by the Publisher.*

Italy—Sicily. *Riv. G. Italiana*, **12** (1905): 516–522, 602–615. **Crinò.**
La Carta di Sicilia di Agatino Daidone e notizie di cartografia siciliana, tratte dai manoscritti della Biblioteca comunale di Palermo e della Fardelliana di Trapani. Memoria del Prof. S. Crinò.

Lake of Constance. *M.G. Ges. München* 1 (1905): 488–490. **Kittler.**
Die Entstehungsgeschichte des Bodensees. Von Dr. C. Kittler.

North Sea. ———
North Sea Pilot. Part III. East Coast of England, from Berwick to the North

Foreland, including the Rivers Thames and Medway. Seventh Edition. London: J. D. Potter, 1905. Size 9½ × 6, pp. xx. and 428. *Index-chart.* *Price* 2*s.* 6*d.*

Rhine. **Baedeker.**

The Rhine from Rotterdam to Constance, Handbook for Travellers. By Karl Baedeker. 16th edition. Leipzig: K. Baedeker; London: Dulau & Co., 1906. Size 6½ × 4½, pp. xxxiv. and 462. *Maps and Plans.* *Price* 7*m.* *Presented by the Publishers.*

Switzerland—Tunnel. *La G., B.S.G. Paris* 13 (1906): 215–221. **Girardin.**

Le Percement des Alpes bernoises. Par Paul Girardin. *With Profiles.*

On the latest tunnel project.

United Kingdom—Great Britain. **Baedeker.**

Great Britain. Handbook for Travellers. By K. Baedeker. 6th edition, revised and augmented. Leipzig: K. Baedeker; London: Dulau & Co., 1906. Size 6½ × 4½, pp. lxvi. and 606. *Maps and Plans.* *Price* 10*m.* *Presented by the Publishers.*

To the already large number of maps and plans given in previous editions, four of the former and nineteen of the latter are now added.

United Kingdom—Ireland. **Ward.**

Thorough Guide Series. Ireland (Part ii.) East, West, and South, including Dublin and Howth. By C. S. Ward. 5th edition. London: Dulau & Co., 1906. Size 6½ × 4½, pp. xxiv. and 236. *Maps and Plans.* *Price* 5*s. net.* *Presented by the Publishers.*

ASIA.

Asia—Historical. *Indian Antiquary* 35 (1906): 33–47. **Franke and Nicolson.**

The Sok and Kaniska. Passages from an article by Dr. O. Franke, Halensee, entitled "Beiträge aus Chinesischen Quellen zur Kenntnis der Türkvölker und Skythen Zentralasiens," published in the *Proceedings* of the Royal Academy of Sciences of Prussia, 1904, selected and translated by Miss C. Nicolson.

Dr. Franke considers the Sok of the Chinese to be identical with the Sakas (cf. July number, p. 76). He traces their various movements, and also discusses the date of Kanishka's reign.

Baluchistan. **Yate.**

Proceedings of the Central Asian Society, Baluchistan. By Colonel C. E. Yate, C.S.I., etc. London: Central Asian Society, 1906. Size 10 × 6½, pp. 40. *Presented by the Author.*

A valuable account of the present condition and general relations of Baluchistan, of which the author was Chief Commissioner from 1900 to 1904.

Central Asia—Tian Shan. *M.G. Ges. München* 1 (1905): 484–488. **Merzbacher.**

Forschungsreise in den Tian-Schan. Von Dr. Gottfried Merzbacher.

China. **Richard.**

L. Richard. Géographie de l'Empire de Chine (Cours Supérieur). Chang-Hai, Imp. de la Mission Catholique à l'Orphelinat de T'ou-sè-wè, 1905. Size 7½ × 5, pp. xviii., 564, and xxii. *Maps and Plans.* *Presented by the Publishers.*

Originally intended for use in the French schools in China, but extended so as to form a compendium of Chinese geography for more general purposes. Each of the provinces is described in turn, and there are sections on the coasts, the political and economic geography, and on the dependent territories.

Chinese Empire—Tibet. *M.G. Ges. München* 1 (1905): 496–499. **Filchner.**

Expedition zum Oberlauf des Hwangho in Osttibet. Von Leutnant W. Filchner.

Chinese Empire—Tibet. **Sandberg.**

Tibet and the Tibetans. By Graham Sandberg. London: Society for Promoting Christian Knowledge, 1906. Size 10 × 6½, pp. x. and 334. *Price* 5*s.* *Presented by the Publishers.*

Chinese Geography. *T'oung Pao* 6 (1905): 519–571. **Chavannes.**

Les pays d'occident d'après le Wei lio. Par E. Chavannes.

The Wei lio was a historical work, now lost, which is quoted from by a Chinese author who wrote in 429 A.D.

Eastern Asia. *Scottish G. Mag.* 22 (1906): 181–188. **Little.**

Hanoi and Kwang-Chow-Wan; France's last acquisition in China. By Mrs. Archibald Little.

French Indo-China. **Patté.**

Paul Patté. Hinterland Moï. Avec une Introduction de M. le Général F. Canonge et une Lettre-Préface de M. le Lieut.-Colonel Adam de Villiers. Paris: Plon-Nourrit et Cie., 1906. Size 7½ × 5, pp. viii. and 260. *Map and Illustrations. Price* 3*s.* 3*d.*

Account of the author's work as a French official in a little-known part of Indo-China.

India. **Dubois and Beauchamp.**

Hindu Manners, Customs, and Ceremonies, by the Abbé J. A. Dubois. Translated from the Author's later French MS. and edited, with Notes, Corrections, and Biography, by Henry K. Beauchamp. With a Prefatory Note by the Right Hon. F. Max Müller and a Portrait. Third edition. Oxford: Clarendon Press, 1906. Size 7½ × 5, pp. xxxiv. and 742. *Price* 6*s. net. Presented by the Publishers.*

India. **Abbott.**

Through India with the Prince. By G. F. Abbott. London: E. Arnold, 1906. Size 9½ × 6, pp. x. and 312. *Map and Illustrations. Price* 12*s.* 6*d. net. Presented by the Publisher.*

Embodies a good deal of shrewd observation on questions bearing on the present and future of the Indian Empire. The views expressed are generally judicious, though a slightly cynical vein is now and then apparent.

India—Bengal. *J. East Indian Association* 39 (1906): 65–79. **Mitra.**

The Partition of Bengal and the Bengali Language. By S. M. Mitra.

India—Bengal. ——

Backergunge District Gazetteer. Statistics, 1901–02 (pp. 31); Bogra (pp. 27); Chittagong (pp. 29); Chittagong Hill Tracts (pp. 15); Dacca (pp. 29); Dinajpur (pp. 29); Faridpur (pp. 29); Jalpaiguri (pp. 29); Malda (pp. 29); Mymensingh (pp. 33); Noakhali (pp. 29); Pabna (pp. 29); Rajshahi (pp. 29); Rangpur (pp. 31); Tippera (pp. 29). Calcutta, 1905. Size 8½ × 5½. *Presented by the India Office.*

India—Census. **Hardy.**

Memorandum on the Age Tables and Rates of Mortality of the Indian Census of 1901. By G. F. Hardy. Calcutta, 1905. Size 13½ × 8½, pp. 66.

India—Gujarāt. *J.R. Asiatic S.* (1906): 458–460. **Fleet.**

The name Gujarāt. By J. F. Fleet.

India—Madras. ——

Madras District Gazetteers. Statistical Appendix for South Canara District (pp. iv. and 74); Ditto Kurnool District (pp. iv. and 46); Ditto, Tinnevelly District (pp. iv. and 58). Madras, 1905. Size 10 × 6½. *Presented by the India Office.*

India—Nepal. **Lévi.**

Le Népal. Étude historique d'un Royaume Hindou. Par Sylvain Lévi. Vol. 2. (Annales du Musée Guimet, Bibliothèque d'Études, T. xviii.) Paris: E. Leroux, 1905. Size 10 × 6½, pp. 410. *Illustrations. Price* 10*s.*

This volume, which completes the work (*Journal*, vol. 26, p. 235), deals with religion and history, concluding with an account of a visit to Nepal in 1898.

India—United Provinces. **Nevill.**

Sitapur: A Gazetteer, being volume 40 of the District Gazetteers of the United Provinces of Agra and Oudh. By H. R. Nevill. Allahabad, 1905. Size 9 × 6, pp. 224, xliv., and vi. *Map. Presented by the India Office.*

Japan. **Kaempfer.**

The History of Japan, together with a Description of the Kingdom of Siam, 1690–92. By Engelbert Kaempfer, M.D. Translated by J. G. Scheuchzer, F.R.S. 3 vols. Glasgow: James MacLehose & Sons, 1906. Size 9 × 6, pp. (vol. 1) xc. and 338; (vol. 2) x. and 398; (vol. 3) x. and 386. *Facsimile Maps and Illustrations. Price* 37*s.* 6*d. net. Presented by the Publishers.*

The attention directed to Japan at the present time lends a special interest to this reprint of one of the most important of the early works on that empire.

Malay Archipelago—Gilolo. **Oudemans and Schut.**
Ts. K. Ned. Aard. G. Amsterdam **23** (1906): 335-340.

De naam "Halemahera," door P. A. Oudemans, met toelichting door J. A. F. Schut.

Malay Archipelago—Java. **Deknatel.**
Ts. K. Ned. Aard. G. Amsterdam **23** (1906): 332-335.

Bestijging van den Tjerimai. Door J. A. Deknatel.

Malay Archipelago—Java. *Deutsch. Rundschau G.* **28** (1906): 241-244. **Zürn.**

Von Tosari zum Bromo. Reiseerinnerungen aus dem Vulkangebiet Javas. Von Ralph Zürn. *With Map and Illustrations.*

Malay Archipelago—Sumatra. **Tobler.**
Ts. K. Ned. Aard. G. Amsterdam **23** (1906): 199-315.

Topographische und Geologische Beschreibung der Petroleumgebiete bei Moeara Enim (Süd-Sumatra). Von Dr. A. Tobler. *With Maps and Illustrations.*

Siam. **Robert.**

Le Siam. Étude de Géographie politique. Par Ernest Robert. (Travaux du Séminaire de Géographie de l'Université de Liége. Fascicule V.) Liége, 1906. Size 10 × 6½, pp. 76. *Map.*

AFRICA.

Abyssinia—Trade. ——

Berichte über Handel und Industrie, zusammengestellt im Reichsamt des Innern. Band ix. 1 Heft. Die Handels- und Verkehrsverhältnisse Abessiniens. Berlin: Carl Heymann, 1905. Size 9 × 6, pp. 60. *Map. Price* 1*s.*

Africa. **Hotchkiss.**

Sketches from the Dark Continent. By Willis R. Hotchkiss. London: Headley Brothers, [*not dated*]. Size 7½ × 5, pp. 139. *Price* 1*s. net. Presented by the Publishers.*

Treats of missionary work in British East Africa, and the mission question in general.

Algeria. **Belloc.**

Esto Perpetua. Algerian Studies and Impressions. By H. Belloc. London: Duckworth & Co., 1906. Size 7½ × 5½, pp. viii. and 192. *Illustrations. Price* 5*s. net. Presented by the Publishers.*

This little book brings out in a striking way the salient facts, both of the physical geography and history of North Africa.

Algeria. *La G., B.S.G. Paris* **13** (1906): 134-135. **Pelet.**

La position géographique d'El Oued. Par Paul Pelet.

Basutoland. *J. African S.* **5** (1906): 233-251. **Mabille.**

The Basuto of Basutoland. By Rev. A. Mabille.

British East Africa. ——

Handbook for East Africa, Uganda, and Zanzibar, 1906. Mombasa: Printed at the *East African Standard* Printing Press. Size 7½ × 5, pp. iv. and 262. *Map. Presented by H.M. Commissioner for the East Africa Protectorate.*

A revised edition of this useful handbook.

Cape Colony—Little Namaqualand. **Ronaldson.**
J. Geol. S. South Africa **8** (1905): 158-166.

Notes on the Copper Deposits of Little Namaqualand. By J. H. Ronaldson. *With Map.*

Central Africa. *J. African S.* **5** (1906): 182-186. **Dawe.**

An Ascent of Ruwenzori. By M. J. Dawe.

Mr. Dawe ascended to a point a little above the base of the glacier at the head of the Mubuko valley. The paper consists mainly of botanical notes.

Congo State. *Z. Ges. E. Berlin* (1906): 114-118. **Frobenius.**

Leo Frobenius' Forschungsreise in das Kassai-Gebiet. II. Bericht über die Reisen und Arbeiten vom 30. Mai bis 2. Dezember 1905. Von Leo Frobenius. *With Illustrations.*

Noticed in the June number (p. 629). See also *ante*, p. 181.

Dahome. **François.**

Notre Colonie du Dahomey, sa formation, son développement, son avenir. Par

G. François. Préface de Lucien Hubert. Paris: Émile Larose, 1906. Size 10 × 6¼, pp. viii. and 284. *Illustrations. Price* 6 *fr.*

A general sketch of Dahome, with a discussion of the possibilities of its economic development.

Egypt. *M.G. Ges. München* 1 (1905): 494–496. **Stromer.**

Geographische Beobachtungen in der libyschen Wüste. Von Dr. Ernst Freiherr Stromer von Reichenbach.

French Congo. *Rev. Française* 31 (1906): 140–148. **Lasalle.**

Réorganisation du Congo Français. Par C. de Lasalle.

See note in the April number (p. 406).

French West Africa. **Decorse and Gaudefroy-Demombynes.**

Docteur Decorse et M. Gaudefroy-Demombynes. Rabah et les Arabes du Chari. Documents Arabes et Vocabulaire. Paris: E. Guilmoto, [*not dated*]. Size 9 × 6, pp. 64.

Reproduction of documents bearing on the career of Rabah, written by, or taken down from the mouth of, persons closely associated with the conqueror.

Lake Chad. *La G., B.S.G. Paris* 13 (1906): 195–214. **Tilho.**

Exploration du lac Tchad. (Février-mai 1904.) Par Jean Tilho. *With Maps and Illustration.*

Noticed in the present number (p. 168).

Liberia. **Johnston.**

Liberia. By Sir Harry Johnston, G.C.M.G., etc. With an Appendix on the Flora of Liberia. By Dr. Otto Stapf. 2 vols. London: Hutchinson & Co., 1906. Size 10 × 7, pp. xxviii. and 1184. *Maps and Illustrations. Price* 42*s. net. Presented by the Author.* [To be reviewed.]

Madagascar. **Martonne.**

Rev. Madagascar 7 (2) (1905): 527–545; 8 (1) (1906): 27–55, 104–124, 215–240.

Fianarantsoa et le Betsiléo Central. Par Lieut. Ed. de Martonne. *With Maps and Illustrations.*

Mauritius. *P.R.S.*, Ser. A, 76 (1905): 507–511. **Claxton.**

Preliminary Report on a Survey of Magnetic Declination near the Royal Alfred Observatory, Mauritius. By T. F. Claxton.

Morocco. *Renseignements Col., Comité Afrique Française* (1906): 49–63. **Pobeguin.**

Documents de la mission maritime Française du Commandant Dyé. Notes sur Mogador. Par E. Pobeguin. *With Illustrations.*

Niger. *La G., B.S.G. Paris* 13 (1906): 81–90. **Desplagnes.**

Une mission archéologique dans la vallée du Niger. Par — Desplagnes. *With Illustrations.*

Nigeria. *Scottish G. Mag.* 22 (1906): 173–181. **Watt.**

Southern Nigeria. By James Watt. *With Illustrations.*

Nile. **Lyons.**

Finance Ministry. Survey Department, Egypt. The Physiography of the River Nile and its Basin. By Captain H. G. Lyons. Cairo, 1906. Size 11 × 7½, pp. viii. and 412. *Maps and Diagrams.* [To be reviewed.]

Nile Valley. *B.S. Belge Géol.* 19 (1905): 260–263. **Rutot.**

La géologie de la vallée du Nil et les nouvelles découvertes éolithiques et paléolithiques qui y ont été faites. Par A. Rutot.

North Africa. **Neumann.**

Nordafrika (mit Ausschluss des Nilgebietes) nach Herodot. Von Richard Neumann. Leipzig: Gustav Uhl, [*not dated*]. Size 9 × 6, pp. 166. *Price* 2*m. Presented by the Publisher.*

South Africa—Natal. ——

South Africa. Natal Route Book. 2 vols. Prepared for the General Staff, War Office. 1906. Size 7½ × 5, pp. (vol. 1) x. and 364; (vol. 2) x. and 714. *Maps and Illustrations. Presented by the War Office.*

South Africa—Zululand. ——

South Africa. Military Report on Zululand. Prepared for the General Staff, War Office, 1906. Size 6½ × 4¼, pp. viii. and 458. *Map and Diagrams. Presented by the War Office.*

Begins with a chapter on the physical geography of Zululand.

NORTH AMERICA.

Canada. **Whates.**

Canada, the New Nation. A book for the Settler, the Emigrant, and the Politician. By H. R. Whates. London: J. M. Dent & Co., 1906. Size 8 × 5½, pp. xiv. and *Illustrations. Price 3s. 6d. net. Presented by the Publishers.*

Discusses, from personal experience, the prospects offered by Canada to immigrants, especially from the point of view of agriculture. Some other questions are also treated of. The book is written from the standpoint of an unprejudiced observer, and should be of great use to intending immigrants, while also urging a plea for a definite policy as regards emigration in general.

Canada. *Blackwood's Mag.* 179 (1906): 392–402. **Hanbury-Williams.**

At the Mouth of the Saskatchewan. By C. Hanbury-Williams.

Canada. *La G., B.S.G. Paris* 13 (1906): 151–153. **Rudaux.**

Le climat de Dawson-City. Par Lucien Rudaux. *With Diagram.*

Canada. ———

Dominion of Canada. Annual Report of the Department of Indian Affairs for the year ended June 30, 1905. Ottawa, 1906. Size 10 × 6½, pp. xxxvi., 452, and 168. *Illustrations.*

Canada—British Columbia. **Robertson.**

Windy Arm Mineral Locations in the Atlin Mining Division. By W. F. Robertson. (Provincial Bureau of Mines, Bulletin No. 1.) Victoria, B.C., 1905. Size 10½ × 7½. *Map.*

Canada—Historical. **Salone.**

Émile Salone. La colonisation de la Nouvelle-France. Étude sur les origines de la Nation Canadienne Française. Paris: E. Guilmoto, [*not dated*]. Size 9 × 5½, pp. xii. and 468. *Map. Price* 7.50 *fr.*

A well-written history of the beginnings of Canada under the French.

Canada—Selkirk Range. **Wheeler.**

The Selkirk Range. By A. O. Wheeler. Vol. 1. Ottawa, 1905. Size 9½ × 6½, pp. xvii. and 460. *Illustrations. Presented by the Author.* [To be reviewed.]

Canada—Treaties. *T. Hist. and So. S. Manitoba*, No. 66 (1905): pp. 12. **Laird.**

Our Indian Treaties. By Hon. David Laird.

Mexico—Mines. **Southworth.**

Las Minas de México (Edición ilustrada). Historia, Geologia, Antigua Mineria, y Descripción General de los Estados Mineros de la República Mexicana, En Español é Inglés. Tomo ix. Octubre, 1905. Publicado . . . por J. R. Southworth. Size 13 × 10½, pp. 260. *Illustrations. Two Copies, Presented by the Author and S. Hardman, Esq.*

United States. **Audubon.**

Audubon's Western Journal: 1849–1850. Being the MS. record of a trip from New York to Texas, and an overland journey through Mexico and Arizona to the goldfields of California. By John W. Audubon. With biographical memoir by his daughter, Maria R. Audubon. Introduction, notes, and index by Frank Heywood Hodder. Cleveland: The Arthur H. Clark Co., 1906. Size 10 × 6½, pp. 250. *Map, Portrait, and Illustrations. Price* $3 *net.*

Printed from an unpublished MS. The author, son of the great ornithologist, accompanied Colonel Webb on his expedition across the continent in the days of the gold fever.

United States. **Fordham and Ogg.**

Personal Narrative of Travels in Virginia, Maryland, Pennsylvania, Ohio, Indiana, Kentucky; and of a Residence in the Illinois Territory, 1817–1818, by Elias Pym Fordham. Edited by Frederic Austin Ogg. Cleveland: The Arthur H. Clark Co., 1906. Size 9½ × 6½, pp. 248. *Facsimile Sketches and Plans. Price* $3 *net.*

From a hitherto unpublished manuscript. It throws valuable light on the settlement of the lands beyond the Alleghanies in the early part of the nineteenth century.

United States—Adirondack Mts. *Popular Sci. Monthly* 68 (1906): 195–210. **Kemp.**

The Physiography of the Adirondacks. By Prof. J. F. Kemp. *With Illustrations.*

Noticed in the July number (p. 79).

United States—Altitudes. *B.U.S. Geol. Surv.*, No. 274 (1906): pp. 1072. **Gannett.**
A Dictionary of Altitudes in the United States (Fourth Edition). Compiled by Henry Gannett.

United States—Arizona. **Lindgren.**
The Copper Deposits of the Clifton-Morenci District, Arizona. By W. Lindgren. (U.S. Geological Survey, Professional Paper, No. 43.) Washington, 1905. Size 11½ × 9, pp. 376. *Maps and Illustrations. Presented by the U.S. Geological Survey.*

United States—California. ———
Preliminary Report of the State Earthquake Investigation Commission. Berkeley, 1906. Size 11 × 7½, pp. 20.

United States—Coal. **Bell.**
Coal Industry of the United States in 1904. Foreign Office, Miscellaneous, No. 643, 1906. Size 10 × 6½, pp. 62. *Price 3d.*

United States—Colorado. **Davis.**
B. Museum Comp. Zoology, Harvard Coll., Geol. Ser. 8 (1905): 1–12.
Glaciation of the Sawatch Range, Colorado. By W. M. Davis. *With Plate.*

United States—Colorado River. *B. American G.S.* 38 (1906): 1–16. **Macdougal.**
The Delta of the Rio Colorado. By D. T. Macdougal. *With Maps and Illustrations.*
See note in the Monthly Record, June number (p. 631).

United States—Geological Survey. **[Walcott.]**
Twenty-sixth Annual Report of the Director of the United States Geological Survey, 1904–5. Washington, 1905. Size 11½ × 8, pp. 322. *Maps.*

United States—Historical. **Lowery.**
The Spanish Settlements within the present limits of the United States, 1513–1561; Florida, 1562–1574. By Woodbury Lowery. New York and London: G. P. Putnam's Sons, 1901, 1905. Size 9½ × 6½, pp. xii. and 516, and xx. and 500. *Maps and Illustrations. Price 21s. net.*

The best history that has appeared on the early pioneer work of the Spanish in the United States.

United States—Historical. **Pittman and Hodder.**
The Present State of the European Settlements on the Mississippi, with a Geographical Description of that River illustrated by Plans and Draughts, by Captain Philip Pittman. An exact reprint of the original edition, London, 1770; edited, with Introduction, Notes, and Index, by Frank Heywood Hodder. Cleveland: The Arthur H. Clark Co., 1906. Size 9½ × 6½, pp. 166. *Facsimile Maps and Plans. Price $3 net.*

One of the many reprints of scarce works of travel, etc., which have appeared in America within the last few years. The author went out with the British troops sent to occupy and organize the portions of Louisiana ceded to England by the treaty of Paris, and his narrative is a valuable authority on occurrences during his five years' residence. All the original maps and plans are reproduced in facsimile.

CENTRAL AND SOUTH AMERICA.

Argentine Republic. **Martinez and Lewandowski.**
L'Argentine au XX^e^ Siècle. Par Albert B. Martinez et Maurice Lewandowski. Avec une Introduction par Charles Pellegrini. Paris: A. Colin, 1906. Size 7½ × 5, pp. xxxii. and 432. *Maps. Price 5 fr.*

A useful summary of facts concerning the Argentine, especial attention being devoted to economic resources.

Argentine Republic. *Deutsch. Rundschau G.* 28 (1906): 206–211. **Federicos.**
Die Quebracho-Waldungen in Argentinien und ihre Zukunft. Von G. L. Federicos.

Brazil and Columbia. *Z. Ges. E. Berlin* (1906): 80–101. **Koch.**
Bericht über seine Reisen am oberen Rio Negro und Yapurá in den Jahren 1903–1905. Von D. Theodor Koch-Grünberg. *With Map and Illustrations.*
Noticed in the May number (p. 505).

Central America and West Indies. **Sapper.**
Verh. 15. *Deutsch. Geographentages Danzig* (1905): 102–134.
Ergebnisse der neueren Untersuchungen über die jüngsten mittelamerikanischen und westindischen Vulkanausbrüche. Von Prof. Dr. K. Sapper.

Colombia—Volcanoes. **Stübel and Wolf.**
Die Vulkanberge von Colombia, geologisch-topographisch aufgenommen und beschrieben von Alphons Stübel. Nach dessen Tode ergänzt und herausgegeben von Theodor Wolf. Dresden: W. Baensch, 1906. Size 13 × 10, pp. 154. *Maps and Plates. Price* 20*m. Presented by the Publisher.* [To be reviewed.]

Columbia—Earthquake. *Nature* 73 (1906): 395. ———
The Columbian Earthquake.

Panama. **Pensa.**
La République et le Canal de Panama. Par Henri Pensa. Paris: Hachette & Cie., 1906. Size 10 × 6½, pp. 344. *Maps. Price* 7 *fr.* 50. *Presented by the Author.*

Paraguay. **Mangels.**
Wirtschaftliche, naturgeschichtliche und Klimatologische Abhandlungen aus Paraguay. Von H. Mangels. München: Dr. F. P. Datterer & Cie., 1904. Size 9¼ × 6, pp. viii. and 364. *Illustrations. Price* 5*s.* 3*d.*

A miscellaneous collection of studies largely bearing on the economic resources of Paraguay. They are of value in view of the scanty nature of the literature on that country.

West Indies. *T. Canadian I.* 7 (1902): 351–370. **Spencer.**
The Windward Islands of the West Indies. By J. W. Spencer. *With Maps and Illustrations.*

AUSTRALASIA AND PACIFIC ISLANDS.

Bering Sea—Seal Islands. **Stejneger.**
Norske G.S. Aarbog 16, 1904–1905 (1905): 128–136.
Fra mine reiser til Sælφerne i Beringshavet. Af Leonard Stejneger.

Hawaii. *Jahresb. G. Ges. Bern* 19, 1903–4 (1905): 79–99. **Volz.**
Eine Reise auf den Sandwich-Inseln. Vortrag von Dr. Walter Volz.

New Guinea—Dutch. *Ts. K. Ned. Aard. G. Amsterdam* 23 (1906): 320–331. **Ruys.**
Bezoek aan den Kannibalenstam van Noord Nieuw-Guinea. Door Th. H. Ruys.

New Zealand. ———
Statistics of the Colony of New Zealand, 1904. 2 vols. Wellington, 1905. Size 13½ × 8½, pp. xvi. and 640.

Samoa—Eruption. *Deutsch. Kolonialblatt* 17 (1906): 143. **Williams.**
Bericht des Amtmanns Williams über den Ausbruch des Vulkans auf Sawaii. *With Sketch-map.*

Samoa—Eruption. *Koloniale Z.* 7 (1906): 150–152. ———
Bericht über eine Reise nach Savaii zur Besichtigung des dortigen, im August 1905 entstandenen Vulkans. Von G. S.

Cf. note in the *Journal* for December, 1905, p. 675.

South Australia. **Gill.**
The History and Topography of Glen Osmond. By Thomas Gill. Adelaide, 1905. Size 9 × 6, pp. vi. and 162. *Illustrations.*

South Australia. **Gregory.**
The Dead Heart of Australia. A Journey around Lake Eyre in the Summer of 1901–1902, with some account of the Lake Eyre Basin and the Flowing Wells of Central Australia. By J. W. Gregory, F.R.S., D.SC. London: John Murray, 1906. Size 9 × 6, pp. xvi. and 384. *Maps and Illustrations. Price* 16*s. net. Presented by the Publisher.* [To be reviewed.]

POLAR REGIONS.

Antarctic. *M.G. Ges. München* 1 (1905): 491–494. **Drygalski.**
Die Antarktis. Von Prof. Dr. E. von Drygalski.

Antarctic—Flora. *C. Rd.* 142 (1906): 456–458. **Cardot.**
Note sur la végétation bryologique de l'Antarctide. Note de J. Cardot.

Antarctic—German Expedition. **Drygalski and Others.**
Verh. 15. *Deutsch. Geographentages Danzig* (1905): 3–64.

Allgemeiner Bericht über die Arbeiten der Deutschen Südpolar-Expedition und deren Verwertung. Von Prof. Dr. Erich von Drygalski. Einige zoogeographische Ergebnisse der Deutschen Südpolar-Expedition. Von Prof. Dr. E. Vanhöffen. Mitteilungen über das Vorkommen und die Tätigkeit der Bakterien im Meer. Von Dr. H. Gazert. Ueber Grundproben und geologisch-petrographische Arbeiten der Expedition. Von Dr. E. Philippi. Ueber die Windverhältnisse an der Winterstation des *Gauss*. Von Dr. Wilh. Meinardus. Erdmagnetische Probleme und die Deutsche Südpolar-Expedition. Von Dr. Fr. Bidlingmaier. Die erdmagnetischen Arbeiten auf der Kerguelen-Station. Von Dr. K. Luyken. *With Map and Diagrams.*

Antarctic—Wilkes Land. *B. American G.S.* **38** (1906): 30–32. **Balch.**

Wilkes Land. By E. S. Balch.

The writer contests the views of Captain Scott in regard to Wilkes Land.

Arctic—Russian Expedition. **Toll.**
B.A. Imp. Sc. St. Petersburg, Classe phys.-math. **18** (1903): 65–94; **20** (1904): 55–66, 149–194.

Rapports sur les travaux de l'expedition Polaire Russe dirigée par le Baron Toll; iv.–v.; vi.; vii.–ix. *With Map and Plates.* [In Russian.]

Polar Regions. **Arctowski.**

Projet d'une Exploration Systématique des Régions Polaires. Par Henryk Arctowski. Bruxelles, 1905. Size 9 × 6, pp. 26.

MATHEMATICAL GEOGRAPHY.

Latitude. *Riv. G. Italiana* **12** (1905): 509–515. **Loperfido.**

Misura della latitudine geografica col metodo dei passaggi in meridiano di stelle fondamentali. Nota del A. Loperfido.

Longitude Determinations. **Christie.**

Royal Observatory, Greenwich: Telegraphic Determinations of Longitude made in the years 1888 to 1902. Under the direction of Sir W. H. M. Christie, K.C.B., Astronomer-Royal, Edinburgh. London: Wyman & Sons, 1906. Size 13 × 10, pp. viii., 324, and 188. *Plans and Diagrams. Price* 15*s. Presented by the Astronomer-Royal.*

Orientation. *G.Z.* **12** (1906): 101–105. **Peucker.**

Möllers "Orientierung nach dem Schatten," Die Taschenuhr als Kompass. Von Karl Peucker. *With Illustrations. Also separate copy presented by the Author.*

Surveying. *C. Rd.* **142** (1906): 421–424. **Hatt.**

Détermination simultanée de deux points au moyen des constructions graphiques à grande échelle. Note de — Hatt.

Surveying. **Lea.**

Hydrographic Surveying: Methods, Tables, and Forms of Notes. By S. H. Lea. New York: The Engineering News Publishing Co., 1905. Size 9½ × 6¼, pp. 172 and viii. *Chart and Illustrations. Price* 8*s. net. Presented by the Publishers.*

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Geological History. *Ymer* (1906): 93–101. **Thoroddsen.**

Endnu nogle Ord om Landbro-Hypotesen. Af Th. Thoroddsen.

On the question of a post-glacial land-connection between Europe and America.

Geology. *Riv. G. Italiana* **12** (1905): 542-552. **Dainelli.**

Le ultime idee intorno alle falde di ricoprimento. G. Dainelli.

Geology. **Chamberlin and Salisbury.**

Geology: Earth History. By Thomas C. Chamberlin and Rollin D. Salisbury. Vols. 2 and 3. London: John Murray, 1906. Size 9 × 6, pp. (vol. 2) xxvi. and 692; (vol. 3) xii. and 624. *Maps and Illustrations. Price (each vol.)* 21*s. net. Presented by the Publisher.*

Geomorphology—Valley Formation. **Reusch.**
Norske G.S. Aarbog. 16, 1904–1905 (1905): 71–75.
En liden dal under dannelse. Af dr. Hans Reusch. *With Illustrations.*

Geophysics. *B.S. Belge Géol.* 19 (1905): 204–215. **Simoens.**
A propos d'une récente tentative de comparaison entre la constitution interne de la Terre et celle de la Lune. Par G. Simoens.

Gravity. *An. S. Ci. Argentina* 60 (1905): 280–301. **Alessio.**
Relazione sulla determinazione della gravità relativa fra La Plata (Osservatorio) e Padova (Regio Osservatorio). Eseguita dal Dottore Alberto Alessio.

Hydrology—Springs. *Popular Sc. Monthly* 67 (1905): 673–683. **Hitchcock.**
Fresh-water Springs in the Ocean. By Prof. C. H. Hitchcock. *With Map and Illustrations.*

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Commercial—Cocoa. *Monthly B. Int. Bureau Amer. Republ.* 22 (1906): 812–818. ———
World's Cocoa Crops and Consumption, 1901–1904.

Ethnology—Eskimo. *Norske G.S. Aarbog* 16, 1904–1905 (1905): 42–54. **Rasmussen.**
En Folkevandring. Af Knud Rasmussen.

Historical—Drake's Voyage. **Evans.**
The Silver Medal or Map of Sir Francis Drake. By Sir John Evans. (Reprinted from the *Numismatic Chronicle*, Fourth Series, vol. 6.) London, 1906. Size 8½ × 5½, pp. 14. *Plate. Presented by the Author.*

The writer makes use of Mr. Miller Christy's book and other descriptions of the medal.

Historical—Early Travels. **Purchas.**
Hakluytus Posthumus or Purchas His Pilgrimes. By Samuel Purchas, B.D. Vols. 11 and 12. Glasgow: J. MacLehose & Sons, 1906. Size 9 × 6, pp. (vol. 11) xvi. and 650; (vol. 12) xviii. and 634. *Maps. Price* 12*s.* 6*d. net per vol. Presented by the Publishers.*

These volumes include travels to Russia and Eastern Asia from Rubruk to the Jesuits in China.

Historical—Magellan's Voyage. **Pigafetta and Robertson.**
Magellan's Voyage around the World, by Antonio Pigafetta. The original text of the Ambrosian MS., with English translation, notes, bibliography, and index, by James Alexander Robertson. 2 vols., and index. Cleveland, U.S.A.: The Arthur H. Clark Co., 1906. Size 10 × 6½, pp. (vol. 1) 274; (vol. 2) 314; (index) 88. *Portrait, Facsimile-maps, and Illustrations. Price* 31*s.* 6*d. net.* [To be reviewed.]

History of Geology. **Geikie.**
The Founders of Geology. By Sir Archibald Geikie, F.R.S. Second Edition. London: Macmillan & Co., 1905. Size 9½ × 6, pp. xii. and 486. *Price* 10*s. net. Presented by the Publishers.*

An extension of the lectures on the same subject published in 1897, supplying a masterly sketch of the foundation and development of geological science.

GENERAL.

British Empire—Census. ———
Census of the British Empire, 1901. Report with Summary and Detailed Tables for the several Colonies, etc., Area, Houses, and Population; also Population classified by Ages, condition as to Marriage, Occupations, Birthplaces, Religions, Degrees of Education, and Infirmities. London, 1906. Size 13 × 8½, pp. lxiv. and 302. *Map. Price* 3*s.* 5*d. Presented.*

The total area is given as 11,908,378 square miles, and the population as 398,401,704 (about April 1, 1901). The estimate of area for African possessions seems of doubtful accuracy both in the aggregate and in its constituent parts, many of the figures being far in excess of Supan's (*Journal*, September, 1904, p. 351).

Educational. **L'Estrange.**
A Progressive Course of Comparative Geography on the Concentric System. By P. H. L'Estrange. London: G. Philip & Son, 1906. Size 11½ × 9, pp. xii. and 148. *Maps and Illustrations. Presented by the Publishers.* [To be reviewed.]

Hints to Travellers. **Neumayer.**

Anleitung zu wissenschaftlichen Beobachtungen auf Reisen . . . herausgegeben von Dr. G. von Neumayer. 3 Aufl. 2 vols. Hanover: Dr. M. Jänecke, 1906. Size 9 × 6, pp. (vol. 1.) xxiv. and 842, (vol. 2) xvi. and 880. *Map and Illustrations. Price (vol. 1) 25m., (vol. 2) 24m. Presented by the Publisher.* [To be reviewed.]

Hints to Travellers. **Reeves.**

Hints to Travellers, Scientific and General. Edited for the Council of the Royal Geographical Society by E. A. Reeves. Ninth edition. 2 vols. Vol 1, Surveying and Practical Astronomy. Vol. 2, Meteorology, Photography, Geology, Natural History, Anthropology, Industry and Commerce, Archæology, Medical, etc. London: the Royal Geographical Society, 1906. Size 7 × 5, pp. (vol. 1) xii. and 470, (vol. 2) viii. and 286. *Maps, Diagrams, and Illustrations. Price 15s. net.*

The work has been largely re-written, especially vol. 1, which has been adapted by Mr. Reeves to modern requirements in the matter of more precise surveys.

Hints to Travellers. **Stewart.**

Active Service Pocket Book. By Lieut. Bertrand Stewart. London: Gale & Polden, 1906. Size 5½ × 4½, pp. xvi. and 426. *Illustrations. Presented by the Author.*

Contains many hints likely to be of use to travellers in general as well as military officers.

World. **Moncrieff.**

The World of To-day. By A. R. Hope Moncrieff. Vol. 5. London: The Gresham Publishing Co., 1906. Size 11 × 7½, pp. viii. and 266. *Maps and Illustrations. Price 8s. net. Presented by the Publishers.*

Year-Book. **Haack.**

Geographen-Kalender . . . herausgegeben von Dr. H. Haack. Vierter Jahrgang. 1906–1907. Gotha: Justus Perthes, 1906. Size 6½ × 4½, pp. xii. and 664. *Portrait and Maps.*

A new feature this year is the very complete directory of Societies and Public Institutions in any way concerning geography. The maps illustrate, as usual, the chief political events and explorations of the year.

Year-Book. **Keltie and Renwick.**

The Statesman's Year-Book, 1906. Edited by Dr. J. Scott Keltie, with the assistance of I. P. A. Renwick. London: Macmillan & Co., 1906. Size 7½ × 5, pp. lxiv. and 1604. *Maps and Diagram. Price 10s. 6d. net. Presented by the Publishers.*

There are considerable additions to the subject-matter in this edition, principally as regards the United States, as well as other important new features. The maps and diagrams, besides illustrating the leading events of the year as regards political geography, show in particular the main economic features of the United States, and the average tariffs of the countries of the world. An ethnological map of Russia, by M. Aitoff, is published by permission of MM. Colin & Co.

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Uebersichtskarte von Mitteleuropa. Bearbeitet in der Kartogr. Abteilung der Kgl. Preuss. Landesaufnahme. Scale 1 : 300,000 or 1 inch to 4·7 stat. miles. Sheets: Berlin; Stralsund. Berlin: K. Preussische Landesaufnahme, 1905. *Price* 1.50 *mark each sheet.*

Iceland. **Thoroddsen.**

Geologische Karte von Island. Von Th. Thoroddsen. Scale 1 : 750,000 or 1 inch to 11·8 stat. miles. *Petermanns Mitteilungen,* Ergänzungsheft, Nr. 153, Tafel 2. Gotha: Justus Perthes, 1906. *Presented by the Publisher.*

A general geological map of Iceland to accompany the second part of Dr. Thoroddsen's account of the structure of the island forming Ergänzungsheft, Nr. 153 of *Petermanns Mitteilungen.*

Portugal. **Serviço do Estado Maior, Lisbon.**

Carta Itineraria do Portugal. Scale 1 : 250,000 or 1 inch to 3·9 stat. miles. Sheets 6–12. Lisbon: Serviço do Estado Maior, 1903–1905.

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ASIA.

Dutch East Indies. **Stemfoort and Siethoff.**

Atlas der Nederlandsche Bezittingen in Oost-Indië, naar de neiws Cronnen samengesteld en aan de regeering opgedrägen door J. W. Stemfoort en J. J. ten Siethoff, Kapiteins van den Generalen staf van het Nederlandsch-Indisch leger. Gereproduceerd, op last van het Departement van Koloniën, aan de Topographische Inrichting te 's Gravenhage, onder leiding van den Directeur C. A. Eckstein. Sheet 5 (new edition), Oost-Java. Scale 1 : 500,000 or 1 inch to 7·9 stat. miles. The Hague : Topographische Inrichting, 1906.

Indian Government Surveys. **Surveyor-General of India.**

Indian Atlas, 1 inch to 4 miles. Sheets : 5 S.E., parts of districts Bannu and Dera Ismail Khan (Punjab), additions to 1905. 16 S.E., parts of districts Dera Ismail Khan, Dera Ghazi Khan, Mianwali, Montgomery, Shahpur, Muzaffargarh, and Jhang (Punjab), additions to 1900. 21 N.E., parts of Udaipur, Jodhpur and Sirohi (Rajputana Agency), and of Idar, Danta, and Palanpur, Native States (Bombay Presidency), additions to 1902. 40 S.W., parts of districts Belgaum, Ratnagiri, and Satara, Native States of Kolhapur and Southern Maratha and Satara Agencies (Bombay Presidency), additions to 1903. 40 S.E., parts of districts Belgaum, Bijapur, Satara, and Sholapur, and States of Kolhapur and Southern Maratha and Satara Agencies (Bombay Presidency), 1905. 41 S.W., parts of districts Belgaum and Kanara, Savantvadi State, and Kolhapur and Southern Maratha Agency (Bombay Presidency), and of Goa (Portuguese Territory), 1905. 49 S.E., parts of districts Gurgaon and Delhi (Punjab), Meerut, Bulandshahr, Muttra, Aligarh, and Moradabad (U.P. of Agra and Oudh), additions to 1904. 50 N.E., parts of districts Agra, Aligarh, Etah, Muttra (U.P. of Agra and Oudh), and Gurgaon (Punjab), and States Alwar and Bharatpur (Rajputana Agency), additions to 1904. 90 N.W., parts of districts Mandla and Bilaspur (C.P.), States of Rewah (C.I. Agency) and Chang Bhakar (Bengal), additions to 1905.—India and adjacent countries, scale 1 : 1,000,000. Sheets : 87, parts of the Andaman and Nicobar Islands, 1905. 92, parts of Assam, Burma, and China (Yun-nun Province), 1905. 95 and 96 (provisional issue), parts of Burma and Siam, 1905. 100 (provisional issue), parts of Tibet and China (Yunnan and Sechuan Provinces), 1905.—Mysore, 1 inch to 16 miles, additions to 1905.—Mysore and Coorg, 1 inch to 16 miles, additions to 1905.—Assam, 1 inch to 32 miles, additions and corrections to 1905.—Lalitpur subdivision, Jhansi District, 1 inch to 5 miles, 1905.—United Provinces of Agra and Oudh, 1 inch to 8 miles : Allahabad district, corrected to 1905 ; Faukhabad district, corrected to 1905.—Bengal, 1 inch to 8 miles : Darjeeling district, corrected to 1901 ; Noakhali, corrected to 1903.—Map of the country 10 miles round Calcutta (Fort William), 1 inch to a mile, additions to railways to 1903.—Northern Frontier Survey, 1 inch to 4 miles. Sheets : 9 N.E., 14 N.W., S.W., S.E., 15 N.E., 21 S.W., 22 N.W., N.E., S.E., Tibet, Season 1904-05, 1905.—North-Western Trans-Frontier Survey, 1 inch to 2 miles. Sheets : (Third edition), 432, parts of Afghanistan, Mohmand Country, Dir and Swat Agency, and district Peshawar (N.W.F. Province). Seasons 1863–98, 1904. 459, parts of districts Dera Ghazi Khan, Mianwali, Muzaffargarh, and Derajat Frontier, Seasons 1884–85, 1887–88–96, additions to boundaries to 1903.—North-Eastern Frontier Survey, 1 inch to 4 miles. Sheets: 6 N.W., N.E., S.W., S.E., Tibet, Season 1904–05, 1905. 7 N.W., Tibet (Chumbi Valley only), Season 1904–05, 1905.—South-Western Asia, 1 inch to 4 miles. Sheet 73 S.E., part of Persia (Fars) 1905.—South-Western Asia Survey, 1 inch to 8 miles. Sheet (3rd edition) 73, parts of Persia and Arabia, 1905.—Assam Survey, 1 inch to a mile. Sheet 29, parts of districts Garo Hills, Kamrup and Khasi, and Jaintia Hills (Assam), Season 1866–69, additions and corrections to 1903, 1905.—Bengal Survey, 1 inch to a mile. Sheets: 186 (2nd edition), parts of district Singhbhum and Mayurbhanja State, Seasons 1859–61, 1863–64, 1905; 422 (preliminary edition) and 423, district Chittagong, Season 1888–93, 1904.—Hyderabad Survey, 1 inch to 2 miles. Sheets 100, 101, 124, and 125, part of Koyalkanda Circar (Nizam's Dominions), Seasons 1821, 1824, 1825, 1829, 1830, 1833, 1901.—Bombay Survey, 1 inch to a mile. Sheets : 121, parts of district Ahmedabad, Baroda State, and Mahi Kantha Agency, Season 1877–78, additions to railways to July, 1903, 1905. 155, parts of district Surat, Baroda State, and Rewa Kantha Agency, Seasons 1879–81, additions and corrections to

1899, 1905. 181, parts of the Panch Mahals district and of the Rewa Kantha Agency, Seasons 1882-83, 1883-84, additions to railways to March, 1904. 231, parts of districts Poona and Ahmednagar, Season 1878-79, additions and corrections to boundaries to December, 1904, 1905. 236, part of district Satara, Season 1876-77, additions to roads and railways to April, 1892, 1905. 337, parts of districts, Dharwar (Bombay), Shimoga and Chitaldroog (Mysore), Seasons 1882-83, 1893-94, corrected to October, 1903, 1905.—Burma Survey, 1 inch to a mile. Sheets: 163 (3rd edition), parts of districts Henzada, Prome, and Tharrawaddy, Seasons 1882-85, 1898-99, 1901-02, 1905. 543, part of district Mergui, Season 1891-92, additions to boundaries to 1905.—Central India and Rajputana Survey, 1 inch to a mile. Sheets: 213, parts of States Gwalior, Jhabua, Rajpur Ali, Jobat, and Indore (C.I. Agency), Season 1879-80, additions and corrections to 1903, 1905. 245, parts of States Gwalior and Dhar (C.I. Agency), Season 1878-79, additions and corrections to September 1903, 1905; 269, parts of States Gwalior, Indore (C.I. Agency), Udaipur, Jhalawar and Kotah (Rajputana Agency), Seasons 1873-79, additions and corrections to 1903, 1905; 300, parts of States Gwalior, Indore, Khilchipur and Tonk (C.I. Agency), Jhalawar and Kotah (Rajputana Agency), Season 1873-74, additions to 1905. 303, parts of States Gwalior, Indore, Dhar, and Dewas (C.I. Agency), Season 1877-78, additions and corrections to 1904, 1905. 388 (2nd edition), parts of States Gwalior and Khaniadhana (C.I. Agency), and district Jhansi (United Provinces), Seasons 1859-61, 1869-71, 1895-96, 1897, 1905; 390 (2nd edition), parts of Gwalior State (C.I. Agency), Saugor District (C.P.), and Jhansi District (U.P.), Seasons 1856-57, 1864-65, 1870-72, 1895-96, 1905. 401 (2nd edition), parts of districts Jalaun and Jhansi (U.P.), and States of Gwalior, Indore, and Datia (C.I. Agency), Seasons 1852-61, 1862-63, 1888-90, 1905; 402 (2nd edition), parts of Datia, Samthar, and Orchha States (Bundelkhand, C.I. Agency) and district Jhansi (U.P.), Seasons 1862-63, 1888-90, 1905.—Madras Survey, 1 inch to a mile. Sheets: 44, parts of districts Chitaldroog and Shimoga (Mysore), Season 1881-82, additions and corrections to 1904, 1905. 71, parts of districts Chitaldroog and Tumkur (Mysore) and Bellary (Madras), Season 1881-82, additions and corrections to 1903, 1905.—Punjab Survey, 1 inch to a mile. Sheets: 81 (2nd edition) parts of districts Peshawar and Kohat, Khyber Agency (N.W. Frontier Province), and Attock (Punjab), Seasons 1877-78, 1881-83, 1900, 1905. 96, part of district Multan, Season 1903-04, 1905. 97, parts of district Multan and Bahawalpur State, Season 1902-04, 1905. 174 (preliminary edition), part of district Montgomery (Bari Doab), Season 1902-03, 1905. 194 and 207 (preliminary edition), part of district Lahore (Rechna Doab), Season 1902-03, 1905. 222, parts of districts Lahore and Amritsar (Bari Doab), Season 1902-03, 1905. 306, district Kangra (Kullu subdivision), Seasons 1896-97, 1900-01, 1905.—Sind Survey, ½ inch to a mile. Sheets: 81, 82, 99, and 100, district Sukkur and Khairpur State, Season 1901-03, 1905. 83, 84, 101, and 102, Khairpur State, Season 1901-02, 1905; 112 and 113, district Sukkur, Season 1902-03, 1905.—Sind Survey, 1 inch to a mile. Sheets: 7, district Larkhana, Season 1901-02, 1905. 60, districts Larkhana and Sukkur and Khairpur State, Seasons 1892-93, 1900-01, 1905.—United Provinces Survey, 1 inch to a mile. Sheets: 41 (2nd edition), parts of States Gwalior, Khaniadhana, and Orchha (C.I. Agency), and district Jhansi (U.P. Agra and Oudh), Seasons 1856-57, 1868-70, 1888-90, 1895-96, 1905. 42, parts of States Gwalior and Khaniadhana (C.I. Agency) and district Jhansi (U.P.), Seasons 1859-61, 1869-71, 1895-96, 1897, 1905. 44, parts of Gwalior State (C.I. Agency), Saugor district (C.P.) and Jhansi district (U.P.), Seasons 1856-57, 1864-65, 1870-72, 1895-96, 1905. 56a (2nd edition), parts of districts Jalaun and Jhansi (U.P.), and States of Gwalior, Indore, and Datia (C.I. Agency), Seasons 1852-61, 1862-63, 1888-90, 1905. 57 (2nd edition), parts of Datia, Samthar and Orchha States (Bundelkhand, C.I. Agency), and district Jhansi (U.P.), Seasons 1862-63, 1888-90, 1905. 60 (preliminary edition), district Jhansi, Season 1895-97, 1904.—Assam. Index map showing scales of publication, scale 1 inch to 50 miles. *Presented by the Secretary of State for India through India Office.*

AFRICA.

Egypt. **Survey Department, Cairo.**

Map of Girga Town. Scale 1 : 1000 or 63·4 inches to a stat. mile. 6 sheets. Cairo: Survey Department, 1905. *Presented by the Director-General, Survey Department, Cairo.*

German East Africa. **Van der Burgt.**

Originalkarte der Route von Mwansa nach Uschirombo in Deutsch-Ostafrika, 1903. Von J. M. M. van der Burgt. Scale 1 : 200,000 or 1 inch to 3·2 stat. miles.

Petermanns Mitteilungen, Jahrgang 1906, Tafel 10. Gotha: Justus Perthes, 1906. *Presented by the Publisher.*

AMERICA.

Brazil. **International Bureau of the American Republics.**

Brazil from official and other sources. Prepared in the International Bureau of the American Republics; Williams C. Fox, Director. Scale 1 : 4,752,000 or 1 inch to 75 stat. miles. Washington: International Bureau of the American Republics, 1905. *Presented by the International Bureau of the American Republics.*

The commercial maps to which series this belongs accompany the reports published by the U.S. International Bureau of American Republics. They are all similar in style, and contain much useful information, specially concerning means of communication, navigability of rivers, mining districts, etc. The present is a general map of Brazil, printed in colours, with the special information shown by various clearly defined symbols. The extreme points to which the principal rivers are navigable are shown by letters, and in cases where the river is not navigable from its mouth, the point at which navigation begins is also shown. In appearance the map is decidedly rough, but the information contained is valuable.

Brazil—Minas Geraes. **Chrockatt de Sá and Thompson.**

Mappa do Estado de Minas Geraes contendo os do Rio de Janeiro, Espirito Santo e S. Paulo. Organisado por J. Chrockatt de Sá com a collaboração de Eduardo A. G. Thompson. Scale 1 : 1,000,000 or 1 inch to 15·8 stat. miles. Rio de Janeiro: Laemmert e Cia, [1905].

This map has been compiled from documents furnished by the Brazilian Ministries of the Interior, Marine and Agriculture, and Public Works, in addition to many other sources of information, including the various mining departments and officials of the country. Much of the area it represents is very imperfectly known, especially in the northern and western parts of the map, and a great many of the river courses and mountain ranges, as laid down, can only be taken as approximate. It is a large map, measuring 45 by 56 inches.

A special plan is given, as an inset, of the mining centre of Ouro-Preto.

Canada. **Dept. of the Interior, Ottawa.**

Sectional map of Canada. Scale 1 : 190,080 or 1 inch to 3 stat. miles. Sheet 23, Emerson, revised to January 16, 1906. Ottawa: Department of the Interior, Topographical Surveys Branch, 1906. *Presented by the Canadian Department of the Interior.*

Chile. **Petermanns Geographische Mitteilungen.**

Die Skyring- und Otway-Buchten an der Magalhães Strasse. Nach den Aufnahmen der Chilenischen Marine im Jahre 1904. Scale 1 : 750,000 or 1 inch to 11·8 stat. miles. *Petermanns Mitteilungen*, Jahrgang, 1906, Tafel 11. Gotha: Justus Perthes, 1906. *Presented by the Publisher.*

AUSTRALIA.

Queensland. **Surveyor-General, Queensland.**

Queensland. Scale 1 : 2,534,400 or 1 inch to 40 stat. miles. Brisbane: Survey Office, Department of Public Lands, 1906. *Presented by the Surveyor-General of Queensland.*

A general map of Queensland in black and white only, showing, amongst other information, main tracks and roads, railway and telegraph lines, Government artesian bores, Government banks, and pastoral stations.

GENERAL.

World. **Bartholomew.**

Atlas of the World's Commerce. A new series of maps, with descriptive text and diagrams, showing products, imports, commercial conditions, and economic statistics of the countries of the world. Compiled from the latest official returns at the Edinburgh Geographical Institute, and edited by J. G. Bartholomew, F.R.S.E., F.R.G.S. Part v. London: George Newnes Limited, [1906]. *Price 6d. net each part. Presented by the Publisher.*

This part contains the following plates of maps and diagrams, with the usual accompanying text: (113) Wool supply; (114, 115) Wool-growing countries; (116) Wool statistics; (129) Steel production; (130, 131) Coal-mining countries; (132) Coal supply. There is also the usual continuation of the list of commodities of commerce, which extends, in this case, from "gutta-percha" to "leather."

World. **Stieler.**

Neunten, von Grund aus neubearbeiteten und neugestochenen Auflage von Stielers Hand-Atlas. 100 Karten auf 200 Seiten mit 162 Nebenkarten in Kupferstich und einem alphabetischen Verzeichnis aller im Atlas vorkommenden Namen (ungefähr 240,000 Namen enthaltend) herausgegeben von Justus Perthes' Geographischer Anstalt in Gotha. Lieferungen 2-8. Gotha: Justus Perthes, 1906. *Price* 60 *pf. each part.*

CHARTS.

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

Charts and Plans published by the Hydrographic Department, Admiralty, during May, 1906. *Presented by the Hydrographer, Admiralty.*

No.	Inches.	
3568 m =	1·5	North sea, Germany:—Lister deep. 2*s.*
3524 m =	1·4	Norway:—Tiötta to Dönna (outer approaches), including Husvær and Gaasvær fiords. 3*s.*
3529 m =	1·4	Norway:—Tiötta to Dönna (inner fiords), including Vefsin and Leir fiords. 3*s.*
3556 m =	1·4	Norway:—Lyngvær to Varholmen. 3*s.*
2117 m =	0·52	Germany:—Kiel bay. 3*s.*
2478 m =	{0·49, 2·25}	Africa, west coast. Manna river to Junk river. Plans:—Cape Mount bay, Monrovia bay. 3*s.*
2455 m =	2·5	Bay of Bengal, Andaman islands:—Stewart sound. 3*s.*
1767 m =	2·0	China, east coast:—Approaches to Amoy harbour. 5*s.*
3554 m =	1·0	China, north-east coast:—Tau Tsui head to Shitau bay. 4*s.*
2815 m =	{5·97, 12·0}	Japan, Nagasaki harbour. Plan:—Approach to Mitsubishi dockyard. 2*s.*
627		Africa, west coast. St. Paul de Loanda to Great Fish bay. Plan added:—Farta bay.
2284 m =	1·45	Plans of anchorages on the west coast of Sumatra. New plan:—Sinabang bay.
1239 m =	4·5	New Guinea, Hall sound. Vari Vari anchorage. Plan added:—Fyfe bay.

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

Charts Cancelled

No.	Cancelled by	No.
2117 Germany. Kiel bay, Als sound.	New chart. Kiel bay	2117
1363 Africa, west coast. Sherbro island to Cape Mesurado. Plan on this sheet:—Cape Mount river. 1364 Africa, west coast. Cape Mesurado to Baffu bay. Plan on this sheet:—Monrovia bay.	New chart. Manna river to Junk river. Plans:—Cape Mount bay, Monrovia bay	2478
1767 China, east coast. Amoy harbour and approaches.	New chart. Approaches to Amoy harbour	1767
1156 Plans on the north coast of China:—Cochran landing.	New chart. Tau Tsui head to Shitau bay	3554
2415 Japan. Approach to Nagasaki harbour. Plan on this sheet:—Approach to dry dock. 2815 Japan. Nagasaki harbour.	New chart. Nagasaki harbour. Plan:—Approach to Mitsubishi dockyard	2815

Charts that have received Important Corrections.

No. 1872, North sea:—Calais to the river Schelde entrance. 1128, Sardinia:—Ports in Sardinia, Ports Conte and Alghero, Port Alghero, Port Torres, Gulf of Oristano, Arbatax road. 3119, Africa, north coast:—Alexandria harbour. 566, Iceland:—Eastern portion. 2978, Iceland:—Sigle fiord to Niardvig. 19, South America, east coast:—Santos harbour. 887, South America, Magellan strait:—English, Crooked, Long, and Sea reaches. 631, Chile:—Smyth channel from south entrance to Fortune bay. 704, Madagascar:—Nosi Shaba to Moramba bay, including Narendri bay. 2577, Philippine islands:—Between St. Bernadino and Mindoro straits. 2987, Philippine islands:—San Pedro bay to Libukan islands, including Juanico strait. 2454, Philippine islands:—Northern portion of the island of Luzon, with Bashi and Balintang channels. 1477, New Guinea:—Jomard island to Yeina island, including Misima, Deboyne, and Renard islands. 2528, New Zealand, sheet iv.:—Poverty bay to Cape Palliser.

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

Indian Ocean and Red Sea. **Meteorological Office.**

Pilot Chart of the Indian Ocean north of 15° S. lat. and Red Sea for July, 1906. London: Meteorological Office, 1906. *Price 6d. Presented by the Meteorological Office.*

North Atlantic and Mediterranean. **Meteorological Office.**

Pilot Chart of the North Atlantic and Mediterranean for July, 1906. London: Meteorological Office, 1906. *Price 6d. Presented by the Meteorological Office.*

North Pacific. **U.S. Hydrographic Office.**

Pilot Chart of the North Pacific Ocean for July, 1906. Washington: U.S. Hydrographic Office, 1906. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Bombay Presidency. **Varley.**

Seven photographs of the Bombay Presidency, taken by F. J. Varley, Esq., M.A. *Presented by F. J. Varley, Esq., M.A.*

Further contributions to the Society's photographs of India by Mr. Varley, who has already presented many others. The views of the rock temples are worthy of special attention.

(1) Rock temple at Harischandagad, Ahmednagar district; (2) Peak of Harischandagad; (3) Temple on Western Ghats; (4) Forest scene in North Kanara; (5) Temple on the Godaveri, Nasik; (6) Rath or processional car; (7) Fort gates, Sendwa, Holkars' territory.

East Africa. **Behrens.**

Forty photographs taken by Lieut. T. T. Behrens, R.E., on the Anglo-German Boundary Survey in East Africa. *Presented by Lieut. T. T. Behrens, R.E.*

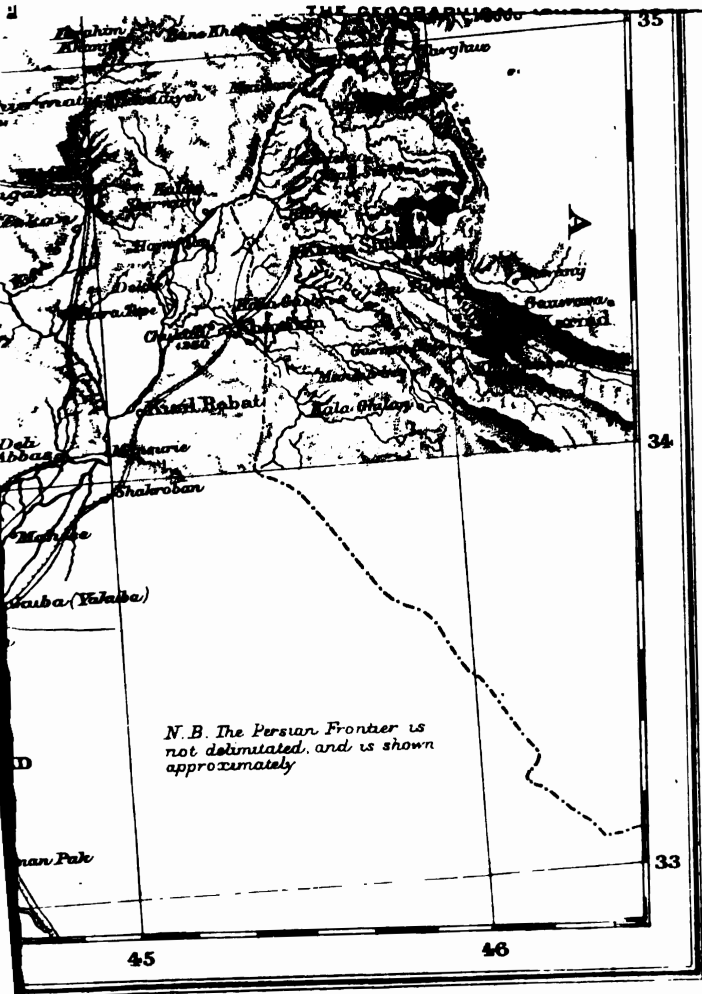
Lieut. Behrens was one of the British members of the Anglo-German Commission for delimiting the boundary between British and German East Africa. During his stay in the country he took many interesting photographs, copies of which he has presented to the Society. Some of them are extremely good, and the subjects are well selected.

(1) Panorama of Lake Jipe; (2) Lolgorossien mountains from Mbarai; (3) Mbarai and Lolgorossien mountains; (4) Transport donkeys, Mbarai; (5) Langara Loriga from foot of Kilimanjaro; (6) Ford, Tsavo river; (7) Source of the Tsavo river; (8) Tsavo river; (9) Dum palms and thorn bush, Tsavo river; (10) Ongelea hills; (11) Masai men and boys; (12) Young Masai men; (13) Masai children; (14–16) Fixing beehive to Baobab tree, Taveta; (17) Wateita porters; (18) Chala lake; (19) Rufu river; (20) Native garden in the Rufu swamp; (21) In the Pare hills; (22) Schagein in the Usambara hills; (23) Forest in the Usambara hills; (24) View from Schagein towards Jipe; (25) View east from Schagein; (26) Camp under the forest, north side of Kilimanjaro; (27) A typical grass fire; (28 and 29) Kilimanjaro from the north-west; (30) Kilimanjaro from the north; (31) Kilimanjaro from the north at sunset; (32) Oldonyu Rok; (33) Melawoni; (34) Kibo from Endoinet; (35) Kimawenzi from Endoinet; (36) Kilimanjaro from the north-east; (37) Kibo and Kimawenzi from the north-east; (38) Kibo and Kimawenzi from Naduyatui; (39) Kimawenzi and "Terminal" beacon from Laitokitok; (40) Kibo from Taveta.

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.

TURKEY IN ASIA

MAUNSELL



The

Geographical Journal.

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RECENT SURVEY AND EXPLORATION IN SEISTAN.*

By Colonel Sir HENRY McMAHON, K.C.I.E., C.S.I.

I had the honour of addressing this Society exactly nine years ago, when I read a paper on "The Southern Borderlands of Afghanistan." † That paper described the geographical work of the Baluch-Afghan Boundary Commission, of which I have been in charge, and which, after some two years' labour, had demarcated the boundary between India and Afghanistan from the Gomul river to Persia, a distance of 800 miles. That boundary-line ended at the top of the highest peak of the Koh-i-Malik-Siah mountain, which enjoys the proud distinction of being a point where three empires meet, *i.e.* India, Persia, and Afghanistan. This same mountain forms the starting-point of my present paper.

In my former paper I described the Baluchistan desert, with its barren mountain ranges, old volcanoes, and wide areas of gravel plain and sandhills. To-night I will endeavour to give you some description of Seistan, which is situated to the north-west of that country. I may note that it lies half in Afghanistan and half in Persia, and is about halfway from the Russian-Turkestan border and the Persian gulf. It is unnecessary, I know, to mention these details to an audience of the Geographical Society; but I am so often asked by kind friends

* Read at the Royal Geographical Society, April 9 and May 11 (Research Department), 1906. Map, p. 312.

† "The Southern Borderlands of Afghanistan," by Captain A. H. McMahon, C.I.E. Read at the Royal Geographical Society, February 22, 1897. Pages 393–415, *Geographical Journal*, vol. 9.

Conical Projection with two Standard Parallels

Published by the Royal Geographical Society

how I liked the Tibetans and how I got on with the Chinese, that I am reluctantly compelled to suspect that the position of Seistan is not so generally known as it should be.

Seistan is a country with a very ancient history and a great past. Time forbids my dwelling long on its past history. For that I must refer you to the many ancient Zoroastrian, Greek, Arab, and Persian historians who have written about it. Among modern writers on this subject, two members of this Society have attached great importance to Seistan, *i.e.* the late Sir Henry Rawlinson and Lord Curzon. The latter has devoted a very valuable chapter to this country in his monumental work on Persia. Sir Henry Rawlinson, when President of this Society, read a paper on Seistan * in January, 1873, thirty-three years ago. He reviewed the ancient history of the country, and, with the aid of the then recent geographical researches of General Sir Frederic Goldsmid, who had just returned from a mission of arbitration in Seistan, and who communicated the results of his explorations there in a paper to this Society,† endeavoured to identify the various places famous in ancient Seistan history with the old ruined sites brought to notice by Sir Frederic Goldsmid and members of his mission. That paper will be found of the utmost value and importance by any one who takes up archæological research in Seistan. It shows profound knowledge of the ancient historians, and is a masterpiece of close and accurate reasoning. After years of careful work in the country, we have found but little to correct, and have been able to definitely confirm most of the conclusions he arrived at.

Seistan is the birthplace of the legendary history and romance of Persia. Here is said to have lived the greatest mythical hero of past ages, the mighty Rustam, whose victories over demons and dragons, and the armies of the west and north, and even distant China, established the power of the Achæmenian dynasty. Seistan, too, was the home of Kai, or Kaikobad, the founder of the great Kayani or Achæmenian dynasty, which gave the world the line of kings, Cyrus, Darius, and others, who shaped the destinies of the whole world. Alexander the Great visited Seistan on his way to India in 330 B.C., and part of his army returned through that country. His historians speak highly of the civilization of the country, which was then called Drangiana, or Zarangiana.

Then came the Sakæ, or Scythians, who, although they only held

* "Notes on Seistan," by Major-General Sir H. G. Rawlinson, K.C.B., President R.G.S. Read January 27, 1873. *Vide Journal of the Royal Geographical Society*, vol. 43, 1873, pp. 272–294.

† "Journey from Bandar Abbas to Meshad by Seistan, with Some Account of the Last-named Province." *Journal of the Royal Geographical Society*, vol. 43, 1873, pp. 65–88.

Seistan for a short time, yet left in it a lasting mark of their stay in the form of its present name, for Seistan is only the later form of Sejistan, and that of Sakœstan, or country of the Scythians. The Scythians were turned out about 275 A.D. The Arabs invaded and conquered the country in the 37th year of the Hegira, *i.e.* about 659 A.D., and held it for many centuries.

Up to about the tenth century Seistan was a very rich, prosperous, and civilized country; but its wealth brought its own punishment, for from that time it formed the victim of a long succession of devastating conquests by devouring hordes. Mahmud of Ghazni, Jenghiz Khan

HELMAND RIVER ABOVE BAND-I-SEISTAN.

Timurlane, Nadir Shah, and others conquered it, and left it a more and more impoverished and stricken country.

Timur, on his first inroad into Seistan, was repulsed, and he himself received an arrow-wound, from which he got his name of Timurlane, or Timurlang, *i.e.* Timur the lame. He vowed he would return and take a bloody revenge, and he carried out his threat only too well. He devastated the whole country, and put the inhabitants to the sword. Zaranj, the then capital of the country, made a gallant defence, but in vain. The skulls and bones lying in large numbers in the old ruin of Zaranj, now called Zahidan, testify to this massacre to the present day. To Timur or his son Shah Rukh is ascribed the crime of destroying the dams and weirs of the Helmand, on which the irrigation of the country depended, and from the destruction of which the country has never recovered.

The ancient Kayani family, who claim descent from the original Kai, the founder of the Achœmenian dynasty, have made spasmodic attempts, in their long rule over the country in recent centuries, to restore the prosperity of the country, but in vain, and they, like their country, have gradually declined in prosperity and importance. Only a few members of this ancient family now survive in Seistan, and they are in very impoverished circumstances.

In succession from Nadir Shah, Seistan came, in 1747 A.D., into the heritage of Ahmad Shah the Afghan, and for the first time found itself under other than Persian dominion. Afghan rule in the country lasted over one hundred years, but was never more than nominal, and the Persians, taking advantage of intrigues between the rival local factions of Seistan itself, began to extend their influence over the country, and in 1866 occupied a portion of it with troops. The dispute which ensued between Afghanistan and Persia over this proceeding led to its being referred to the British Government for arbitration, and General Sir Fred. Goldsmid, who visited the country as arbitrator in 1872, laid down a boundary-line through Seistan. This settlement formally perpetuated what the course of local events had already brought about, *i.e.* the division of Seistan between Persia and Afghanistan, and ancient Seistan thenceforth ceased to possess any individual national existence as an undivided whole.

Sir Frederic Goldsmid related his experiences of Seistan before this Society in 1873, and I need not repeat what he said. Suffice to say that he was greatly hampered in his work by the obstruction and hostility of the Persian Commissioner and the Persian governor of Seistan. His movements were restricted, objections were raised to his flying the British flag in his camp, and difficulties of all kinds were placed in his way. He and his mission, after making all such inquiries and surveys as were possible during a short stay in the country under these very unfavourable circumstances, proceeded to Teheran, where the award was delivered. That award laid down on paper a boundary-line giving one portion of Seistan to Afghanistan, and the rest to Persia. From the Band-i-Seistan northwards to the Naizar or reed-beds on the Hámun shore, the main bed of the Helmand was defined to be the boundary.

The main channel of the Helmand then ran close to Nad i Ali, and thence northwards in almost a straight line. Later on, however, in 1896 it suddenly took a new course to the west of the old channel, along what is now called the Rud-i-Pariun. This in course of time led to disputes, for doubt arose as to whether the old or the new main channel was the boundary. Matters became still further complicated by disputes over the distribution of the water of the Helmand river, on which both countries depend for their cultivation. The British Government was again called upon to arbitrate, and I was deputed, with a large well-equipped mission, to proceed to Seistan, and arbitrate upon both the boundary and the water disputes. We left Quetta early in January, 1903, and returned late in June, 1905, after a stay of some two and a half years in Seistan. We thus had ample opportunities of carefully studying the country, and I will give you to-night some of the results of our observations.

I first invite your attention to the map of Seistan. We found, on our arrival, the existing maps inaccurate and somewhat misleading, and also full of blank spaces showing unsurveyed tracts, some of which had

HELMAND RIVER AT KUHAK, SHOWING MOUTH OF THE ROD-I-SEISTAN AND THE BAND-I-SEISTAN WEIR.

never been visited or seen by Europeans. Mr. Tate, the survey officer of our mission, and his able survey staff made complete new surveys of the whole country, both on a scale of 4 miles and 1 mile to the inch, and we filled up one after another all the unsurveyed blanks in Seistan and the surrounding country. No less than 38,000 square miles were thus surveyed, and the difficulties and dangers attending this task will be illustrated by what I will tell you later on.

The Seistan of the present day has an area of about 7006 square miles, of which 2847 square miles are in Persian and 4159 square miles in Afghan territory. The extreme fertility of the soil and the abundance of water for irrigation make Seistan a very rich country in the matter of agricultural products. Its population is about 205,000, but the country, even with the lazy, happy-go-lucky methods of the present day, furnishes a very large amount of grain and food-supplies in excess of local requirements, and it could, of course, be made to furnish very much more. Under improved government, Seistan could, with but little trouble, be made into a second Egypt. It was so once, and could become so again. If I deal to-night chiefly with the deserted portions of Seistan, I beg you not to forget the extent and richness of the inhabited portion.

With the exception of those portions of the country which consist of high barren plains, covered with a thin layer of gravel, and the cliffs which fringe those gravel plains, and in places the shores of the Hámun, Seistan presents to the eye a wide expanse of dead level country. Everywhere, except in the present inhabited portion, it is bare and desolate, destitute of vegetation or human life. In the inhabited and cultivated tract the country is intersected by a labyrinth of canals, large and small. No trees are to be seen in Seistan except on the river-banks or in Mian Kangi, the tract between the two main branches of the Helmand, where a tangled growth of low tamarisk jungle covers the face of the country. This is almost impenetrable, and is the home of innumerable jackal and wild pig.

The cliffs I have mentioned are vertical bluffs from 30 feet to several hundred feet in height, and, when seen from near, are striking features of the landscape. Elsewhere there is nothing to break the dead monotony of the flat horizon, except old ruins, and here and there a modern village of domed houses, picturesque in the distance, but dirty and squalid on nearer approach. Everywhere, except on the higher gravel plains, are ruins. Elsewhere, wherever one looks in Seistan, whether in the desert tracts or in the now inhabited portion of the country, are ruins. No country in the world contains so many. They are to be seen in all stages of decay, from shapeless mounds to high imposing structures of great size. They stretch everywhere as far as the eye can reach. A few, such as a minaret at Nad i Ali and that of Mil-i-Kasimabad, are of burnt brick; the rest are of burnt brick only at their base, and of sun-dried brick above. The regrettable absence of stone in Seistan has deprived this country of the lasting monuments of a still more remote past which stone buildings would otherwise have afforded.

It may seem strange that mud-brick buildings should live to the great age of some of these ruins. It must be remembered that their walls are always thick, that the Seistan soil makes bricks of excellent durable quality, and, more important still, there is little or no rain in Seistan. The annual rainfall only amounts to some 2 to 3 inches. The villages of the present day are, in the greater part of Persian Seistan, collections of domed houses generally built on mounds. In Mian Kangi and Afghan Seistan the villages are mostly collections of wattle and daub huts. The capital of Persian Seistan, Nasratabad,* is merely a village surrounded with high walls. Here are the British and Russian Consulates.

Round the north and north-west of Seistan, as shown by the blue-coloured portion of the map, is the Hámun, or lake area, into which the various Seistan rivers discharge their surplus waters. As one approaches the shores of the Hámun the scenery changes. The monotony of a flat horizon of dry land gives place to one of water and reeds. Dense reed-beds, called naizar, skirt the Hámun in many places. These beds are often several miles in width, and composed of high reeds 10 feet or more high. They look impenetrable, but narrow

THE ROD-I-SEISTAN.

winding lanes exist in them, known only to the Sayads, a strange aboriginal race of Seistan, who live by netting fish and water-fowl, and who pole their "tutins"—long cigar-shaped reed rafts—through these lanes. The Sayads live all the year round at the water's edge, in huts made of reeds, and they change their abodes as the waters advance or recede. They have a language of their own, and are an unsociable people, suspicious of strangers, ever ready to decamp and hide themselves in the naizar if they think a tax-collector is in the neighbourhood. Beyond the reeds lie vast open stretches of water, extending sometimes to the horizon.

* The capital is always spoken of in Seistan as Shahr-i-Seistan (city of Seistan), or Seistan. The name Nasratabad is seldom used locally.

All Seistan, both the high gravel-covered plains and lower lands, is composed of alluvial soil. In strange contrast to this, there stands up by itself in the Hámun, as a prominent feature of the Seistan landscape, a solitary hill of rock, 496 feet high. It is called the Koh-i-Khwaja, and many legends centre round it. On its southern slopes are the massive ruins of Kakhaha, of the origin and era of which we know nothing. The then ruler of Seistan, in later times, for seven years successfully withstood on this hill the siege of Nadir Shah, the Persian king. Closer examination shows it to be a hill topped with a cap of basaltic lava some 200 feet in thickness, below which is alluvial silt of first brick-red, and lower down yellow colour baked and burnt into a hard crystalline condition. Mr. Ellsworth Huntington is of opinion that this hill contains the core of a volcano; but I am inclined to think, from the fact that the lava cap slopes downwards to the north-east, that this conclusion is not necessarily correct. From the quarries on the top, in which remains of old and much-weathered portions of mill-stones abound, one sees that in some very distant time the people of Seistan came here for that useful article. The rock is too hard for the degenerate people of the present day to cut or make use of. The numerous raised tombs, built up of rocks on the summit, have puzzled many travellers. They are all empty, and have an opening at their ends or sides. Their object and use is obvious. They are merely the temporary resting-places of the departed, who have been stored away there until their relations could remove to sacred Meshed for burial.*

[So much for the general scenery and characteristics of Seistan. I now bring to your notice one or two interesting problems which the physical geography of Seistan presents for solution. It will be seen that Seistan is a large basin some 7000 square miles in area and without any outlet to the sea, which receives all the drainage of a vast tract of country, over 125,000 square miles in area, girt on all sides by high mountain ranges. The Helmand, Khash, Farah Rud, and Harut Rud rivers flow into the Seistan basin, and it receives the flood waters of many torrent beds coming from the mountains on the west. The Khash, Farah Rud, and Harut Rud drain the country to the north as far as the Paropamisus and Hazarajat (Hazara) mountains. They do not flow into Seistan all the year round, as their upper waters, during a portion of the year, are all taken off for irrigation in the higher reaches, but in spring and early summer they are rivers of no small size, and bring large volumes of water into Seistan.

The principal river of Seistan is the Helmand. It drains a large portion of Afghanistan. Its sources rise as far away as near Cabul,

* The portion of the paper in brackets formed the subject of separate discussion at a meeting of the Research Department of the Society, held on May 11, 1906. The record of that discussion will be found after the conclusion of the paper in the next number.

and extend to the lofty watershed of the snow-covered mountains of Hazarajat. It is some 600 miles in length, and its volume, on reaching Seistan, varies from a normal minimum of some 2000 feet per second at low river to 50,000 and 70,000 cubic feet per second in ordinary flood seasons, and to as much as 600,000 and 700,000 cubic feet per second in years of abnormal flood, such as occurred in 1885. It will be seen from this that the Helmand is a very large river. It is, moreover, the only large river in Southern Asia between the Indus and the Tigris. Down to Bandar-i-Kamal Khan the Helmand flows along the bottom of a narrow deep bed of 1 to 2 miles in width, which cuts through a wide alluvial gravel-covered plain. This river-bed presents all the normal

RUINS OF THE CITADEL OF ZAHIDAN, THE ANCIENT ZARANJ.

features of an ordinary trough of erosion. The alluvial cliffs, 200 to 250 feet high, which form the walls of this cutting on either side, leave the river near Bandar-i-Kamal Khan and recede northwards and southwards, as shown on the map, at the point where the Helmand enters the Seistan delta.

After arriving in Seistan, the Helmand at the present time divides into three branches. The first, called Rud-i-Seistan, is really a big canal which takes off at the Band-i-Seistan. Persian Seistan largely depends on the Rud-i-Seistan for irrigation. To divert sufficient water into this channel during the early winter, or low river season, a gigantic weir, made of densely packed bundles of Tamarisk branches, is thrown across the Helmand every autumn when the river is at its lowest. About Christmas-time the rising river breaches this dam, and gradually carries it away. This "band," or weir, is from 70 to 100 feet wide, some 1700 feet long, and in height from 5 feet at the sides to 15 and 20 feet in the stream. The main channel of the Helmand is now the Rud-i-Purian, and the third is now a smaller channel, the Nad-i-Ali channel, which, as stated before, used to be the main channel. All three branches discharge their surplus waters into the Hámun, which encircles the north and west of Seistan. The Khash, Farah Rud and Harut Rud discharge their waters also into this Hámun, which becomes in the flood season a vast sea more than 100 miles in length, and varying from 5 to 15 miles in breadth. Every few years, when its level reaches a certain height, it escapes through the Shelag channel into another large and still deeper lake depression, called the Gaud-i-Zirreh. It did this during the whole month of August, 1903, while we were in Seistan.

The Helmand and other Seistan rivers in flood-time come down very heavily laden with fine silt, and I should mention here that the proportion of silt in the Helmand is extremely high. We found it on occasions to be as much as one part of silt to 127 parts of water, a figure which very few rivers in the world can surpass. This silt is deposited by floods over the country, and the natural tendency is for the rivers and canals to build themselves up with their own silt on to a higher and higher level, until in course of time they are running along the tops of ridges higher than the surrounding country. This goes on until some obstruction or big flood causes a breach in their banks, and they desert their old channel and divert themselves by a new channel on to lower ground. This is what happened when the Helmand deserted its old Nad-i-Ali main channel in 1896, and made for itself a new one in the Rud-i-Pariun. Everywhere in Seistan are traces of old deserted river and canal beds due to this natural cause.

As seen in the map, the present Helmand with its branches forms one delta; and to this delta is confined all the cultivated and populated area of Seistan. This has not always been the case, for we find in what is called the Tarakun-Ramrod tract numerous old ruins of great extent and traces of old canals and cultivation. We find here, also, the traces of old river-beds, and we find that the Helmand used to flow down here and use this delta just as it now does its present one. Its surplus waters discharged into the Gaud-i-Zirreh, just as they now do into the Hámun.

Again, let us examine the waterless tract on the east of the present Helmand. This, before our arrival in Seistan, was a blank on our maps, and we were the first to explore it. Previous travellers had reported rumours of the existence of old ruins in this tract also, but no one had entered this waterless desert or seen the ruins. We found not only ruins of countless numbers and great extent throughout all this tract, but traces of ancient canal systems and ancient river-beds. In fact, the extent and nature of the ruins, the character of the relics found in them, such as seals, pottery, china, and glass, and the magnitude and perfection of their canal systems show that this must have been, not only a former delta of the Helmand, but the delta used by the Helmand in, as far as existing ruins testify, one of the most prosperous times of Seistan history. Of all the vast ruins of this tract, now mostly buried or half

THE MIL-I-KASIMABAD, SEISTAN.

buried in sand, the largest would seem to be those now known as Sarotar. This series of ruins extend from near Kala-i-Fath, past Sarotar, for some 60 miles northwards in an unbroken line to beyond Chakansur. The northern ruins of this series are free from sand, some of them, such as Amiran and Chihal Burj, being in a wonderful state of preservation. While this delta was used by the Helmand, the surplus waters discharged themselves into a big depression which we found to exist along the east, and which we have called Lalla Nawar, and which must have been the Hámun of those days. Again, what is now called the Sena Rud marks the course of an ancient bed of the Helmand. This discharged the river into the southern portion of the present Hámun, and its delta comprised portions of both the present inhabited delta and the Ramrod delta. No traces of old ruins are to be found on the Sena Rud, and it seems to have been in use in pre-historic times. It may perhaps have been the river-bed of a portion of the period to which the palæolithic remains, to which I will refer later, belong.

Thus we find Seistan is composed of at least three deltaic areas, each with its own Hámun for flood waters to escape into. The traces still visible, of not one, but a succession of old river-beds in each tract, show that each of these deltas has been used by the river, not once, but many times in past ages. As the Helmand in the course of ages swung round from side to side, one delta was abandoned and another came into use. What was a Hámun at one time became a dry plain at another, and so on. Thus we find immersed under the waters at the north-west course of the present Hámun the ruins of the city of Sabari Shah, while Lalla Nawar is now a waterless desert, and the Gaud-i-Zirreh very seldom receives any water. The population have, of course, followed the river, and even in historic times the capital of Seistan has changed its site from delta to delta. Ram Shahristan and Agriaspa, the capital of Seistan Drangiana in Alexander's time, is, I think, now marked by the ruins of Ramrod, in the Tarakun delta, while Zaranj, the capital of the times described by Arab historians, and which Timurlang destroyed, is undoubtedly the Zahidan in the present delta. To what era we are to ascribe Sarotar, I feel some doubt, but I think we shall not be far wrong in making it a very ancient capital—that, perhaps, of Indo-Parthian times. Older than these are the innumerable shapeless mounds of burnt bricks scattered over the whole country, marking the sites of earlier towns, and still more ancient capitals. Eastwards and westwards the Helmand has swung from age to age, piling fresh silt over the face of the country, and burying still more ancient ruined sites below the surface. These we only see occasional traces of when the river cuts out a new channel, or a deep wind-scour temporarily exposes a portion of some buried ruin.

We come now to the most puzzling of the many problems which the study of Seistan presents. If we try and calculate the mass of silt which the rivers bring into Seistan each year, we soon work up to big figures. We should be justified, therefore, in supposing that the general level of the Seistan deltas is gradually rising, for there is no outlet from Seistan, no means by which the water can carry the silt elsewhere, and bit by bit all the silt that comes down is placed on top of what is there before. Do our recent surveys and observations corroborate this supposition? Far from it, for we find all round the Seistan area higher terraces of alluvial silt. These are clearly marked by the wave-cut cliffs which fringe the Hámun in places, and by the high cliffs which mark the edge of the Dasht-i-Margo, on the east of Seistan, and which have their counterpart on the west of Seistan in the old alluvial deposits of corresponding height, still visible on the sides of the mountains and mountain glaces. In other words, the former level of the Seistan alluvial area must have been at least 400 feet above the present level. The only solution of the problem I can suggest is that the Seistan area has gradually subsided, owing to the weight of silt deposited on it. Such subsidence is, I believe, not unknown in deltaic areas, but hardly, perhaps, to the extent shown in Seistan. What has become of all the superincumbent earth which buried Seistan when it lay 400 feet below the then surface of the ground? What becomes of

RUINS OF TARAKUN, SEISTAN.

the silt that is now brought down every year; and what becomes of the material of the cliffs, which are still being cut away by water and wave action? There is no outlet to any sea, no tides and currents to carry the silt away to that sea.

If Seistan began by being a deep hole, and if this hole is gradually filling up, the aggradation or rising of its floor would long ago have shown signs of reducing the gradients of the lower reaches of the Helmand by checking the velocity of the river and causing deposit of silt. There is no sign of this, and the gradient of the present river resembles that of the ancient beds by which the river came in old days. The only solution of the problem seems to be the fact of a gradual but steady subsidence of the whole Seistan basin.

Mr. Ellsworth Huntington, of the Carnegie Institute of Washington, who visited Seistan while we were there, has recently written some very interesting notes * on that country. He took great interest in the old gravel beaches and other old high-water level marks which abound in Seistan. He attributes the changes in water-level to climatic oscillation, and to glacial and interglacial epochs. As an alternative suggestion he hints at the possibility of the Helmand having oscillated from one side of Seistan to another. We have since proved, as I have shown above, that the Helmand and other Seistan rivers have continually swung from side to side in the past, and this we know to account for many of the old beaches and high-water marks in Seistan. I regret that I did not bring to his notice the theory I have now propounded, *i.e.* that the Seistan deltaic area as a whole is undergoing gradual but incessant subsidence.

Another problem which confronts one on first considering Seistan is, what becomes of the great volume of water which its rivers pour into it? The Hámun is nowhere very deep, only about 15 feet in the deeper depressions, and not more than 4 to 8 feet over the remaining area at flood-time. Its extent rapidly shrinks after the flood season is over, and by winter large tracts of it have dried up. We thought at first that there must be some subterranean outlet to account for all this, but soon found that this was not the case. Not only is there no such outlet, but the bottom of the Hámun is extraordinarily water-tight, and very little loss occurs from absorption. Evaporation, however, we found in Seistan to be very rapid. Mr. Ward's observations and calculations show that no less than 10 feet of water is consumed by evaporation alone in the course of the year. In other words, a lake 10 feet deep is removed by evaporation alone in a year. The heat of the Seistan summer and the extraordinary wind of that country easily account for this high rate of evaporation, which renders it unnecessary to search for any other explanation regarding the annual recession of the lake area.

So much for the disposal of the silt and the water. What becomes of the salt? It is well known that inland seas which have no outlet are apt to become, through evaporation, more and more salt, until they become in some cases lagoons of brine with margins of solid salt. In Seistan, where so much water is consumed by evaporation each year, one would expect the salting process to be very rapid. This is far from being the case. The Hámun is singularly free from salt, and the water is drinkable. The Helmand water, it is true, is very pure, but it is too much to expect that either the Helmand water or the water of

* "The Basin of Eastern Persia and Seistan." By Ellsworth Huntington, Carnegie Research Assistant. *Vide* 'Records of the Carnegie Institute Expedition of 1903,' pp. 219–317.

every other Seistan river is so absolutely free from salts as to account for the freshness of the Hámun. Nowhere in the Hámun area is there any trace of a salt * deposit. The problem may be partly explained by the fact that the Hámun every ten years or so is flushed out by an overflow into the Gaud-i-Zirreh, but I do not think that this is a sufficient explanation in itself, and the problem awaits further elucidation. When the Hámun water overflows through the Shelag, the water in the Shelag is drinkable. Within a few months of the Shelag ceasing to flow, the water, which is always to be found throughout its course in large stagnant pools, is pure brine, with solid salt-crystals round the margins. The water of the Gaud-i-Zirreh, also, as it dries up, leaves a

A PORTION OF THE RUINS OF RAMROD, SEISTAN.

thick deposit of salt. The contrast between the conditions of the Hámun and the Gaud-i-Zirreh in this connection is very curious, and requires explanation.

I come next to another very curious phenomenon in Seistan. This is the wind. If ever a country merits the title of "land of the winds" it is Seistan. Every one who has visited Seistan or written about Seistan has mentioned its celebrated wind, called the "Bad-i-sad-o-bist roz," or wind of 120 days, which blows in the summer. Few of

* The salt efflorescence which comes to the surface in places in Seistan, as in every other country, and more frequently near the Hámun margin, is of course formed by capillary attraction from the ground below, and must not be confused with salt deposited by water from above.

these have had the misfortune to experience it, but as we went through two seasons of this wind we are able to say something about it. It more than justifies its reputation. It sets in at the end of May or the middle of June, and blows with appalling violence, and with little or no cessation, till about the end of September. It always blows from one direction,* a little west of north, and reaches a velocity of over 70 miles an hour. It creates a pandemonium of noise, sand, and dust, and for a time gets on one's nerves; but it is in reality a blessing in disguise, for it blows away the insects which from April to June make life in Seistan a perfect purgatory, mitigates the awful summer heat, and clears the country of typhus, small-pox, and other diseases rife in the country in May and June. This Bad-i-sad-o-bist roz is not felt in the mountainous country west and north-west of Seistan. It is said to be even more violent in Lash Jowain than in Seistan. It is less violent in Herat, and rapidly decreases in violence south of Seistan, and is but little felt on the Nushki Robat trade-route. One would think this 120-day wind enough, but violent winds prevail all through the winter from December to April, and blizzards are of constant occurrence. These winds always come from the same direction. The winter blizzards are terrible, and the wind attains a terrific velocity. In a blizzard at the end of March, 1905, the anemometers registered a maximum of 120 miles an hour. The average velocity for a whole sixteen hours was over 88 miles an hour.

The extraordinary frequency and violence of the Seistan wind, and the regularity with which it blows from the same quarter, are very remarkable. That it has blown from the same quarter in past ages is proved by the fact that all the ruins of Seistan are built at the same angle, with their front and back walls at a right angle to the wind, and their side walls at the same angle as the wind. No wind can blow with such violence and frequency without leaving its mark on the country. Its effects are everywhere visible in Seistan. Everything looks wind-swept and wind-stricken. There are no trees except the tangled thickets of low tamarisk which fringe the rivers and cover the lowlying tract of Mian Kangi between the Nad-i-Ali and Rud-i-Pariun rivers. These by their denseness protect each other from the wind, and afford protection to a few Babylonian willows, which have taken advantage of their protection to raise themselves into trees. Over the greater part of the country not a single tree exists.

The present villages and habitations are all built with their backs presenting lines of dead wall on the windward side. The old ruins are oriented at exactly the same angle, on account of the wind. The effect of wind is everywhere visible on these ruins. Their bases are undercut by wind as though by water-action. The thickness of the walls, the

* Between $316\frac{1}{2}°$ and $333\frac{3}{4}°$.

excellent quality of the burnt bricks made and used by the ancient inhabitants for the lower courses of their buildings, and the extreme hardness and durability of the Seistan soil when made into the sun-dried bricks of which the upper portions of the ruins are composed, have withstood the destructive effect of the wind in a wonderful manner, but in the older ruins we often find that the walls facing the wind have entirely disappeared, and only the side walls remain, while in still older ruins only one or two solitary pinnacles remain to mark what were once large, massive, and extensive buildings.

The wind has buried large tracts of the country under sand. Many of the old ruined towns are wholly or partly buried in sand, and this

GLIMPSE OF OUTER LINE OF WALLS OF SAR-O-TAR RUINS, SEISTAN.

burying process goes on all the year and every year, and is covering up not only valuable lands, but inhabited villages. In Seistan, as elsewhere, the invading army of sand is preceded by lines of skirmishers in the form of travelling "burkhans," horseshoe-shaped sandhills, which steadily advance until they meet some obstacle, which retards them until the reserves come up to their support and bury all before them under hills of sand. I will give you a couple of instances illustrating the rapidity of this burying process.

On our arrival in Seistan, we found Kila-i-Nau, a big and flourishing village, built on the south side of a high ridge for protection from the wind. Before we left, the sand had attacked that ridge, surmounted it, and buried the village, forcing the inhabitants to build a new village elsewhere. An example of still greater rapidity was afforded at the village of Kila-i-Kohna. Up to June, 1904, this village had a large deep pond on its northern side. By September, *i.e.* in less than three months, this deep pond was converted into a sandhill some 10 feet high.

The wind, however, does not confine its energy to burying only. While it covers some tracts deep in sand, it also sweeps other tracts clear of sand, rendering valuable land available for cultivation, and exposing long-buried ruins once more to view. These are, however, only the milder effects of wind-action. The Seistan wind, in its more destructive moods, has in places removed, not only sand from place to place, but has scoured away the whole face of the country. Everywhere we find the sides and banks of the canals which irrigated the lands on which the dwellers of the old ruins depended, left standing like walls high above the present surface of the surrounding land. These banks, having been hardened by water, have withstood the action of the wind better than the surface of the land, which has all been blown away to a depth of several feet. This depth in places is very considerable, and we find the outlines exposed of still older canals which existed at some yet earlier age, and which must have been buried deep in the ground when the canals above them, old as they are, were in use.

Some very startling evidences of the way in which the wind has scoured away and removed the old surface of the country, are to be found in the south-west corner of Seistan, which was probably once the richest and most populous part of the country. Owing to its remoteness from the beaten track, and its present inaccessibility from want of water, I do not think it has ever been visited or explored by any Europeans except ourselves. I refer to the desert track through which the boundary-line runs between the Sena Rud and the Shelag. Here we find wind-scours 20 feet or so deep, which have left isolated mounds to mark the height of what used to be the surface, and which show that the present general surface at these places is at least 20 feet lower than it used to be. I say, at least, because the mounds are themselves wind-worn, and it is therefore impossible to say how high above the present surface the old surface was when it was last cultivated and used by man. That it was once a wide flat surface capable of extensive cultivation, we know from the broken pottery which is found here lying everywhere in extraordinary profusion, testifying to a very large population; moreover, a very ancient population, because the pottery is of the primitive red type which is familiar to experts as denoting great age. Even an amateur can detect how much older it is than the more finished pottery that abounds in the old ruined sites of Seistan.

But what are the rounded mounds that abound in countless numbers in this tract, and which catch the eye by reason of their black colour? Closer inspection shows that the colour is due to these mounds being covered with black pottery and bits of black stone. This black pottery is, I think I am right in saying, the oldest form of pottery known, and one of the first indications of dawning civilization in primitive man. The black stones are bits of hard black lava and volcanic tuft, and other rocks common in the distant mountain ranges west of Seistan, but curious things to find here in this alluvial region. As one turns them over, the idea strikes one that they seem to be chipped into shapes unusual in the ordinary stone. Some look as if attempt had been made to fashion them into something, and others as if they were chips from other stones. Here and there we find what is evidently a spear-head, a knife, or a rudely fashioned axe-head. Some are made of black volcanic rock, others are of better quality, delicate implements of obsidian and agate and so on, evidently for the use of the *élite* of those days. Stone implements they are, of the palæolithic type. I leave it to experts to decide what age these belong to. If palæolithic experts are to be trusted, the users of such implements date back to many tens of thousands of years ago. Be the thousands of years what they may, enough has been found to prove that the age of past dwellers in Seistan is of very respectable antiquity, and in itself sufficient to give interest to that country.

Let us return to the ever-present Seistan wind. There are to be found scattered over the southern tract of Seistan, in the middle of the high gravel-plains of that region, a number of very curious depressions, large holes, as it were, cut out of the surface of the country. Some are very large, several square miles in area, and some 200 or more feet deep. Some of these depressions are connected with each other by gorges, others are connected by gaps in their side with the lower plain of Seistan, and through these gaps floods have at times found their way and formed large and sometimes deep lakes. Others, again, are isolated depressions, having no outlet at all. How were these formed? Ordinary explanations, such as water-action, subsidence, and so on, fail to apply. After much consideration, I have come to the conclusion—I record it with diffidence—that they have been dug out purely by wind-action. This may seem startling, but I must point out that all I have seen have a long axis, which more or less coincides with the direction of the wind. The few that are irregular in shape can, I think, be accounted for by the supposition that they originally formed two or more separate depressions which have gradually become merged into one. While advancing this theory to explain these minor depressions, I do not go so far as to suggest that it accounts for the huge depression of Seistan itself.

The Seistan wind, however, being such as it is, and its effects on the landscape being so very marked all over the country, we are bound to attribute to it the removal of some considerable portion at least of the silt which is yearly brought into Seistan.]

The above remarks may serve to bring to notice some of the interesting features of Seistan, but space forbids my either dwelling more fully on them or discussing many other interesting problems connected with the physical geography, archæology, and ethnology of the country. Our mission collected an immense amount of information on these and kindred subjects, and this information is being placed permanently on record in the form of official publications.

Mr. Ward, the expert irrigation officer of the mission, who was indefatigable, with the aid of his able staff, in collecting every manner of miscellaneous information, is, and has been for the past nine months, engaged in editing and putting these records through the press, so some idea can be formed of their extent. Mr. Tate, our survey officer, who is an archæologist of no small experience, has also written a valuable note on the archæology of the country, which I hope will soon be published. With the aid of the data thus collected, some advance may be made in elucidating the various interesting problems of this country. Few countries in so small a compass contain so many and varied evidences of past events, both physical and human. It offers unique opportunities for the study of physico-geographical phenomena and their relation to human life.

In the existing population we have, it is reasonable to believe, some of the purest types extant of the ancient Aryan race, and a more thorough study of all that Seistan has to teach us may throw valuable light on the early origin and history of the Aryan race, and on the wider and still more important subject, the physico-geographical history of a large portion of Central Asia. The eminent American experts who, under the auspices of the Carnegie Institute of Washington, are working at this subject in Turkestan and Transcaspia, have already had their attention called to the importance of Seistan as a key to similar problems in larger areas by one of their number, Mr. Ellsworth Huntington. I have already referred to his interesting notes on this country, and if some of his conclusions, made during his short stay in Seistan, fail to agree with the results of observations made by us during a long stay in the country, with all our advantages of a large and capable staff, ample means and equipment, the necessity is demonstrated of a still longer and more thorough research in this country.

We have had gratifying proof to-night of the brotherly interest which the United States take in our geographical work in the ice-bound Antarctic, and it will interest you to now learn how Americans and ourselves are also working hand-in-hand in the geographical problems of the arid deserts of Central Asia.

(*To be continued.*)

THE ECONOMIC GEOGRAPHY AND DEVELOPMENT OF AUSTRALIA.*

By J. W. GREGORY, F.R.S., D.Sc., Professor of Geology in the University of Glasgow.

IV. LABOUR-SUPPLY.

A. *Growth of Population.*

This growth of the manufacturing industries is all the more remarkable, as it is often held that it is neither economically possible nor politically desirable, for Australia to develop into a great industrial state. But it is generally conceded that Australia wants a larger population. The Australians are at present somewhat overhoused. Railways run through empty bush at a loss, where with an adequate adjacent population they would yield handsome profits. Large sums have been spent on irrigation works that have failed financially, because there were not enough people to supply the careful labour, by which alone the water could be profitably used. But the cry of the emptiness of Australia is greatly exaggerated. It is true that as yet only the coastal districts are peopled, and so the mean density is 1·5 per square mile, which is practically the same as Canada. But most countries have their scantily occupied areas. In our own overcrowded island we have Sutherland with its 2028 square miles and population of 10 to the square mile. Considering its conditions and position, Australian population has grown with unprecedented rapidity. Sir Jervoise Baines † has pointed out, that if we separate Australia into the inhabited and practically uninhabited districts, the settled districts are fairly well peopled for a pastoral and agricultural country. The average density per square mile of the densely peopled districts of Victoria is 48·94, and of the sparsely peopled only 1·39. In Queensland the densely peopled districts have 22·28 per square mile, and the sparsely peopled districts only 0·07 per square mile. The rate of increase of the population compares well with that of either America or South Africa.

In the century between 1673 and 1775, the population of the United States grew from 160,000 to 2,803,000, and Canada has taken over two centuries to reach 4,500,000; but the Australian population has grown from 6500 in 1800, to 3,773,248 in 1901; and if we compare the growths of population in the last half-century, we find that the percentage increase in Australia has been greater than in either the United States or Canada.

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* Continued from page 145.

† J. A. Baines, "A Census of the Empire," *Journ. R. Stat. Soc.*, vol. 66, 1903, p. 12.

	U.S.A.	Canada.	Australia.
1840	17,063,000	1,690,000	(1841) 206,095
1850	23,192,000		(1851) 403,889
1860	31,443,000	(1860) 3,360,000	(1861) 1,153,973
1890	62,481,000	(1887) 5,020,000	(1891) 3,183,327
1900	76,356,000	5,528,847	(1901) 3,773,248

Nevertheless, though Australia has done well in attracting population, it needs to do still better. It has come to a pause in its increase, the cause of which need not here be discussed. But in face of the agricultural depopulation in parts of the British Isles, it is not surprising that there is no rush of people to agricultural pursuits in the back blocks of Australia. The best chance that the past rapid increase in the density of population will be maintained, is by the growth of manufacturing industries. In this important step in Australian development, Victoria has so far taken the lead; but the great coalfields along the coast of New South Wales should make the district between Sydney and Newcastle the manufacturing metropolis of Australia.

B. *The Aborigines.*

There is, however, an easier and quicker alternative method of increasing the Australian population. Australia might encourage the introduction of coloured labour. There was no chance of getting such labour from within Australia. When colonized, the continent was practically empty. The total aboriginal population at the beginning of last century is estimated at about only 150,000, and according to Coghlan it is now about 153,000. When Victoria was settled in 1836, it was occupied, according to the official estimates of that time, by only some 6000 black fellows. The aborigines make magnificent stockmen, and so would gladly have been preserved. They belong to the same great race group as ourselves—the Caucasian, but were of that nomadic type which has always perished before the advance of a settled civilization. In spite of the best efforts of the Australian Government to protect and preserve these people, they have died out before the spread of European diseases, and the change in life rendered necessary, as the wild game was replaced by sheep and cattle. There is a reported increase in the number of aborigines in recent years in the northern parts of Westralia and the Northern Territory; and there has been an excess of births over deaths in one of the aboriginal reserves in South Australia.

Nevertheless, it is very doubtful whether the race can be permanently saved. Some criticisms of Australia imply that it once had a dense population, which has been ruthlessly exterminated by the settlers. We hear yarns in the smoking-rooms of steamers about parties of settlers having, in the early days, gone out black-fellow shooting. But there seems very little foundation in fact for such stories.

The destruction of the Tasmanian aborigines was complete long before Tasmania was allowed self-government, and while the island was under British military rule; and the peaceful collection of the remnant into the reserve upon Flinders island was accomplished by a private settler, Robinson. The aborigines throughout Australia have always had the warm championship of men who were keenly interested in them, and always ready to defend them against oppression. The emphasis with which the authorities, in the earliest days of the Port Philip settlement, threatened to hang any white man convicted of murdering a black fellow, showed the determination of the Government to deal even justice between the two sections of the inhabitants.

C. *Asiatic Immigration.*

The north-western ports of Australia are only four days' steam from that overcrowded corner of Asia where dwells about half of the human race. The daring Malay seamen knew of the existence of Australia centuries before it was known in Europe. The people of south-eastern Asia had their chance of occupying Australia, for, as the Malays conquered Madagascar, they could have colonized Australia. But it was not sufficiently attractive; it was too dry and dusty. But now that we have opened up the land, built railways, drilled wells, founded a lucrative trade, and secured personal safety, the Asiatics would gladly go and reap where we have sown.

Australia has only to remove the artificial barriers she has erected, to let in an Asiatic deluge. The coloured immigrants would keep clear of the still unoccupied interior. The cities and the pleasant coastal districts would be good enough for them. The difficult interior would still have to be opened up by the white man. But the figures of the Australian population would be easily multiplied.

Australia had her chance of acquiring a great coloured population. But she unhesitatingly rejected it. A rush of Chinese into Australia began in 1879, and lasted until 1887, when they had become fifteen per thousand of the population; and the stream was flowing with rapidly increasing volume. Even in Great Britain, protected by our dense established population, we defended ourselves by last year's Aliens Bill against the immigration of our civilized European neighbours. Australia, with her young settlements and her exposed position, needs to be incomparably more cautious. It stopped the immigration as soon as it threatened to come in a volume greater than could be safely mastered. New South Wales defended itself by a simple Chinese exclusion bill.

Some of the States, however, in deference to the wishes of the British Government, instead of excluding aliens on account of colour or race, adopted an education test, and the Commonwealth legislation has followed on the same lines. So that Australia has been denounced for framing its mild Aliens' Immigration Act on the very lines recommended by the Home Government.

D. *The Possibility of a White Australia.*

Australia had another chance by the introduction of Kanaka labourers into the tropical plantations; but, resolute in her policy of a "White Australia," that system has been stopped, and after December 31, 1906, the last Kanaka labourers will be returned from Australia to their South Sea islands. This anti-Kanaka legislation has been severely condemned, on the ground that the "White Australian" policy inevitably condemns the tropical regions of northern Australia to lie permanently waste. We often hear that white men cannot work in the tropics, and that northern Australia, including many of the most fertile and best-watered regions of the continent, must either be left unoccupied or be developed by coloured labour. But is this idea more than a popular prejudice, due to the high mortality of the tropics in times when tropical diseases were not understood? Is there any physical reason why white men should not work in the tropics? Is it the heat? Attendants in Turkish baths, stokers in steamers, glass-blowers, and furnace-men in metallurgical works, withstand higher temperatures than are encountered in any tropical country. But it may be said that these men are not engaged in the open air, exposed to the fatal fury of the sun. British troops, however, have to march in India, and it is found that they are healthier then, than when cooped up in barracks. British tea-planters in India have been instanced as a healthy race, although their duties require them to be out in the hottest time of the day, in the hottest season of the year.

Not only is there nothing in the heat of the tropics to prevent white men working there, but, according to the high authority of Sir Joseph Fayrer, European children may be reared in India almost as well as in Europe. According to Sambon, the infant mortality of European children in Calcutta is 58 per 1000. According to Mulhall,* in the years 1876–80, it was 145 per 1000 in England, 163 per 1000 in France, and 302 per 1000 in Wurtemburg. In Lancaster in 1904 it was 274 per 1000.

The old high death-rate of the tropics has been greatly reduced by improved sanitation and modern knowledge of tropical diseases. Barbados once had a bad reputation for unhealthiness, but it is now, according to the health statistics of its garrison, healthier than stations in the British Islands.

The old dread of the tropics is passing away. Algeria was once regarded as intensely unhealthy. Sambon, in a remarkable paper on Acclimatization, which he read before this Society in 1896, quotes General Duvivier, "That the cemeteries are the only colonies always growing in Algeria." But with care the death-rate has steadily declined. According to Mulhall,† the death-rate of the French in Algeria

* Mulhall, 'Dictionary of Statistics,' p. 177. † *Ibid.*, p. 189.

from 1853 to 1856 was 46·3 per 1000, and it had been reduced in the years from 1873 to 1876 to 26·8 per 1000. And Algeria is now a popular European health resort.

Of course, where work has to be done under such rough conditions that life must be freely sacrificed, as when, in railway construction, a man has to be buried under every sleeper, as was said about the Panama railway, he must be a coloured man. But under conditions when ordinary economy of life can be preserved, there seems to be no physical reason why white men should not, in time, work in the tropics. No doubt we prefer a temperate to a tropical climate. But in the tropics nature is more generous; she returns a more valuable harvest, and thus compensates man for the discomforts and for the unquestionable reduction in personal efficiency. There seems to me no adequate reason why Australia should not all in time be occupied by white races; but it must be admitted that the White Australia policy involves delay in the development of some districts; for the experiment of the white occupation of the tropical lands should proceed slowly, as otherwise it must be accompanied by unnecessary loss of life. There are certain industries, such as cotton-planting, that require ample, cheap labour for the short picking season, and it may be impossible to start them on profitable lines at present. And Australia has to decide whether it is better to postpone the growth of such industries, or to risk the evils of coloured labour.

E. *Kanakas and the Queensland Sugar Industry.*

If there be one state in Australia that should have suffered by the "White Australia" policy it should be Queensland.

The following table compiled from the returns in the "Statistical

	Queensland.		New South Wales.	
	Area under sugar-cane.	Production of sugar.	Area under sugar-cane.	Production of sugar.
	Acres.	Cwts.	Acres.	Cwts.
1890	50,922	1,378,480	20,446	380,320
1891	50,948	1,024,380	22,262	530,660
1892	55,520	1,227,360	26,751	485,780
1893	59,251	1,522,920	28,112	478,605
1894	71,818	1,834,240	32,909	452,756
1895	77,247	1,725,100	32,927	444,261
1896	83,093	2,015,480	31,053	571,140
1897	98,641	1,958,320	25,865	553,066
1898	111,012	3,274,680	24,759	582,198
1899	110,657	2,465,780	22,517	307,048
1900	108,535	1,851,080	22,114	398,760
1901	112,031	2,417,160	20,809	390,375
1902	85,338	1,532,520	20,301	430,884
1903	111,516	1,836,560	20,219	435,718
1904	120,317	2,953,760	21,525	400,150

Abstract" shows the acreage and yield of sugar in Queensland and in New South Wales since 1890. In New South Wales, where there has been no interference with Kanaka labour, there has been a fall in the acreage under sugar. But in Queensland, in spite of the anti-Kanaka legislation, there has been no such fall; the drought of 1902 reduced both acreage and yield, just as it reduced the wheat yield of the Commonwealth from 38,561,619 bushels in 1901–2 to 12,378,068 bushels in 1902-3; in 1904 the Queensland acreage is the maximum on record, and the yield has only been beaten once, in 1899.*

The Queensland sugar industry, in fact, has done remarkably well, when compared with the same industry in other parts of the British Empire. Thus in British India there has been a long and fairly steady fall from 3,100,232 acres in 1891, down to 2,280,000 acres in 1904. Similarly, in the British West Indies, the exports of domestic sugar from the twelve islands of Jamaica, St. Lucia, St. Vincent, Barbados, Grenada, St. Christopher, Nevis, Montserrat, Antigua, Dominica, Trinidad, and Tobago having fallen from 3,903,980 cwt. in 1890, to 2,358,325 cwt. in 1903 and 2,892,106 cwt. in 1904.

The people of Queensland are apparently satisfied with the change, for they have continued to return a large majority committed to the White Australia policy. It should be remembered that the Kanaka labour was stopped by the Federal Parliament, on the insistence of a majority of the Queensland members.

F. *The Labour Legislation.*

For its persistent support to the principle, that the main policy of Australia is the maintenance of the purity of its race, Australia is deeply indebted to its labour party. I went out to Australia with the natural prejudice of a British Conservative against the labour party. I understood that the advanced labour legislation was ruining Australian industries by its selfish and short-sighted policy; but after five years in Australia, during which I had the honour of the acquaintance of politicians of all sections of political opinion, I learnt to realize how much that party is misjudged. The industrial legislation is intensely democratic, but it is not wildly socialistic. We hear of the socialistic experiments, but not of points where Australia is conservative and has lagged behind ourselves. Its State railways were forced on it by geographical necessities. They had to be made quickly in order to open the mining fields, and they have had to be extended to develop territory, which will not pay for railway accommodation for years to come. The states have had to spend money on railways and country schools as a part of their land-settlement policy, and content to look for returns a generation ahead. No commercial company could be expected to build railways where it pays

* Kanaka labour continues in Queensland till the end of the present year, but the statistics show that the industry has not been killed by the imminent deportation of all the coloured labourers.

Australia to have built them. An Australian government will support a school for the family of two or three settlers, at a cost per child which seems wildly extravagant, because it knows that the best type of people will not settle in the back country unless they can get a fair education for their children. In most departments of State work the government is not especially socialistic. Where Australian legislation is more advanced than our own, is where the simpler conditions of Australia render it possible to do by law, what in Great Britain must be left to more elastic agreements between unions of employers and trades unions.

The fact that Australian industrial legislation is in some respects behind our own shows that the labour party has used its political power with moderation. Much of its energy has been devoted to legislation to secure the well-being of the Australian people, even at the cost of some unpopularity among its own supporters. The advanced temperance legislation was mainly carried by its insistence. At least in Victoria, to speak of the State I know best, educationalists find that proposals for the improvement of teaching in the State schools, for increased opportunities for technical and University education, and for the provisions of facilities for research and culture by libraries, museums, and picture-galleries find some of their warmest allies in the labour party.

G. *National Defence.*

Perhaps nothing has led the Australian democrats into greater disfavour than their views on military and naval defence. But the policy of training every man to the use of arms by military drill at school, the encouragement of cadet corps and rifle clubs, which has been recently recommended for this country by Lord Roberts, is the very system which the Australian liberal party has strenuously urged, and which Australia has for years endeavoured to adopt. In New Zealand, for example, it is laid down by the regulations of the Education Department (1904, p. 7) "that military drill must be taken by boys in every school in which there are twenty or more boys of twelve years or upwards, as provided in the regulations for public school cadet corps."

H. *Labour Costs in Australia.*

Successful manufacturing requires economic labour, and as Australia is a land of high wages and short shifts, it is not surprising that the view is sometimes held that it cannot compete against Europe with its low wages and long hours. We hear glowing descriptions of how rich Australia might be if she would only employ cheap coloured labour, which works with enthusiasm for one shilling or two a day under any conditions. The Australian workman will not accept these terms. He demands good wages, short hours, healthy conditions of work, reasonable precautions for safety, and sympathetic treatment. If the miner gets them, then he does his best to give his employer what, to use his own phrase, he calls a "fair thing." While mine-surveying in Australia, I had excellent opportunities of observing the miners at their work. I could hear the regular blows of their hammers, kept up steadily throughout their shift. The men insist upon a full length of time for their meals, but there is very little loitering when the foreman is away, and hustling in his presence. To see what the Australian miner regards as a "fair thing," let us look at a few figures. Take, *e.g.*, coal-mining, as in it the conditions are more uniform than with gold-mining, and the results can be more easily compared, field with field. The following table, quoted from Coghlan (*op. cit.*, p. 946), shows the output

AVERAGE COAL OUTPUT, 1893–1903.

	Tons raised per annum per miner.	Average value at pit's mouth. s. d.
Austria*	605*	6 3
New South Wales ...	565	6 5
United States	536	5 6
Germany	317	7 3
Great Britain	272	10 1
France	203	11 9
Belgium	174	13 5

in tons per miner per year, and the value, at which coal is produced at the pit's mouth. The Australian miner, during the ten years 1893–1904, turned out 565 tons per miner, at the cost of 6*s*. 5*d*. per ton, against 272 tons at 10*s*. 1*d*. per ton in Great Britain. The Australian miner produces more tons of coal per year than any other miner of black coal in the world, for the Austrian figures include brown coals, and so do not enter into the comparison.† The Australian miner in his eight hours' shift raises more than twice as much as the English miner in his ten hours' shift. The British miner has thinner seams; but even allowing for this difference, it is obvious from the above table that Australian coal-mining has not yet been ruined by its labour.

In gold-mining, the best standard is quartz-mining in Victoria. The following show the grade of Victorian gold from all the gold quartz mines of Victoria for the year 1903:—

Gippsland	15·3 dwt.
Beechworth	11·5 „
Maryborough	9·4 „
Castlemaine	9·3 „
Bendigo	9·1 „
Ararat and Stawell	7·0 „
Ballarat	6·9 „

* Includes Cretaceous lignite.

† The output from Great Britain for 1904 was 279 tons per miner, at the price of 7*s*. 2½*d*. per ton, and in Germany 248 tons at the price of 8*s*. 6⅝*d*. per ton.

If we take individual mining-fields in Victoria, the last report of the Mines Department of that State states that in the gold-fields of Ararat and Stawell the ore grade for the previous year was only 23*s.* 0½*d.*, and of Ballarat only 22*s.* 0½*d.*

The average yield of the gold ores of the whole of Victoria for the ten years 1894–1903 is shown in the following table; the ore value is calculated at 3*s.* 3½*d.* per dwt., which is the average for Victoria:—

	Average yield of ore * in dwts.	Average value. *s.*	*d.*
1894	8·3	27	4
1895	8·4	27	8
1896	9·7	31	11
1897	8·9	29	0
1898	9·1	29	11½
1899	9·5	31	3½
1900	8·8	29	0
1901	8·6	28	4
1902	9·0	29	7½
1903	9·0	29	7½
Average	8·93	29	4½

In Western Australia we learn the same lesson, although its mining has especial difficulties with its refractory ores, scarcity of fuel, and scanty water. At Kalgoorlie, all the water required by the mines has to be pumped from an artificial reservoir 350 miles distant, and 1245 feet lower.

The *Government Gazette* of December 15, 1905, gives the records for the previous October. The grade of the ore, comparing whole fields, ranges from 145·84*s.* per ton for the small yield from the remote mines of West Pilbarra, and 62·19*s.* from the 117,268 tons treated during the month in East Coolgardie. But the ore values fall in the lower-grade fields to—

Coolgardie	35·64*s.* per ton
Mount Margaret	28·31*s.* ,,
Lawlers	27·60*s.* ,,
Yilgarn	25·62*s.* ,,
Niagara	25·09*s.* ,,
Peak Hill	15·50*s.* ,,

Individual mines work still lower-grade ores; and the same number of the *Westralian Mining Statistics* † mentions, among small mines—

* 'Ann. Rep. Secretary for Mines for the year 1903. Victoria.' Melbourne, 1904, p. 16.

† "Mining Statistics, Western Australian Goldfields." Supplement to *Government Gazette*, No. 74, December 15, 1905.

Star of Freemantle	10 stamps	yield	6·83s.	per ton.
Transvaal, Greenmount	20 „	„	7·91s.	„
Phillips river	10 „	„	13·0s.	„
Queens Cross Leases, Coolgardie ...	10 „	„	7·0s.	„

Railway construction shows the same lessons. The cost of the first Australian railways was enormous, and adds heavily to the average cost of the lines; but the following, recent Victorian lines, on the wide gauge of 5 feet 3 inches, have been built at the cost of as low as £1420 to £2185 per mile,* although made by white labour through arid country, mostly covered with thick scrub.

	Length.	Average cost per mile.
	Miles.	£
Woomelang to Mildura	110·15	2185
Birchip to Woomelang	26·45	1420
Wycheproof to Sea Lake	47·89	1485
Quambatook to Ultima	30·31	1501
Dimboola to Jeparit	21·59	1834
Jeparit to Albacutya	18·47	1663

These remarkable economic achievements are due, not only to the skill of Australian engineers, but to the high efficiency of Australian labour; and when we see what Australia can do with white labour, we may congratulate her on the decision not to risk the introduction of coloured races. This policy may mean a slower growth, but it will probably mean the surer growth of a united, homogeneous people.

The fundamental plank in the democratic programme of Australia is the belief that a high average of character is the most important of national assets. The Australian points to the dangers in Europe from its submerged tenth, and the extremes of wealth and poverty. He urges that in America unrestrained individualism is leading to the same evils, and tends to engender a spirit of national selfishness. So he believes that Australia will be the happier and better in the end, if the country be so governed, as to secure a high average of comfort and character, rather than a few millionaires and a multitude of paupers. Here, say the Australian liberals, we have a continent with immense industrial resources, with a fine climate, a rich soil, and capable of producing food, clothing, and all things necessary for a great population. The vast trackless forests, the wastes of uncleared scrub, the low-grade ores, and the rich coalfields, are sources of wealth, from which every man willing to do an honest day's work should be able, for generations to come, to earn a fair day's wage. So they claim that it is the highest duty of Australian statesmen to develop a people, who will carry on the civilizing mission of our race in a manner worthy of

* 'Victorian Railways. Report of the Victorian Railways Commissioners for the Financial Year ending June 30, 1904.' Parl. Pap., Victoria, 1904, No. 32, pp. 30–31.

their unique opportunity. So they insist that every child must have a sound and stimulating education, and every town a good free library, and men must be employed under conditions which rouse an intelligent interest in their occupation, and leave ample time for rest and recreation.

I have tried briefly to indicate the motives that have inspired Australia, for the widespread misunderstanding of her policy seems to me deplorable, and to have, perhaps, possibilities of future trouble. For the typical Australian has not much formal religion. His real religion is his patriotic devotion to the empire; and it should be remembered that his loyalty is not only to the British Isles, but it is even more strongly, loyalty to the British spirit. Australia recognizes that the success of the British Empire has been due to our readiness to sacrifice immediate returns to ultimate benefit, and our comfort to our conscience. In an impulse of disinterested philanthropy, we squandered millions in the emancipation of the slaves of our empire. We burdened ourselves with a huge national debt in the struggle to save Europe from French militarism. We have built up our empire by the ungrudging sacrifice of our best blood and the expenditure of unstinted treasure. Australia believes that her choice of the harder of the two paths open to her, rather than risk ultimate injury to character, is in accordance with British traditions. The most serious chance of disagreement between Britain and Australia is that of our drifting into positions in which we appear to the Australians to have forfeited their allegiance by disloyalty to the national faith. Nothing else seems to me likely to wither the tie that binds us; for Australian attachment to the Empire is a deep-rooted, intimate sentiment. It brought her loyal to our side on the field of battle, where her efficient help stirred our national pride; and we may feel even prouder of her high economic triumphs, as they have been gained loyal to the noblest traditions of our race.

Before the reading of the paper, the PRESIDENT said: The author of 'The Great Rift Valley' needs no introduction to any audience in this country, and, indeed, Prof. Gregory's reputation as one of our most brilliant as well as one of our most active geographers and geologists has spread far beyond these islands. But I think it may be interesting if I recall to you a few of the leading points in his scientific career, and especially those where he has come into touch with our Royal Geographical Society. I shall not dwell upon his early travels for geological purposes in the Rocky mountains and elsewhere, but I will remind you that about twelve years ago he gave us here a most important contribution to our knowledge of the physical geography of British East Africa, based upon his notable journey to Mount Kenya and Lake Baringo, an expedition the more notable on account of the very slender resources with which Prof. Gregory carried it out. Not long after, he went as naturalist with the expedition which Sir Martin Conway took to Spitsbergen, and shortly after his return he read us a highly scientific paper on the plan of the Earth and its causes. We had hoped that Prof. Gregory might have been able to accompany our National Antarctic Expedition as the director of the civilian scientific staff, and it is no derogation from the merits of the geologist who actually went with that expedition if I say that the loss of Prof. Gregory's experience and insight could not be made good. Instead of going to the Antarctic with that expedition, Prof. Gregory accepted the Chair of Geology in the University of Melbourne, and, subsequently, the directorship of the Geological Survey of Victoria. He made one notable expedition to Lake Eyre, where he gathered materials upon which he has based some interesting conclusions as to the past history of the island continent. But during his residence in Australia he did not confine himself solely to geology; he paid a great deal of attention to the economic conditions of that country, and we may be sure that whatever a man of his calibre and his experience may have to say about the economic development of Australia will deserve our closest attention, and also full discussion after his paper, which I now invite him to read.

After the paper, the PRESIDENT: We are so fortunate as to have here to-night Sir John Forrest. I need hardly say that his name is well known to everybody who cares about the British Empire. Every one knows him by reputation as having been, after official employment of various kinds, the first Prime Minister of Western Australia when she became a self-governing colony. Every one knows he held that position until the Commonwealth was formed, and resigned it only to take office in the Commonwealth ministry, which he still holds. I believe he has held high official position for twenty-three years, with only a break of one year. But while all imperialists know Sir John Forrest by reputation in these capacities, there is another person even more interesting to us as geographers, and that is the youthful John Forrest of thirty to forty years ago. His is one of a small galaxy of names of men who broke through from the seaboard into the interior. There was his expedition in the search after Dr. Leichardt which, like the search after Dr. Livingstone, led to remarkable results. Then came his arduous journey from Perth to Adelaide round the great bight of Australia. Later on came his last and most daring expedition into the very heart of the continent. As the minister of to-day and the explorer of old, we shall be glad to hear anything that he may tell us about Australia.

Sir JOHN FORREST: I am afraid you have given me a somewhat difficult task in that you desire that I should tell you about my experience in days now long ago, and also that I should say a few words in regard to the address which we have been so fortunate as to listen to. I can only assure you that I am very glad indeed to be here in this hall again. I think it is thirty years since I was here, and I remember I gave an account to the meeting at that time of my last journey through Western Australia from Champion bay on the west coast to the overland telegraph line, which I struck about 700 miles north of Adelaide. Since that time many other explorers have crossed from east to west or from west to east; but no other explorer, either before or since, has done what I was fortunate enough to be able to do—that is, cross with horses only. Since that time camels have been introduced into the work of Australian exploration; and when I tell you that a horse wants water every day, at least, and a camel can go, under exceptional circumstances, nearly a month without water, you can well understand how much more difficult it was for us, in '69, '70, and '74, to penetrate into the interior of Australia than it has been for those who have followed in our footsteps. I have listened with very much pleasure to the lecture which we have heard from our friend Prof. Gregory, which he has divided into two parts. First of all, he told us a great deal about the physical conditions of Australia, and then he finished his address with matter that would have served well a politician. I must thank him for saying so many friendly words about Australia and about the intentions and desires of the Australian people. In regard to the matter of white Australia, I have never gone so far as to say that I should leave all the northern part of Australia unoccupied and waste (some people go that far) rather than have it developed by the employment of coloured labour. I have never gone that far, but I say this—that if white men can do the work, I shall do all in my power to encourage them to do it, and instead of their being any feeling in this country against Australia for desiring to keep that continent a white man's country, I think you should all rejoice. You should all rejoice that we are trying to build up in the southern hemisphere another place where our countrymen, the people of the United Kingdom here, may go and live and flourish, another England, another permanent home for our race in the southern hemisphere. When I visited, a few weeks ago, a portion of Syria—Jerusalem, the cradle of our faith—and I saw the result of nearly two thousand years of the civilization of a coloured race; when I saw an absolute absence of anything like comfort as we know of it; when I saw those people living under conditions which I hope will never prevail in Australia, then I thought to myself, I do rejoice, and I am sure the people of the mother-country ought to rejoice, that we are making an effort to preserve that continent of Australia for them. It is sometimes said that we in Australia are selfish, and that we are trying to keep the place all to ourselves. Well, I don't think that is so. We desire to see the place filled up with good sterling white British people. Even with the small number of four millions British people, we are doing a great work who are there already. We have an external trade—three-quarters of it with the British people—of £100,000,000 sterling a year, and we have a production from the soil, including the manufactures (which amount to £29,000,000 sterling a year, and are increasing) of £120,000,000 a year. Can you show me any other place in the world where so much is done, where such great figures can be shown for so small a number of people? There is no other place in the world where four millions of men, women, and children produce £120,000,000 of primary productions. And I am sure there is no other place in the world where four million people, including men, women, and children, have an external trade of £100,000,000 sterling a year. Well, I think that there is no reason to complain that we are not going ahead; every year we are progressing. At the present time, we are more prosperous than we ever were since Australia was founded, and if we have a few more good seasons—because a great deal depends upon the annual rainfall—well, then, perhaps we shall get "too big altogether for our boots." I do not know that I need say anything more; I did not come here with the intention of speaking, I came here with the intention of listening, and I have listened very attentively to the paper with the greatest pleasure, not the least interesting portions being those which might have been expected from one of the leading politicians of Australia rather than a learned Professor of Geology. It only shows you that Prof. Gregory has not been in Australia without keeping his eyes open, bringing his keen judgment and knowledge to bear, not only on our geology, but also on our social conditions. I am delighted to be here to-night, and to renew my acquaintance, after so many years, with the Royal Geographical Society. I was very closely connected with it in my youth, and I have every reason to be proud of the Geographical Society, because they were good enough to give me the greatest honour that they have the privilege of bestowing some thirty years ago. I have had a varied career, as my friend the President has told you. I have been fortunate enough, he says, to have been in office—I think he said for twenty-two years out of twenty-three. Well, that is a very long time indeed; but I will say this to you here to-night—that although many successes have been agreeable, and have given me, when I look back upon them, very much satisfaction, I am prouder of being a Gold Medalist of the Royal Geographical Society of London than I am of any other honour that I have ever received.

Sir Horace Tozer (Agent-General for Queensland): I am afraid I can only say a few words. The paper divides itself into two subjects, and one of those is intensely interesting to all Australians like myself, and it will be read with interest there, and will place on record many facts not hitherto understood. I certainly was delighted with it. In regard to the second part, I am precluded by my office from ever alluding to controversial politics in England; I cannot, therefore, say anything about them whatever. I am sorry to think that the professor was not able to visit the north-eastern parts of Australia—Mount Morgan, in the north particularly. I am perfectly sure he would have been able to give us a most interesting geological description of Mount Morgan. You cheered when you saw a picture of a mine, and knew that it only had a capital of £15,000 and returned £1,500,000 in dividends. Mount Morgan had not a single farthing capital, and has returned something like £7,500,000 in dividends. If he had gone there, it would have stimulated others to seek for discoveries of a similar character. I am very proud of the land of my birth, and I can only say that if Great Britain maintains the position she has established for all her colonies, of not interfering with them, they will remain as they have always been—the bonds of empire.

Mr. T. A. Coghlan (Agent-General for New South Wales): We have been so long accustomed to have thrown at us opinions so entirely different from those voiced by Prof. Gregory, and so completely unfavourable to Australian ideas and aspirations, that to hear the learned professor's views concerning our country is like inhaling a breath of fresh air in a close room. My object in addressing you is to support the professor's views on the economic aspect of Australian settlement, and to point out how Australia occupies a position essentially different from any other portion of the empire, or, indeed, any other country peopled by a white race. It stands out of the course of the great trade routes of the world, remote from Europe, from which it is removed thirty days' steaming. On the other hand, it is close to the teeming shores of Asia, being seven days from India, ten days from China, and eleven days from Japan, and along its northern coasts lie the great East Indian archipelagoes. The peculiarity of its isolated position makes the pressing problems Australia has to face in the development of settlement unique of their kind, and there can be scarcely any question that upon the right solution of these problems will depend its ultimate position among the people of the world. Other countries have been able, from analogies to be found in history, to gain some light on the perplexities of their progress; but this is denied to Australia, where the problems of its civilization must needs be approached one by one and solved experimentally. Australia, as it has been frequently said, is the outpost of white civilization in the East. It has no native difficulty such as that of South Africa, and its troubles in the matter of coloured population arise from its proximity to India and China, the Japanese element of the case being of a negligible quantity. What Australia sees very clearly is, that if it admits the Asiatic population freely, it will be speedily face to face with a difficulty at once economic, political, and ethical. Australia is so close to South-Eastern Asia that with unrestricted immigration it might easily find itself with a large Asiatic population out of all sympathy with Australian ideals, aliens in manners and religion, in sympathy and aspirations, with whom inter-marriage would be impossible, or, if possible, most harmful —a population to be defended in case of aggression, and useless and untrustworthy for the purposes of general defence. Apart from the question of morals, the chief

Australian objection to the Chinese is economical. He is a producer, and not a consumer. If the price of labour be determined by the cost of its maintenance or production, then the European, with his need for varied food, superior clothing, sanitary surroundings, comfortable lodgings and amusements, and like conditions for his wife and family, requires a much larger wage than does the Chinese worker, and in competition must go to the wall—a fate he is not likely to accept in Australia without a desperate struggle. The Australian has won from the wilderness comparative comfort and contentment, conditions which would be jeopardized to all except the wealthy by the indiscriminate introduction of the Chinese. The country most favoured by the partisans of black labour is the northern territory, where there is much fine land, and tropical produce grows in great profusion. But who would gain by its employment in the development of this territory? The bulk of the white population would certainly not be beneficially affected; but over and above all this, Australians argue that it has not yet been demonstrated that white men cannot work in the Australian tropics. The experience of other countries does not determine the question. What is true of Africa and America is not necessarily true of Australia, where it is found that occupation vastly improves the coast lands, from the point of view of health, malarial fevers retreating before the face of systematic cultivation. As regards work in the open, in what respect is the Chinese or Japanese more fitted by upbringing for work in a warm climate than is the native-born Australian? Taken as a whole, the climate of Japan is a cold one. At Hakodate the temperature of the coldest month averages 28°·3 Fahr., and at Tokio 36°·3 Fahr.; while the temperature of the hottest month is in one case 71°, and in the other 79°·9. Similarly in China, at Shanghai, in the centre of the coast, the average of the coldest month is 25°·7, and of summer 82°·6; while at Pekin the temperatures are 26°·6 and 79° respectively. Compare these temperatures with those of Sydney, where the average of the coldest month is 52°·3, and of the hottest 71°·5; or of Melbourne, where the average temperature of the coldest month is 47°·6, and of the hottest 66°·3. In any case, what is the urgency of the matter? Australia has the centuries before it. If its people now make the error of introducing Asiatics, the blunder will be fatal and irreparable, whereas the course of finding out by experiment what the white man can do in the tropics is obviously the one dictated by sanity and safety. The second point to which I should have wished to make reference is the oft-repeated statement that Australia is given over to socialism and all things socialistic, but to do so adequately I should have to pass beyond the limits of even economical geography. May I say that there is in Australia much more excuse for socialism than in this or in any other old country. In the early days of settlement in Australia, the Crown delegated to the governor such powers as made him the father and ruler of the state. Yet there was no talk of socialism in those days. The governor was not only the commandant of the settlement, but was patriarch and bread-provider of the struggling colony. He was dictator, chief justice, court of appeal, parliament, store-keeper, and census-taker. He journeyed from district to district of his little realm, questioned his people, admonished them as to their conduct, and carried back with him to headquarters the list of their grievances. He built their roads, their schools, their churches, their markets, regulated the price of their produce, distributed rations, and altogether his relations with his people were immediate and very personal. The conditions of Australia made Government intervention an absolute necessity, and the physical peculiarities of the country made settlement impossible except with the continued assistance of the Government. There are in Australia no large navigable rivers to convey merchandize to the interior; and railways were an original and urgent necessity of progress. Private enterprise was allowed to make an attempt to supply this want, but it failed disastrously; and if the country had waited for private enterprise for its development, it would still be without any proper means of communication. The principle of action adopted by the Australian states is that where any service is in the nature of a monopoly, it is best undertaken by the state or municipality. But even this very excellent doctrine is not by any means pushed to its logical conclusion. The adoption of the principle of state ownership of railways and of the great monopolies—water supply, sewerage, telegraphs, telephones, etc.—involved the creation of a public debt, inasmuch as no state is in a position—Great Britain any more than Australia—to undertake railway extension on a large scale out of ordinary revenue. Compared with the United Kingdom, Australia is very lightly burdened, the unproductive state and municipal or local debt being in each case—United Kingdom, £990,000,000, equal to £23 6*s.* per inhabitant; Australia, £45,000,000, equal to £11 9*s.* per inhabitant. In reality, therefore, the debt of Australia is proportionately much less than that of the United Kingdom, maugre all that is said to the contrary. Taking all forms of taxation on real property in Australia, it will be found that the total for the Commonwealth amounts to £3,833,579 on a capital value of £683,944,000, equivalent to 11*s.* 2*d.* per cent.; and as the net return from property in Auustralia is at least 5½ per cent., the burthen of taxation on property is equal to 2*s.* 1½*d.* in the £ of rental value. For this sum, the services of water and sewerage are included; excluding these services, the rate would not average more than 1*s.* 7*d.* in the £, the highest rated area in Australia not having, I believe, a greater burthen than 2*s.* 6*d.* It may be safely affirmed that the highest rate of district taxation ever proposed to any Australian Parliament does not reach to half the minimum now imposed in the most favoured districts in England. The aim and end of all land legislation in Australia, including that of land taxes, has been the settlement of the industrial population on the soil and the prevention of the accumulation of large estates. It is notorious that in many respects this legislation has not been successful, and the accumulation of large estates has gone on, and will continue to go on, so long as the holding of land in large areas is found to be profitable. In dealing with the question of the settlement of population on the land, Australia has had to solve its difficulties by experiments, and the various experiments which have been tried have all had the family resemblance of failing more or less in the object which they sought to attain. There has been the policy of granting land without payment; the sale of land in living areas to persons willing to develop such land; sales by auction; free selection after survey; free selection before survey; indiscriminate sales by auction; and leasing in one form or another,—all these methods have been but so many roads to the establishment of large estates, and all the Australian Governments have been forced to the conclusion that it is necessary, in order that the development of settlement shall not be further impeded, that the large estates shall be bought back from their owners and cut up for closer settlement. It would, of course, be contrary to our knowledge of human nature to expect that even this policy of cutting up estates will cure the greed for land that is everywhere a passion, and not less in Australia than elsewhere; but whether successful or not, there is a strong sentiment in Australia that the land question is the key to the solution of many social difficulties, and if such question were solved satisfactorily, much would be done to prevent the formation of an hereditary pauper class, which is so depressing a spectacle in this as in all other countries. This idea has been at the root of much of the recent land legislation of the Australian states as well as the determination of Australian statesmen to maintain the policy of a white Australia, and assure to the working classes a reasonable living wage. It is also the idea which is behind recent legislation in regard to friendly societies and savings-banks for those who are able to save, and old-age pensions for those whose lot in life and whose misfortunes have prevented them acquiring a competence sufficient to give some sort of ease to their declining years.

I may say it has afforded me the very greatest pleasure to listen to Prof. Gregory, and I am quite satisfied that his paper, whether it is appreciated in this country or not, will find in Australia the very warmest acceptance. He is most accurate, so far as I know, in all his facts, and the picture he draws of Australia is one which I very much welcome. I believe what he has said will do an enormous amount of good, because he comes to Australia as an unprejudiced spectator, with just the knowledge which well-informed men have. He studied our customs, he studied our occupations, and brought back with him a most favourable impression, and an impression which is most gratifying to us who are natives of that great continent.

The Hon. J. Greeley Jenkins (Agent-General, South Australia): I should be violating one of Australia's social laws were I to speak—the eight hours' principle. I do not wish to do that. However, for just a moment, I will take the opportunity of thanking the professor for the interesting paper that we have listened to to-night, and I would like to take the opportunity, also, of pointing to my friends, Sir John Forrest and Sir Horace Tozer, as two examples that Australian climate does not kill white men. Sir John passed from the dryest part through the hottest part of Australia. That was thirty years ago. Look at him now! If you have in this beautiful climate of England any brighter or more healthy specimen, in the language of the Americans I might say, "Trot him out." I am not going to dwell on anything in relation to foreign labour—that has been discussed in this country; but there was one remark made, either by the lecturer or one of the speakers, that, coming from Australia, I strongly emphasize; that is, we ought to have a fairly good idea of what we want for ourselves. All we ask is that we shall have the privilege of making our own laws.

The President: I feel sure that you will all join in a most hearty vote of thanks to Prof. Gregory for the admirable geographical paper he has given us, and also for the political additions to it, and that you will include in that vote of thanks Sir John Forrest and others who have given us so interesting a discussion upon Prof. Gregory's paper.

Prof. Gregory: I would like just to thank you very heartily for your kind vote of thanks, and especially for the kind remarks made by the President, Sir John Forrest, and the Agents-General. I am sure if my paper has had no other results than that of producing the valuable statistics of Mr. Coghlan, the trouble will be thoroughly repaid. I might remark that I think the final part of my paper was not so much political as economic. If it is not economic geography, I do not know what economic geography means. Unless one considers labour questions, it is impossible to estimate the value that can be made of the raw materials.

SOUTHERN PERU: NOTES ON TWO EXPEDITIONS.

By C. REGINALD ENOCK, F.R.G.S.

I. Regions of Sandia and Carabaya, and Lake Titicaca.

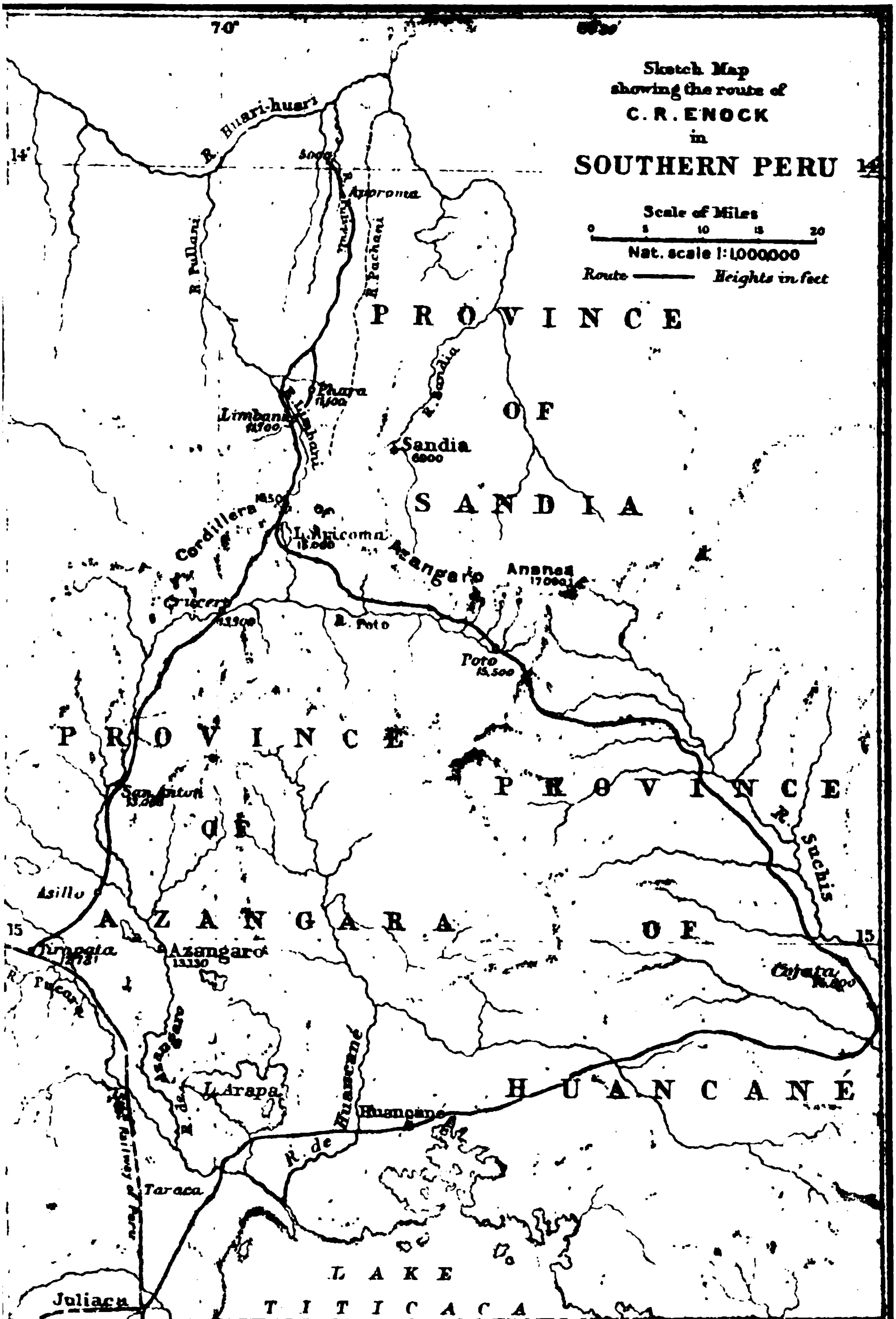
Early in August, 1904, I left Lima with the object of examining some ancient gold-mines in the interior of Peru, beyond the Andes, upon the headwaters of the river Inambari. The river is an affluent of the great Madre de Dios river, which forms part of the fluvial system draining the western portion of the watershed of the Amazonian basin, and which, rising in the Andes near the boundary of Peru with Bolivia, unites with the river Beni, and under the name of the river Madeira falls into the Amazon.

Three days' steaming from Callao brought me to the port of Mollendo, whence the southern railway of Peru, *viâ* Arequipa, took me to the station of Tirapata, a distance of 337 miles by train. The railway crosses the Andes at a height above sea-level of 14,666 feet at "Crucero Alto," and descends thence into the basin of Lake Titicaca. It then runs north-westerly to the station Sicuani, from which point con-

PEAK OF CORAPUNA.

struction work is now being carried out in order to complete the connection to the old Inca capital of Cuzco. Looking westward from the railway near the summit—Crucero Alto—a glimpse is obtained of the peak of Corapuna, of unknown height, but which, judging by its considerable ice-cap, must be of great elevation. The accompanying view is not taken from this point, however, but from much nearer the peak, on a subsequent journey.

The elevation of Tirapata, where I exchanged the train for the saddle, is 12,731 feet. It is surrounded by the vast stretches of flat land, or pampa, which extend north-westerly from the shore of Lake Titicaca along the Pucara and Azangaro rivers. Save at mid-day, when the sun shines strongly, the region is cold and bleak, and the air rarefied, due to the altitude. From the same cause cereals and alfalfa


Sketch Map
showing the route of
C. R. ENOCK
in
SOUTHERN PERU
Scale of Miles
0 5 10 15 20
Nat. scale 1:1,000,000
Route
Heights in feet
70°
14°
14
15
15
R. Huari-huari
R. Pullani
R. Pachani
Aporoma
PROVINCE OF SANDIA
R. Sandia
Sandia
6900
Phara
11,500
Limbani
11,700
Cordillera
L. Aricoma
15,000
Azangaro
Ananea
17000
Crucero
13,300
R. Poto
Poto
15,500
PROVINCE OF AZANGARA
San Anton
Asillo
Azangaro
13,130
R. Pucara
PROVINCE OF HUANCANÉ
R. Suchis
Cojata
15,500
L. Arapa
R. de Azangaro
R. de Huancané
Huancané
Taraca
Railway of Peru
Juliaca
LAKE TITICACA

do not flourish, and the chief product is that of potatoes, and the principal industry among the Indian inhabitants that of breeding alpacas and sheep for their wool, and llamas as beasts of burden.

The first three days of my journey was performed over a new road which had been constructed by an American mining company, and on the third night I arrived at the town of Crucero, 13,800 feet. From this point the road becomes very rough and broken, due to the steep ascent to the main summit of the Andes, known at that part of its course as the Cordillera of Azangaro. The name "Azangaro," I may mention in passing, is that of a town on the river of the same name, and is stated to be a corruption of a Quechua word meaning "the farthest away," and it is supposed to be the furthest westerly point—the Cordillera—dominated by the Inca *régime*.

The road crossing the summit skirts the shore of a large lake—Lake Aricoma—whose green and blue profundities reflected the peaks, covered with perpetual snow, which arise immediately upon its eastern verge, and whose glaciers give birth to the constant streams which feed it. The altitude of this beautiful lake is about 15,000 feet above sea-level, and the road ascends to about 16,500 feet shortly beyond, crossing a portion of the ice-cap. I again passed this point upon my return journey, and shall further speak of it. To the north-west are seen some of the snow-clad peaks of the Nevado de Vilcanota, a colossal range.

This summit of Aricoma marks the water-parting of the continent, the southern side forming that of the watershed of Titicaca, whilst the northern is that of the Amazonian basin. The usual Andian storm came on as I descended, and, pelted, battered, and soaked with rain and snow, arrived at nightfall at the village of Limbani, 11,700 feet altitude, and lodged at the house of the "gobernador." Here I met a Peruvian engineer, bound for the same place as myself, and we decided to make the journey in company to my objective point, known as "Aporoma," where the gold-mines are found.

Having overcome the difficulties and delays which are the invariable accompaniment of the organizing of an expedition in Peru, we set out in the early morning on the last day of August. The expedition included ten Indians, armed with machetes, etc., and carrying heavy packs consisting of our bedding, implements, and food for three weeks' journey, for the route lay through an uninhabited region where no supplies could be obtained. Nine of these Indians were the usual Cholos of the Sierra, whilst the tenth was a "Chuncho," of the—reputedly—cannibal tribe of that name, inhabiting the far interior of the Montaña. Nevertheless, the Chuncho, having come to the Sierra when comparatively young, had become somewhat civilized, and was, moreover, almost the only one among them who could speak or understand a little Spanish.

I had taken a consensus of opinion as to the route it would be necessary to traverse, and as a result decided to go on foot, a proceeding which I found to have been wise, as the trails were impossible in places for horses or mules. Our way lay at first along the river Limbani, and leaving this the trail wound up a long steep ridge to a height of 13,500 feet. The granite formation at Limbani had now changed to a slate, and gold-bearing quartz lodes are encountered in the region. Having crossed the high ridge, slowly and with frequent halts, for the rarefied air of that altitude renders walking fatiguing and the work upon the lungs severe, we descended the difficult zigzag and scarcely visible trail to a grass-covered valley below, and slept in a "tambo" upon the banks of a stream near a small Indian village known as Cutani. A "tambo" is a building which serves for the common accommodation of travellers, and a few of these huts—for they are nothing more—are maintained in one or two places in Peru by local authorities for that purpose, although unfortunately they are very scarce, notwithstanding that routes of travel often pass through uninhabited regions. Poor as was this tambo, its roof was waterproof, and there was some dry firewood inside, which ensured supper and a dry bed. For many subsequent nights these desirable adjuncts were only obtained with considerable difficulty, as, in order to sleep within a hut of any description, this had first to be constructed.

The progress of the party was, as regards actual leagues covered, relatively slow, for the Indian carriers were rather heavily laden, and my companion, moreover, was not a rapid pedestrian. I frequently found myself far in advance of the rest of the party, alone in those strange and untravelled solitudes of the Andes upon the border of the mysterious Montaña.

The descent of the eastern slope of the Andes is rapid, and the change of temperature as the traveller approaches the region of the forests very noticeable. At the end of the second day I found myself alone, following the trail along what appeared to be the back of a high sharp ridge, for the heavens were entirely obscured in a thick, warm mist, and the landscape entirely shut out from view. Looking through the bushes on either hand, it was apparent that the ground descended precipitously on both sides, and, indeed, on the right hand I could hear, as if far below, the murmur of running water. This I knew to be the river Pacchani, which rises in the Cordillera and empties in the Huari-huari, and so into the Inambari river, before mentioned.

The mist panoramas in these regions are remarkable at certain seasons, and the rains are heavy and continuous after mid-day. I sat down and waited for the rest of the party, and as soon as the Indians approached set them to work cutting boughs and building a shelter for the night on the only spot available—a small ledge of rock about 6 feet wide, with an abrupt precipice of some thousands of feet of sheer descent into the river below, and over which our feet almost hung as we lay down to sleep upon our blankets.

For two days more we pursued our journey, the rain pouring down upon us incessantly. The "trail," if by courtesy I may term it such, passed at times through a series of rock-basins worn in the slate, and progress was made through them as through a succession of "baths," for they were full of water from the rain. I made no pretence of keeping dry; it was impossible during the march, for, apart from the "baths" underfoot, the vegetation met overhead, and, being loaded with water, sent down its showers at every step. Impatient of the wearied Indian bearers, I carried a machete in my hand, and often was obliged to carve a way through the thick growth of the brushwood which covered the old trail, for we had now left the open slopes of the Cordillera and entered upon the upper edge of the Montaña, or region of forests.

The altitude at which this vegetation begins is from 10,000 to 11,000 feet above sea-level, and the line of demarcation is strongly noticeable. Above are the slopes and valleys of the "pajonales," or grass-covered areas, free of trees of any description, whilst below the traveller enters among thickets of tangled brushwood of all kinds, and in places of beautiful flowering shrubs. As he pursues his journey onward and downward palms and tree-ferns appear, the atmosphere becomes warmer, the mists lie heavier, and the silence is broken only by the patter and fall of the heavy water-drops from the boughs above. Scarcely a living thing appears to inhabit this upper fringe of the tropical Montaña. There are no monkeys, no snakes, no birds, and very few insects. An occasional puma is heard, and at times the swish of condorian wings in the ambient above; but nature here is in a changing phase, and her profusion of animal life seems to be reserved for the more tropical interior, still many leagues away towards the sunrise. At times the mists lifted for brief moments, and gave me glimpses of far-reaching tree-clad slopes divided by profound valleys, stretching away into the vast Amazonian basin. At a turn of the trail which brought me out upon the brow of a hill, I beheld a cascade on the opposing slope of a valley, a high white, lace-like fall among the green background of the branches, and I hailed it with satisfaction, for, from descriptions of the place, I knew it to be not far from the point of my destination. It forms the source of a small river, the Puli-puli, which runs close to the mines of Aporoma.

Difficult as the trail had been, it nevertheless bore witness to the considerable work which had at one time been carried on at these mines, for long portions of it were constructed of slabs of stone placed in the form of steps, and must have been made at considerable expense in the past centuries when the mines were worked, first by the Incas, and later by the Spaniards, for these latter did but work on a larger scale, in many cases, what the former had previously discovered and used.

At length, after more than four days on foot from Limbani, and sleeping and eating under difficulties, we arrived at Aporoma. It was already evening; the rain was falling heavily, as usual, and there was no habitation or living being in the vicinity, notwithstanding that in bygone ages it had been the scene of the activity of thousands of workers, and that a village had existed there. But after diligent search among the vegetation, in a spot which the Indian guide, with that strongly developed faculty for locality which his kind possesses, had stated as being the site of the former house near which he had worked

OLD GOLD WASHINGS OF APOROMA.

when a boy, the walls of a habitation were discovered. Animating all hands, I directed the clearing away of the heavy growth of vegetation which cumbered them, and within a couple of hours the interior was free; a durable roof, composed of strong branches covered deep with leaves and grass, was constructed upon the walls; our beds were arranged upon a floor-covering of aromatic boughs; and a fire was kindled in one corner, so that we were able to contemplate the coming night with something of equanimity. The altitude at this point was about 7200 feet; the temperature at 8 p.m., 46° Fahr., and at 3 p.m. in the afternoon, 60° Fahr.

The mines are worthy of a brief description. They consist of a large area, between the rivers Huayna, or Puli-puli, and Pacchani, of Tertiary gravel; the bed of an ancient river, upheaved by some eruptive action probably, and resting upon a bed-rock of clay-slate. As previously stated, they were worked many years ago as open placer mines. Conduits and sluices were constructed of stone, and tunnels through the gravel banks, and various other works, which in some ancient records are stated to have cost a sum equal to more than half a million pounds. Vast quantities of gold were extracted, and the old workings, very extensive, attest the activity which was displayed. A "grant" of six thousand Indians was "spent," it is stated, upon this work by a Spanish viceroy, and much of the gold extracted went to Spain. The "grant" of Indians principally left its bones in the vicinity of its toil; decimation of the population came about by rebellion, greed, and avarice, abandonment followed, and nature presently covered up the scarred evidences of man's transitory handiwork with her generous bores of flower and foliage.

I penetrated some leagues further into the Montaña, following the course of the river, and descended to an elevation of 5000 feet. The temperature here was much higher, due to the descent, and registered in the evening 69° Fahr. The hill-slopes and valleys are thickly covered with trees of comparatively small girth and height, and the existence of a few cedars marked the beginning of the region where these flourish. The country is exceedingly broken and difficult of access here, and the rivers are torrential and rapid. The geological formation is a slate, heavily charged with iron pyrites, and containing quartz.

Returning to Aporoma to finish my study of the mines, I was confronted with a strike of the Indians. The cause of this was the lack of provisions, which had given out. To gain a couple of days, we despatched those among them who were not absolutely necessary, and supplied the remainder with food from our own slim remaining stores. But at length I had to give the order to depart, for there remained nothing but rice and tea, and on this we were obliged to subsist for five days, under forced marches, in order to get out of the Montaña and return to Limbani.

The traveller has continually to observe the truth that misfortunes never come singly; and on the second day one of the Indian bearers, the Chuncho, disappeared, and left his baggage in the trail. As the other bearers were already overloaded, it was impossible to distribute his bundle among them, and, ordering a halt, I was obliged to have a selection made of articles which could be dispensed with most easily. I abandoned my travelling-cot and various articles of clothing, and my companion some of his instruments, whilst we reduced the number of our cooking-utensils to the lowest possible limit. The Chuncho we never saw again, and the Indians considered that he had gone to rejoin his tribe. As a tribute to aboriginal honesty, I may state that he took nothing away but his own things, notwithstanding that among the articles he carried were my saddle-bags, containing a sack of Peruvian and Bolivian silver dollars!

At the end of the third day our meagre rations of rice and tea were concluded, and we formed camp early, with the intention of making a long march on the morrow to the town of Phara, which was rather nearer than Limbani. A rude roof of branches was constructed, but, fortunately, the rain had held off during the return journey. The sky had been clear, but as evening fell the mists arose and formed one of those curious and weird transformation scenes such as the traveller in the Andes may witness. I find in my note-book the following description, written upon the spot:—

"The sun has set, but it still tinges the western sky with its beautiful and indescribable tints. The palest saffron fades into the pearly green of the zenith, and the last and orange rays, calm and cold, flash faintly and expiringly upwards. In and among the deep cañons of the stern and purple-green hills below, the fleecy cloud-masses of pearly vapour slowly pour, filling them with impalpable lakes, so soft, so pure, they seem the essence of the elements, spread for the couch of some unseen god-traveller. Below, wrapped in the shades of darkness, are those steep ways and cañons I have passed, leading from the far Montaña. But the mist-sea is rising, urged by some evening breeze—appalling masses, which break over dim distant peaks like awful billows. They rise slowly, surely, terribly, as if to engulf even the high point whereon I stand. But night is at hand, and even as they rise they are dispersed or covered by its sleepy pall. A single and glorious jewelled planet has dominated the eastern escarpment, and gleams softly down upon the closing scene."

We duly arrived at Phara, and breakfasted at the home of the "cura," and in return for his hospitality photographed the ancient church there. Within this building is an enormous altar composed of mirrors and brasswork, which latter was at one time covered with gold and silver. The point of interest about this altar was that it had originally belonged to the church at Aporoma, I was informed, which had stood in the village there, the vestiges of which, as I have described, are now buried under the dense vegetation—the growth of generations.

At Limbani I paid off the Indians, and, having with great difficulty secured mules, we again ascended the steep eastern slope of the Cordillera, and arrived at Aricoma, before described. The Indians gave themselves over to a carousal at Limbani, and I may here mention the evil effects which are being produced in the regions of the Cordillera by the abuse of alcohol among the indigenes. I have on some occasions had to waste several days in attempts to secure beasts and a guide in these interior towns, but, nevertheless, have met cavalcades of twenty or thirty mules or horses entering or leaving the place, and loaded with—what? Square tins of alcohol! This terrible stuff is alcohol of 40°, made from sugar-cane, and enormous quantities are consumed by the Indians, who will go to any lengths to obtain it. At times it is impossible to purchase a piece of bread in the native shops, or anything in the way of provisions, but, nevertheless, they are all replete with bottles of this "aguardiente," or rum. I have seen huts covered with the sides of the empty tins, and in one place the church is actually roofed with these tins! It is a lamentable state of affairs, and must lead to the diminution of the working population, but its remedy seems to lie only in the hands of the wealthy sugar-growers, who make the rum, and who are sometimes the legislators of the country.

The lake of Aricoma runs north and south, about 2 leagues in length. Its depth seems to be very considerable, as I have observed in many other similar lakes which are so remarkable a feature of the Cordillera of the Andes throughout its length. The existence of these numerous bodies of water, actually astride the summit of the mountain range, is a matter which arrests the attention of the engineer, and probably some day they will form a valuable source of hydraulic power.

Our journey was slow, for my companion was not a good horseman, and a heavy snowstorm overtook us upon the edge of the lake. Night was approaching, and the group of Indian huts we had expected to reach was still many miles distant. It was useless to proceed, and I called a halt. The only shelter was that afforded by the remaining walls of an ancient Inca ruin, and I formed a sort of tent by securing the corners of the sheets of my bedding into the interstices of the stonework with stones rammed in. Under this we arranged our couches, and made coffee over our spirit-lamp, afterwards obtaining a few hours' sleep, whilst the snow steadily piled up on our fragile roof. Notwithstanding the altitude—15,000 feet at this place—it was not very cold, the thermometer scarcely going down to freezing-point, which was fortunate.

Instead of returning over my original route, I had decided to extend my journey to include others of the auriferous regions of the provinces of Sandia. We therefore followed a south-easterly course along the tableland which forms a plateau below the snow-capped peaks at an altitude more or less equal to that already recorded, with the town and mines of Poto as our objective point.

The topographical and geological formation over this distance is remarkable. Our way lay principally along the bank of the Poto river which runs through extensive pampas or plateaus, as above stated, of auriferous glacial or alluvial drift. In many places the Indians work on the banks of the streams by the method known to them as "acochar," which consists in damming the water up in a small reservoir, and then allowing it suddenly to flow out and impinge against a bank or area of auriferous material, washing it down into a rude stone-paved sluice, where the gold is recovered. These auriferous pampas and banks, which cover distances of many leagues, are probably deposits formed by glacial action upon the gold-bearing slates and quartz of which the Cordillera is composed. The stones and material are not water-worn, as in alluvial gravel elsewhere, but are angular, and contained in an ashen-hued soil, carrying the gold. The pampas are strewn with boulders of white quartz for many leagues, which catch the rays of the sun. The more broken portions of the plateau and the lateral valleys are covered with pasture, and hundreds of thousands of head of sheep, llamas, and alpacas abound. I encountered large herds of vicuña, and quantities of geese, ducks, etc., upon the numerous small lakes. Some of these plateaus have probably been at a former epoch lake bottoms, and, indeed, I passed through remarkable formations, consisting of long "shores" of conglomerate, or indurated gravel, which stood up in vast cliffs underlaid by caves, and which latter were the home of thousands of "vizcachas," or native squirrels.

The town and mines of Poto are at an altitude above sea-level of nearly 16,000 feet. Very extensive mining has been carried out here by the Indians before and during the Spanish *régime*, by the method previously described of "acochar." There is at present a modern plant working by the "hydraulic" method, with water under pressure, upon an enormous moraine of gold-bearing detritus. The huge bank descends from the Cordillera of Ananea, above the line of perpetual snow, a few miles distant. There are also mines at Ananea, more than 17,000 feet elevation, and these workings are certainly among the highest on the globe. During my stay at Poto (in September) the thermometer registered generally 104° Fahr. at mid-day, in the sun, and 37°·4 Fahr. in the shade, by which it will be seen how considerable is the range of temperature due to heat of the sun and the rarefaction of the air. Nevertheless the cold is not intense even at the coldest season, although snow and rain storms are frequent and severe. Terrible thunderstorms occur, and the lightning continually strikes exposed points. I may here mention that the presence of electricity in the atmosphere, even at normal times, is very noticeable. The fur boas which one wears as protection against the wind, and one's clothing, "crackle" in a remarkable manner when the least friction is applied. The same effect is strongly produced in combing one's hair, and if it be done in the dark, sparks are observed to be produced by the friction of the comb.

Leaving Poto, I continued my journey alone, except for my Indian guide, still in a south-easterly direction, with the intention of skirting the northern end of Lake Titicaca, and arriving at the station of Juliaca, on the southern railway of Peru.

The country was entirely covered with freshly fallen snow. The temperature was like that of the breaking up of an English winter and the coming of spring, for the air was soft and mild in the early morning. Beautiful white cumulus cloud-masses against a glorious blue sky, with a bright sun, were reflected in the mirror-surfaces of the numerous small lakes I passed. Magnificent water-fowl swam upon these lakes, and I obtained one of them with a shot from my long-barrelled Colt's revolver—this not as a wanton taking of life, but that the bird would supply the scarcity of provisions I knew I should encounter on the morrow.

Bands of vicuña stared wonderingly as I passed, and one splendid fellow—a sentinel upon a knoll—is almost within reach of the revolver's range, so near that I am tempted to try a shot. But I might have saved my cartridge, for he and his ten companions are away like the wind, only to stop and utter their curious and plaintive, protesting or warning cry 300 yards away, where they stand gracefully and gaze at me.

Ever these glorious white, cloud-massed, cumulus columns, upward flung into the blue empyrean; ever these silent and virgin everlasting peaks of eternal snow, which I am paralleling, upon the Bolivian border, and whose mysterious cañons and violet snow-cornices blend from time to time with the fleecy mist-matter above them; ever this unbroken solitude, and the feeling of being upon the top of matter; and ever this extensive silence, undisturbed save by the cry of the "alcamarini" * or the vicuña. Strange and beautiful region, working out some function of the world's changes in the plan of Nature's ceaseless and inexplicable operations!

But the late afternoon advances, and a bitter wind arises from the snow-clad Cordillera and changes the aspect of all, and the sun has long since set, when, cold, hungry, and weary, I arrive at the town of Cojata. The industry of the people here is the breeding of alpacas, and the buying and selling of wood. Gold-mining is also carried out, and a considerable trade done with Bolivia in the "aguardiente," or rum, before spoken of. Cojata is very near the frontier-line of that country, which there consists of a small stream intersecting the pampa (part of the river Suchis). The vast glacial moraines of gold-bearing detritus are still a feature of the region, as are also the pampas of similar material; and there is no doubt that these provinces of Sandia and Carabaya form one of the most important auriferous regions in the world. The Bolivian and Peruvian Indians here speak nothing but their language of Aymará. They, men as well as women, wear their hair in long "trensas," or queues, like Chinamen, and they often have a distinctive dress and head-gear, highly ornate. Their principal diversion appears to be the consumption of aguardiente, accompanied or followed by a "jarania," or fandango. Physically, they are by no means an inferior race, and the women are often of fair height, robust, and not unattractive in appearance, save that they are unwashed. The altitude of Cojata is about 14,800 feet.

Leaving this point, the trail ascended an eminence, from which

* A white gull-like bird.

I got a faint and momentary view far to the south of the famous peak of Sorata (or Llampo) (23,600 feet altitude), in Bolivia. Passing now downwards and through areas of a remarkable rock-formation of hard white sandstone, lying in horizontal strata, the trail descends rapidly towards Lake Titicaca, and at every turn of the road I strained my eyes in search of its blue surface—my first approach thereto. At length I beheld it, still far off, and between the barren and rocky hills which I had to pass before reaching my halting-place—the town of Huancané. The first view of Titicaca was very beautiful.

From Huancané to Juliaca is a long day's ride, and, having secured a guide, I left before sunrise. The road lay at first through the lands cultivated by the Indians, and the swamps and marshes bordering upon the lake. These latter places are dangerous, and it was necessary to wade through a sheet of water, with my horse submerged to the saddle-

INDIAN HOUSES NEAR LAKE TITICACA.

bags. One may also cross by means of the curious "balsas," or rafts, which the Indians use for navigation, and which are constructed of masses of woven rushes. At one portion of the route the scenery is exceedingly picturesque. There are areas of yellow water-weed, from which numerous scarlet-feathered herons arise as the traveller passes. The tips of the white cordillera are reflected in the blue surface of the lakes, and the remarkable conical-shaped houses of the Indians give a character to the scene not found elsewhere in Peru. I examined some of these houses; they are square at the base, built in regular courses of adobe bricks. Each course is set in from the lower one, and thus the structure becomes a cone, curved in profile, and circular on plan in the upper portion.

After sundown the cold became intense, due to the bitter blast which swept across the plateau from the lake. The altitude of Titicaca is 12,578 feet above sea-level. My guide had brought me by a longer route than was necessary, and it was not until 9 p.m. that I drew rein upon my wearied horse before the station hotel at Juliaca, where I again enjoyed the luxuries of a good dinner and comfortable bed, after nearly two months' journeying in those interesting but inhospitable regions—inhospitable not as regards man, but nature.

As will have been seen, some of the portions of the country I traversed are very little known, and upon the verge of the "Montaña," uninhabited. The most easterly point at which I arrived, near the junction of the streams before mentioned with the Huari-huari, or Inambari river, is south-west of and only about 25 or 30 miles from the port Markham, on the navigable river Tambopata, a port named after the late President of the Royal Geographical Society, whose work and interest in the country are always gratefully remembered by Peruvians. I had desired to extend my journey to this river, but the circumstances already described rendered it impossible.

The region is one of vast possibilities, both as regards the auriferous plateaux and the zone of the Montaña, which is healthy, and capable of producing crops of any kind after clearing and cultivation shall have taken place. Roads, however, or branch railways must be built before much colonization can be brought about, and some advance is already being made in this respect. When the project of uniting the railway system of the Pacific with the navigable headwaters of the Amazonian fluvial ways is carried out, a beginning will have been made in the opening up of one of the most valuable portions of the Earth's surface.

II. Huancavelica and Adjoining Departments.

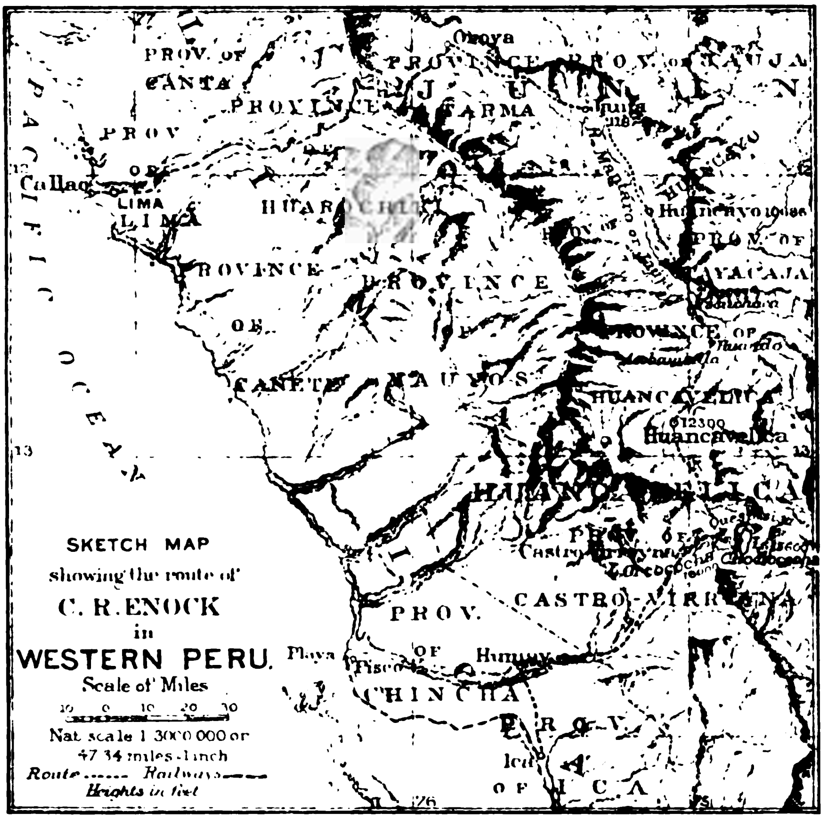
To reach the interior of Peru, and the rich mineral-bearing zone upon the eastern slope of the Andes, the traveller must, from the Pacific littoral, invariably cross the summit of the Cordillera, for this vast natural barrier runs parallel with the coast, and leaves no pass, speaking generally, at a less altitude than 14,000 or 15,000 feet above sea-level.*

The Department, or state of Huancavelica, which I visited in November, 1904, is one of the richest of the mineral-bearing regions of Peru, but it is difficult of access, due to its mountainous nature and to the fact that no roads, worthy of the name, have yet been constructed to give outlet to its products or communication with the coast. My way lay by the port of Pisco, about one day's steamer journey south of Callao, and past the town of Ica, a few miles from the port, with which it is connected by a railway. Ica is the centre of a fertile agricultural district, where cotton, sugar-cane, wine, brandy, etc., are produced. The crops here, like all those of the agricultural regions upon the coast zone, are grown under irrigation, for, as is well known, the whole of this vast stretch of continent, from Ecuador to Chile, is a

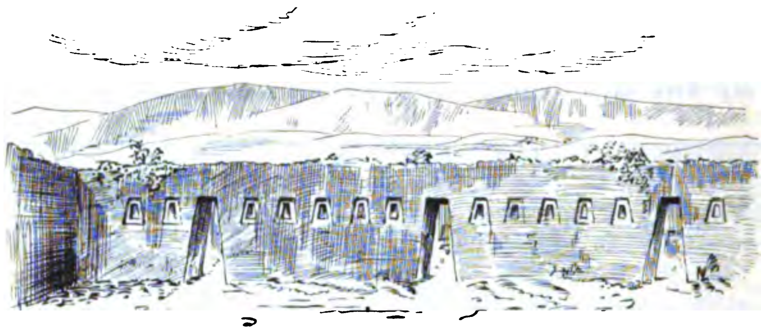
* There is an exception to this near Payta.—C. R. E.

rainless region. Vegetation exists by virtue of the streams of water descending the western slope of the Cordillera—streams which have their origin in the ceaseless thawing of the ice-cap, and the heavy rains of that lofty region. For the Andes, having deprived the western zone of its rainfall by reason of the climatic conditions brought about through its agency, has, in part, remedied the defect by giving origin to these torrential streams.

My first day's journey lay across the usual sterile desert zone



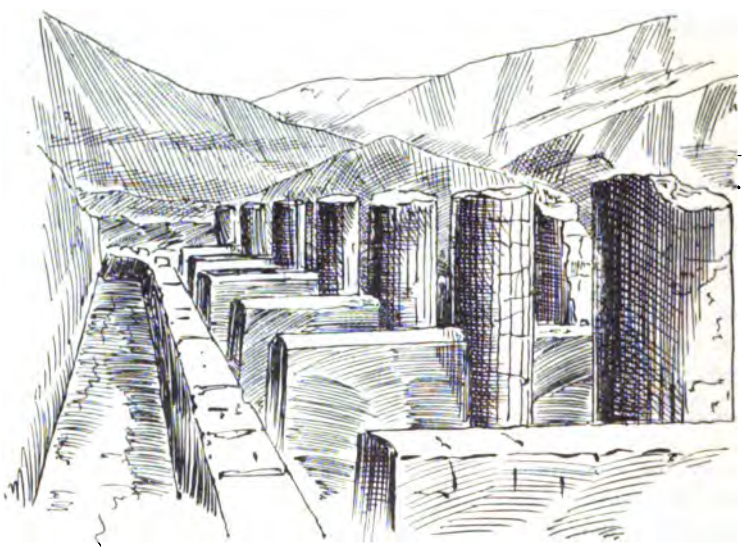
between the coast and the foothills of the Cordillera—deserts over which the wearied horseman toils from sunrise to sunset. There is a group of extensive Inca ruins upon the desert, which I examined in passing. The principal feature is a large courtyard some hundreds of feet in length and width, with a series of doorways opening therefrom. Between these doorways, which are symmetrically spaced, are niches, and both are of the tapering form so often seen in Inca architecture. A portion of one wall is shown in the accompanying sketch. The walls were of adobe and rough pieces of stone, the whole being made into a smooth surface with plaster formed of mud or clay. The general face of the walls has been coloured with red paints, and the niches with yellow paint or pigment. Parts of this colouring still remain, notwithstanding the centuries that have passed



INCA RUINS NEAR PISCO, PERU.

over it. The pigment may have been formed of iron oxides, or possibly vermillion from the cinnabar mines of the interior.

Regarding these ruins upon the coast zone, it has been a matter for observation that they are not built like those of the interior—of cut



RUINS OF INCAHUASSI. INTERIOR COLUMNS.

stone—and they still exist only by reason of the rainless climate and the climatic conditions, which tend towards exceedingly slow disintegration.

Whilst speaking of this immediate region, I may mention the ruins of "Incahuassi" (house of the Inca), which are found some 50 miles to the north-west of this point, near the coast also. They are chiefly interesting as showing the use of columns in Inca architecture, various writers upon Peru having asserted that columns were unknown, to those builders. They are shown in the accompanying sketch; they are 65 to 85 centimetres in diameter, and the ruins are stated by Señor Larrabure (an archæologist and late minister of foreign affairs in Peru), who visited them, to belong to the fifteenth century.

At nightfall I arrived at Humay, a hacienda upon the Pisco river, from which its extensive vineyards are irrigated. This place, although peaceful and picturesque, has not left a pleasant impression upon me, for during the night my room was invaded by swarms of mosquitoes, whose stinging was the cause, undoubtedly, of the "tercianas," or intermittent fever from which I suffered afterwards.

Upon leaving this point I knew little of the hardships I should be obliged to endure for the remaining four days of my journey to my destination. The road by which I had been directed passed through a portion of the country void of towns or villages, and consequently of food of any kind, notwithstanding that I had been informed that such was available. The arriero who conducted my pack-mule and served as guide was almost constantly drunk with aguardiente, and, as far as I could observe, took no other nourishment (!) during the last three days' travel. On two occasions I searched his saddle-bags and confiscated and destroyed the bottle of alcohol he carried, but he again obtained supplies of this from acquaintances among the Indian shepherds *en route*. These people were also drunk, even early in the morning, and there is no doubt that the effects of alcohol is beginning to ruin the inhabitants of these regions, as I have elsewhere observed. Due to the effects of the fever, I could not touch the coarse and scanty food of these shepherds' huts; at night the cold was intense, for we were now at a considerable altitude, and I had foolishly neglected to bring my cot or a mattress, desiring to travel rapidly without impedimenta.

There was nothing for it but to get out of the situation, and although I could scarcely mount my mule I was obliged to keep on, driving in front of me the drunken arriero and the pack-mule. Towards the close of the last day a violent attack of vomiting came on, and I fell rather than got down from the saddle, and lay upon the plain utterly exhausted. The altitude was 16,000 feet above sea-level, the air exceedingly rarefied, and a bitter blast swept across the plateau. I thought for some time that I should never rise again from the spot, and it was only by an effort of will that I did so. But I managed to swallow two or three spoonfuls of condensed milk, and, mounting with the aid of the arriero, who was now sober and penitent, I continued onward, and near midnight arrived at my objective point—Santa Inez.

Situated here are the silver-mines of Quespisisa, or Santa Inez, which have produced great quantities of that metal. They contain extensive bodies of ore, which will be made available upon further working. Hydrographically, the region is interesting also, for there are two large lakes of true Andean character here. The higher, known as Lake Orcococha, is 16,000 feet, and the lower, Lake Choclococha, 15,600 feet above sea-level. They are separated only by a distance of a few thousand yards, the upper being dammed up with a natural dam formed by a moraine of soil and gravel. A noteworthy feature of this lake-basin is that, although it is upon the western or Pacific side of the summits of the Andes it nevertheless is drained into the eastern or Amazonian watershed, by means of the river Pampas, which breaks through the Cordillera and so into the Apurimac river and headwaters of the Ucayali and Amazon. Close at hand, to the west, and at slight difference of elevation, are other smaller lakes, which give rise to the Pisco river flowing to the Pacific. Here, then, is another of those numerous instances which are met with in the Andes, where the water-parting of the continent is defined by a lake, a part of whose waters in times of abnormal flow may positively belong to the one or to the other of its adjoining watersheds. There is no fish-life within their waters, a common characteristic of the lakes in these high regions. Each is 5 or 6 miles in length and about 1½ in breadth; whilst at a depth of 250 feet, I was informed, bottom was not reached in the middle. Their blue surfaces reflect the snow-capped range to the east, but in the rainy season are lashed into fury by the terrific thunder-storms of this altitude.

The general rock-formation is a trap, whose terraced lines are seen far off upon the peaks, as they emerge from beneath the ice-cap. A remarkable peak of diorite stands solitary, not far from the lake-shore, and is known among the Indians by the name of Quispijahua, which means "the flower of glass." This name is due to its form, for at the summit it spreads out into almost a petal-like shape, a result partly of geological formation, and partly to its having been continually riven and split by lightning strokes. It is reverenced by the Indians, and legends have been woven around it.

The whole of this region, from Castrovirreyna on the west to Ayacucho on the east, is exceedingly rich in minerals, including silver, copper, gold, as well as salt, and in places coal, all of which, when the country becomes more known and opened up, will be valuable elements of industry. The highest elevation at which I arrived was 17,500 feet, just below the ice-cap.

After a sojourn of about two weeks in the neighbourhood, I continued my journey in a north-westerly direction. But my troubles were not yet over, for I was again attacked by the "tercianas," and rendered unable to go on. These intermittent fevers have the characteristic of quite suddenly depriving one of one's strength, and there was nothing for it but to give up the idea of reaching the next village and to sleep out upon the "puna," or plateau. Fortunately, the temperature fell but little below freezing-point. During the night the arriero—not the former one—let the mules escape, and was obliged to follow them, leaving me alone and unable to get up for the whole of the following day. The sun blazed down, and I was consumed with thirst, and nevertheless unable to reach the shimmering blue lake which lay within 100 yards of me! At length I beheld afar off an Indian approaching with some llamas, and I hailed him. But, after the manner of his kind, he was afraid, and, instead of coming towards me, he quickened his pace and soon disappeared. I suffered greatly from thirst, and with the sun and the fever was almost delirious, and still no sign of the arriero. I managed to reach my saddle-bags and took a mouthful of extract of coffee, which revived me a little, but what I wanted was water. Again I saw another Indian, towards the close of day, and as he came within hearing, I called him, not this time, however, in Spanish, which might have had the same effect as before, but in the few words of Quechua which I was able to employ. "Shami! yacu-t-apami!" ("Come here! bring some water!") I shouted; and the poor Indian, gathering probably some confidence from being addressed in his own tongue, came up to me, and, following my directions, brought me water from the lake. I rewarded him with a silver dollar, and he stayed by me until nightfall, when the arriero returned with other animals from the hacienda.

After a loss of various days I arrived at the city of Huancavelica, 14 leagues from Santa Inez, and which can be accomplished in one long day's hard riding. The country passed over was the usual treeless puna, alternating with lakes, swamps, rocks, and streams, and generally covered with grass, which gives pasturage for herds of cattle and sheep. The climate is exhilarating, and the views magnificent, and in the intervals when the fever did not trouble me, I enjoyed the ride and the unfolding landscape.

At Huancavelica are the famous quicksilver-mines, which are generally mentioned in all geological treatises. The history of the mines would fill a bulky volume. They were discovered in 1566, and were administered under a Spanish viceroy, and since that period have produced approximately 60,000 tons of mercury from the cinnabar ores, which exist in an enormous lode, or "farallon," to use the Spanish term. In 1786 bad work caused the mine to collapse, and it is stated that five hundred Indian miners remained entombed therein. Huancavelica was visited and described by both Bufon and Humboldt, as also Raimondi. I penetrated into some of the vast subterranean caverns which have been excavated to extract the ore, and made an examination of the general conditions of the region, in order to draw up a report thereon. The workings are about 2400 feet above the level of the cathedral and city of Huancavelica, which latter is at an elevation of 12,300 above sea-level. The Huancavelica river flows through the city, emptying lower down into the Mantaro, which in its turn falls into the Apurimac, before mentioned, and so into the fluvial system of the Ucayali and Amazon. The Mantaro river, almost alone of Peruvian rivers, runs in this part of its course to the south-east, or directly opposite to their general north-west direction, over nearly 3° of latitude to where its course abruptly changes near Huanta. The climate of Huancavelica is cold, but temperate. Alfalfa and cereals are not produced, owing to the altitude, and the principal industry is that of cattle, but was formerly, and some day must again become, mining. The general geological formation is limestone and sandstone, and hot springs occur, and are used as baths.

Leaving this remarkable place, my way lay across a lofty "puna," some thousands of feet above the town; for, notwithstanding the marvellous wealth in minerals that the region has produced, no road has been made beyond the primitive mule trail to the outside world. Such was the Spanish method of mining, from which no benefit accrued to the community, who toiled and died to enrich an arbitrary and distant monarch. The arms of Spain carved on the stone at the portals of the mine, with figures of saints, and ruined churches, are the principal remaining vestiges of this *régime*.

Descending rapidly from this plateau, the track passed into the valley below. The change from these dreary and inclement altitudes to the warmer climate of this valley was very agreeable, especially in my still weak state. The piercing wind gives place to a balmy breeze, and the dry grass of the puna changes to other vegetation. I pass a tree, and recollect "Thalaba and the Sledge"—

> "Behold! the signs of life appear,
> The first and single fir!"

It is not a fir; there are no firs on the Andes, but it is a real tree although a wind-beaten specimen, drawing its scanty nourishment from the rocky soil, and stretching its attenuated boughs athwart the path. A tree! the first I have seen for weeks. It has green leaves, and, moreover, a bird carols in its branches. A little lower down a patch of celandines and dandelions bring to my senses a waft as from England's lanes. Here, also, are glorious masses of yellow acacia, and other flowers and shrubs on either hand, through which my mule brushes as we descend. But what is this—this sweet familiar perfume which suddenly greets me? Familiar, although for the moment I cannot recognize it. I look about, and, behold! there it is—a low hawthorn bush in flower. Its leaves are somewhat different in form from those of English hawthorns, but there is no mistaking the well-known dark-green hue and glossy sheen of the leaves, nor the little white flowers and the sweet subtle perfume which carries the mind momentarily to another land. It is "may"!

I pass through the villages of Acobambilla and Huando, ascend and pass a high ridge, and again descend by steep and rapid zigzags down the sides of its cañon to the river Mantaro, or Jauja, before mentioned, and sleep at the town of Izcuchaca, 10 leagues of a broken, steep, and tortuous road from Huancavelica.

Izcuchaca is somewhat of a strategic point. A stone bridge crosses the river, and the place was generally promptly taken and held by various revolutionary forces in times past, as it commands the road to the interior of a large and important part of the country. I found the greatest difficulty in obtaining anything to eat along the whole of this route. The Indians are of a surly and suspicious character, and will sell absolutely nothing to the traveller. In Izcuchaca I had expected to find an inn and some comforts, but the place was dominated by a Chinaman, who was the "gobernador," as well as the owner of the inn. This individual, due to some caprice which I was unable to explain, absolutely denied me food and shelter, and even several Peruvians of respectable appearance who were standing by failed to offer such or indicate where it could be secured, notwithstanding that they knew I was a stranger, a traveller, and that night had fallen and a heavy rain set in. This is the only place in Peru where I have experienced such a lack of hospitality, and I retain an unpleasant impression of the place. But I found shelter at length in the hut of a humble but honest individual, who, moreover, obtained alfalfa for my animals, which was the most important, for they had eaten but little for several days. There was no food in the house, and it was too late to purchase anything in the place, and all that I and my arriero could obtain was a cup of weak tea and a piece of dry bread from my saddle-bags, the only food of which we partook until the following night upon arriving in Huancayo.

On the next morning at daybreak, I shook the dust off my feet of Izcuchaca. My road now lay along the bank of the rapid river for some distance. Leaving that I crossed another high ridge and plateau, and at length descended into the large and fertile plains of Jauja, and slept in a fairly comfortable inn within the important city of Huancayo, 13 leagues from my last stopping-place. This plain, through which runs the river Mantaro, or Jauja, that I had been more or less following, is one of the finest agricultural regions in Peru, and crops of every description are produced. Not far away are extensive and valuable mines of good coal, as well as of copper and silver.

From Huancayo to Jauja, my next day's journey, the road is flat, and passes through numerous towns and villages, which, with their cathedrals, squares, and trees, present a restful and old-world appearance. The altitude of Huancayo is 10,686 feet, and that of Jauja 11,874 feet, the distance between the two cities being 10 leagues. The small Indian shops all along this route seem to contain little but bottles of "aguardiente," or rum, and a great deal of drunkenness is encountered among the Indian labourers.

On the morrow I began my last day's journey in the saddle. The road left the pleasant valley and wound up on to a high, cold plateau. Fourteen leagues lay between Jauja and my objective point, Oroya, the terminus of the famous Oroya railway, where I should take the train for Lima. It is a remarkable thing that the inhabitants of Jauja and of the numerous towns of the valley have been content to live through the many years since that railway was constructed without making any attempt at a road for vehicles which would give them cheap and comfortable communications therewith. The existing trail is simply a track over the limestone strata, where the wearied pack-trains stumble ceaselessly, in the same condition almost as when the Andes were upraised from chaos. However, this is now being remedied by the construction of a branch railway from Oroya.

The altitude of the latter place, where I arrived in the late afternoon, is 12,178 feet above sea-level, and the railway thence rises at the summit of the Andes to the west to 15,642 feet, the highest in the world, and doubtless the only existing instance where the traveller is carried from the limit of the perpetual snow-cap to sea-level in a few hours. Near Oroya great activity is being displayed upon the Cerro de Pasco mines, which are said to be the largest copper deposits in the world.

The region which I traversed is but little known outside the country. It is embraced between the parallels of 11° and 14° S. lat., and 77° 10′ to 74° 45′ meridians west of Greenwich. It is a region of great resources, and will undoubtedly be the scene of an early development, for the dawn of an era of progress is upon the old empire of the Incas, awakening it from its years of stagnation, and giving it a place among the progressive nations of its hemisphere.

RECENT CHANGES IN THE COURSE OF THE LOWER EUPHRATES.

By H. W. CADOUX.

In the various descriptions which have been written during the last few years concerning the country which the so-called Baghdad or Persian Gulf railway is to pass through, there has been a somewhat marked absence of information about the country south of Baghdad which must be traversed by the railway to its ultimate destination on the Persian Gulf. The following notes of a journey made down the lower Euphrates from Baghdad in September, 1903, may therefore not be altogether devoid of interest.

Recent events have transpired in that portion of Chaldæa between Musseyib and Samawa which, besides being of the gravest local importance, are of general interest, throwing as they do a certain amount of light on the way in which large tracts of country, the scene of former activity and cultivation, come to be abandoned, and are to-day buried many feet deep in the sand of the desert.

Few people who have read Mr. Ellsworth Huntington's stirring description of the upper Euphrates in its headlong course through the gorges below Harput, or who have watched the powerful sweep of the middle Euphrates through the basalt-capped hills that hem it in at Halebohe, would recognize in the dry and sandy bed that now stretches from Musseyib to Samawa, the original course followed by these historic waters in their never-ending journey towards the sea.

From Baghdad to Musseyib on the Euphrates, the road, which goes almost due south, crosses a flat and in summer very dusty plain, scarred with the remains of many ancient irrigation canals, a few

FIG. 1.—EUPHRATES FLOWING BETWEEN BASALT-CAPPED HILLS AT HALEBIYE (HALEBCHE), 30 MILES NORTH-WEST OF DEIR-ES-ZORR, LOOKING NORTH.

of which are still utilized during flood-time. It is otherwise devoid of any special feature of geographical interest.

This main road from Baghdad to the pilgrim shrines west of the Euphrates crosses the river by the bridge of boats at Musseyib, hundreds of pilgrims passing over the river daily to Kerbela and Nejef. The river flows here in a broad placid stream 175 yards or so in width, with a maximum depth of 14 feet in the dry season. Its banks are from 8 to 14 feet in height, composed of alluvial sand of varying degrees of fineness and with little or no cohesion. This lack of cohesion has doubtless had considerable influence in bringing about changes in the lower parts of the river's course. The current during the dry season is about 1500 yards per hour, and this increases to quite 4 miles per hour during flood-time, when the river, swollen by the melting of the snows in the highlands of Turkey, rises to 10 feet above the low-season level.

A detailed account of the way in which the waters of the Euphrates have abandoned their original bed below Musseyib would be a long one, involving a good deal of local history. Briefly, the causes contributing to this unfortunate occurrence may be divided into those of a natural origin and those directly attributable to the hand of man.

The chief natural cause has been the gradual heightening of the bed and banks of the river above the level of the surrounding country by the silt and sand brought down, especially in flood-time. From almost time immemorial the waters of the Euphrates have escaped during the flood season to the lower country west of the river, forming large marshes, amongst others the Bahr Nejef. According to the unvarying account of natives who have visited the Bahr Nejef in recent years, a great part of it has dried up, and palm gardens are now planted in many places where its waters held sway. No doubt this is due, in a measure, to better drainage by the Hindiye canal, and also by a diminution of flood water from the Euphrates.

This formation of marshes in a direction roughly parallel to the rivers from which in flood-time they derive their waters, is a very noticeable feature in the country traversed by the lower Tigris and Euphrates. Their existence would seem to indicate that the rivers in question have, in the main, kept to their present beds for a time sufficiently long to allow the deposition of enough silt to raise them appreciably above the original plain through which they flowed.

The first blow dealt at the lower Euphrates was the opening of the Hindiye canal, the entrance to which has been changed a good many times, but always kept somewhere near Musseyib. Probably in its origin only an irrigation canal, it had attained a breadth of 85 yards twenty years ago, and to-day is some 200 yards broad in the same place. Its course being fairly straight and running along the

FIG. 2.—BROKEN BARRAGE AT MOUTH OF HINDIYE CANAL, 5 MILES BELOW MUSSEYIB. TO THE LEFT, HINDIYE; TO THE RIGHT, EUPHRATES, LOOKING NORTH-WEST.

FIG. 3.—BED OF EUPHRATES AT MAHNAWIE, BELOW THE BARRAGE, LOOKING WEST.

ground west of, and roughly parallel to, the Euphrates, the current of water is sufficient to not only keep the bed clear of silt, but to deepen it in places by scouring.

In order to save the country lying along the lower Euphrates between Musseyib and Samawa from the destruction which threatened it, the Turkish Government had a barrage built across the present mouth of the Hindiye canal 5½ miles below Musseyib. This raised the level of water in the Euphrates bed by 2 metres, causing a third of the total stream to pass slowly along the original bed, the remaining two-thirds finding their way down the Hindiye canal and eventually joining the Euphrates near the town of Samawa.

Amongst the causes attributable to human agency, and leading to the present disastrous condition of affairs, may be mentioned the irrigation methods adopted by the Arabs dwelling near the river from Hilla downwards. Noted for their lawless character, they have effectually resisted all attempts on the part of the Turkish Government to regulate the use of the river for agricultural purposes. By means of large canals, one of the most noted being the Daggara canal below Hilla, the Arabs have for many years past led away a very large proportion of the water to the low ground east of the Euphrates. Using a part of this water for their rice and grain-fields, they, with the improvidence which characterizes their daily life, allow a vast amount to run away into the marshes. This lessening of water in the river has had the effect of increasing the deposition of silt in the river-bed. The Arabs on the Euphrates below Divaniye, unable to irrigate their fields with this diminished stream of water, resort, during the months of June and July, to the building of "sukurs," or dams, across the bed of the river. The sukurs, which are composed of baskets filled with clay, faced with the same material, and protected in parts with matting, are put down in sets of three. The first sukur has a gap of about 8 feet, and the last down-stream three outlets of about a foot each. This artificial slowing down of the current must tend to increase the silting-up of the bed above the sukurs. Another factor not without importance is the great quantity of wind-borne

FIG. 4.—BED OF EUPHRATES AT ANANA, NEAR BABYLON. WORKMEN DEEPENING THE BED, LOOKING WEST.

sand deposited in the river when its transporting power has been reduced to a minimum.

The final *coup de grâce* was dealt by the breaking of the barrage at Musseyib in July, 1903, the immediate result of which was to leave the lower Euphrates river-bed dry for a distance of nearly 150 miles, the whole volume of water passing down the Hindiye canal. Only during the few weeks of high flood does a very limited amount of water find its way down to Hilla and the villages below, and it is doubtful whether any would find its way down as far as Samawa.

Such is the brief and sad history of a tract of country where for centuries stately palm trees waved their heads over the fertile waters flowing at their feet, and where sailing-craft with their burdens of grain and dates moved slowly down, praying that Allah would give them favourable winds to carry them without mishap to Basrah. A few more years under the conditions now obtaining, and the great Chaldæan plain will claim its victim. Of a once populous and cultivated area little will remain but a barren steppe, dotted with heaps of sand-covered ruins, where the desert robber will prowl by day and the jackal by night. Such is one phase of the river's influence in the history of man.

Our route from the Musseyib barrage to Hilla, where we arrived September 14, was *viâ* Mahnawie and mainly along the dry bed of the Euphrates. At Anana, not far from Babylon, a large number of Arabs under Turkish control were digging a channel about 20 inches deep in the river-bed, with a view to expediting the arrival of the water at Hilla as soon as the barrage was repaired.* The members of the German expedition carrying on excavations at Babylon were taking their drinking-water from holes dug near the river by their headquarters at Kweyrich.

Hilla presented a dismal appearance, its bridge of boats lying on the dry river-bed. Numerous holes were being dug in the deepest part of the bed for supplying the inhabitants and soldiers with drinking-water, which was found at an average depth of 3 feet.

Leaving Hilla, we travelled some 15 miles along the river-bed, passing by a number of palm groves and many villages, amongst others Dubla, Jerboa, and Heygan Saghir. From this point the palms ceased, and the banks generally assumed a less cultivated and prosperous appearance for the next 10 miles, being latterly dotted with a large number of fortified hamlets standing 200 to 300 yards apart. In many places large pools of water left in the depressions of the bed were slowly drying up under the intense heat of the sun. Some contained fish, which were often lying dead in an advanced state of decomposition on the edges of the shallower pools. At one large pool we came on a score or more of naked Arabs with conical fishing-baskets, busily engaged, with much shouting and laughter, in trying to catch the fish which dashed about in the muddy water in their efforts to escape. All along the way the universal cry that greeted us was "Ish wakt yeji mai?" ("When is the water coming?"), and the women would often come down the banks and run after us with ever the same question on their lips.

For the next 5 miles the river-banks, as well as the desert beyond, presented a more desolate appearance, many of the hamlets were deserted, and the fighting towers were beginning to show signs of decay. We were told that these mud towers with loopholes for

* It is hardly necessary to add that their expectations regarding the repairing of the barrage were not fulfilled.

fighting had been brought into use on this part of the river only during the last few years. The fortified hamlets of this and the preceding section were mainly inhabited by Daggara and Wisama Arabs, both of whom bear an unenviable reputation, the stopping and blackmailing of loaded craft having been one of their favourite occupations before navigation on the river ceased.

At a distance of about 30 miles by river from Hilla, we left the bed and rode southward across the desert to a hamlet belonging to the village of Jodare, and bordering on the river-banks. We were considerably impeded in our progress by a severe dust-storm, blowing from the south, and with some difficulty found, amid the many deserted

FIG. 5.—DESERTED HAMLET AND FIGHTING TOWER OF JODARE ON BANKS OF EUPHRATES, BETWEEN HILLA AND DIVANIYE, LOOKING SOUTH.

hamlets, one which was surrounded by a hedge, and bore signs of being inhabited. The Arabs occupying it showed considerable reluctance in responding to our call, but we were glad enough to eventually find shelter from the blinding dust-storm inside the square-loopholed tower, where they shut themselves up at night or in time of danger. The state of the country may be well judged from the fact that an Arab from another small village, whose services we had temporarily enlisted as guide, insisted on getting well away into the desert before we called out the occupants of the hamlet where we intended passing the night.

The following day, September 17, we journeyed on to Divaniye, keeping mostly to the desert road, which touches the river at points.

The nearer we approached Divaniye the more barren became the plain. The hamlets bordering the river were here and there occupied, but most of them seemed entirely deserted, and we were glad at last to catch sight of the palm groves of Divaniye through the dusty atmosphere.

The river-bed in this part has an average breadth of 90 to 95 yards, with banks between 13 to 16 feet high. The deepest part of the bed is almost invariably within 10 feet of the steep bank on the outside curves. Much tamarisk was growing on the inside curves. Divaniye looked even more forlorn than Hilla, and the bridge of boats, which in ordinary times gave it an appearance of importance, was lying ignominiously on the sand of the river-bed. From Divaniye to Samawa we followed the desert road for about 20 miles, to a small village on the river-bank, taking its name from the shrine of Imam Hamza, which stands in the desert about a mile to the west of the river. The country traversed between Divaniye and Imam Hamza was barren and sandy, the only vegetation visible being camel thorn, and a small desert plant with fleshy stems and leaves called by the Arabs "arid," and eaten by camels when nothing else is available. The hamlets along the river's edge, where we touched it, were nearly all abandoned, the inhabitants in most cases having trekked westwards towards the Hindiye, in order to find water for their cattle.

The desert just north of Imam Hamza was the nearest approach to the conventional desert that we had seen anywhere. Its surface, furrowed by the strong southerly wind that had been blowing for some time, was covered with miniature sand-dunes, and depicted a desolation that could almost be felt. Near the village of Imam Hamza the deposition of wind-borne sand in the river-bed was very marked, heaps of it between 18 to 30 inches in depth lying against the banks. It seemed, indeed, as if nature had turned her back on this unhappy river.

Below Imam Hamza the river-bed narrows down in some places to 40 to 50 yards, with banks over 18 feet in height. A further 14 miles by road, skirting the river, brought us to the small village of Abu Jowarir, where we passed a miserable night on the top of a mud parapet, tormented by sandflies, which were more vigorous and aggressive here than in any place we had yet seen. The desert south of Abu Jowarir towards Samawa loses its desolate appearance, and around the fortified village of Sheikh Tweyni we rode through some pieces of excellent pasturage. The ground was netted with both new and old irrigation canals. Below the village of Sheikh Tweyni we saw dari growing, the first we had seen since leaving Musseyib, and the broad expanse covered with its green leaves was a pleasant contrast to the barren country we had traversed on the previous day.

Samawa has the appearance of a prosperous Arab town. It has a large bazaar, and is visited by many Arabs from Nejd. According to the maps, Samawa stands on the Shatt-i-Ateshan, or lower end of the Hindiye canal, some 5 or 6 miles before its junction with the Euphrates. To-day, however, the whole of the Euphrates water, including that which was until this year carried down in the original bed of the Euphrates, passes Samawa, the junction of the lower end of the Hindiye with the Euphrates being above Samawa. We were unable to visit the actual junction, but careful inquiry of a number of men who frequented the river revealed the fact that boats formerly ascending the river for Divaniye and Hilla passed up the Hindiye above Samawa, and entered the old Euphrates bed some two hours' journey (5 or 6 miles) above the last-named town. This passage from

FIG. 6.—BED OF EUPHRATES NEAR IMAM HAMZA, SHOWING TWO MONTHS' DEPOSITION OF WIND-DRIVEN SAND AGAINST THE STEEP BANK, LOOKING NORTH-WEST.

the Euphrates to the Hindiye canal above Samawa would seem to have been formed since Colonel Chesney's expedition, although it may have existed then in the shape of an irrigation canal.

Our voyage from Samawa to Nasriye by boat was a pleasant relief after the dust and extreme heat of the journey from Musseyib. Below Samawa, the Euphrates flows in a broad turbid stream with a breadth varying from 60 to 120 yards, between banks of alluvium 7 to 14 feet in height. Lower down towards Nasriye it broadens considerably, being about 300 yards across in front of that town. On our way down we passed extensive fields of dari near the river. Beyond them the desert and its scrub vegetation held unbroken sway. Large herds of camels would come down occasionally to the river to drink, sometimes as many as a hundred animals at a time, the property of the powerful tribe of Montefig Arabs, who occupy the country south of the Euphrates here, but also pasture their flocks across the river.

Nasriye is destined to become an important town if the Baghdad railway extension to the Persian gulf is ever constructed along the course originally planned, *i.e.* crossing the river at Musseyib, passing Kerbela and Nejef, along the right bank of the Hindiye to Samawa, and the right bank of the Euphrates to Korna. Its position at the lower end of the Shatt-el-Gharraf makes it the natural centre for communication with the country lying between the Tigris and Euphrates, and it is, in addition, in the middle of a rich grain-producing country.

The Shatt-el-Gharraf (formerly marked on the maps as Shatt-el-Hai and Shatt-el-Amara, both names being now unknown locally, and never used) seems to have been originally a huge irrigation canal, which the spring floods from the Tigris have eroded, till in places along its course it averages over 75 yards in breadth, with banks of alluvial sand up to 18 feet in height. Commencing from the Tigris river opposite Kut, it runs southwards, passing the towns of Hai, Jelaat-sikker (corruption of Kalaat-es-sikker), and Shatra, dividing before it reaches the Euphrates into several channels, the principal one being near Nasriye. It is navigable along its whole length when the Tigris is in flood, and native craft pass up and down for a space of about four months during the year.

On our return journey from Nasriye, we rode along the Shatt-el-Gharraf to Kut, and thence along the Tigris to Baghdad. The country between Nasriye and Hai seems fairly prosperous, and there are many patches of cultivated ground along the edges of the Shatt el Gharraf. We saw here for the first time the use of long poles with a weight attached to one end, and supported on a pivot, used as in Egypt for drawing up water from the river by means of the bucket attached. The method used all along the Euphrates south of Musseyib is the "cherrid," or "kyart." This consists of a capacious leather bucket suspended over a bricked-in well, built in the river-bank, and having an inlet towards the river. The bucket is lowered into the well, and drawn out by a couple of oxen, to whose yoke the rope is attached, and who walk down an inclined plane dug in the ground so as to increase their pulling power.

From Kut to Baghdad the country away from the banks of the river Tigris is desert, dotted here and there with tepés and mounds, and furrowed with the remains of irrigation canals. There is the usual sparse vegetation, mainly camel thorn, and a species of dwarf mimosa, called "shokk;" but there is little that is beautiful in the desert in summer, except when the dull red glow which heralds the approach of sunrise grows brighter, and, touching everything with shafts of pink and golden light, makes for a few brief minutes a glorious picture out of the sand and earth of the wilderness.

GEOGRAPHICAL WORK OF THE GEOLOGICAL SURVEY OF CANADA, 1900–1905.

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SHORT summaries of the geographical work of the Geological Survey of Canada were published annually in the *Geographical Journal* until the time of the death of Dr. G. M. Dawson, the late Director of the Survey. The present article is intended as a continuation of those summaries, and gives concisely the geographical work accomplished by the staff of the Geological Survey of Canada during the years of the present century.

The work of the survey may be divided into exploratory surveys of the more inaccessible northern portions of Canada, and the more detailed work necessary for the production of regional sheet maps. These latter are produced either in the flat in the eastern provinces, or with contours in the mountainous portions of the west. The surveys for the production of sheet maps are confined to the more accessible portions of the Dominion, in or close to civilization where exploratory work has already been done; in consequence, no attention is here given to the geographical results of this part of the work beyond an enumeration of the number of sheet maps published during the time under consideration. The account of the exploratory surveys, for convenience, is given in order from west to east, starting with Yukon territory and extending to Hudson bay and the Arctic islands of the east.

Exploratory surveys of the Yukon river and of several of its large tributaries were made by Dawson, McConnell, and McEvoy in the later years of the last century, and in continuation of these McConnell, in 1900, examined the Stewart river, a large eastern branch, from its mouth to Fraser falls, 200 miles up-stream. The survey of the upper water of this river was completed by Keele in 1905, and a survey from its headwaters across to and down the Peele river, a large western tributary of the Mackenzie river, was made the same year by Camsell. A number of the smaller tributaries of the Yukon have also been explored, and similar work has been carried on near the Alaskan boundary to the westward of the Yukon. As a result of these explorations, a fair idea of the geography and geology of Yukon territory has been obtained as far north as the Porcupine branch, which heads within a few miles of the lower part of the Mackenzie river, and there remains only a comparatively small area between the mouth of the Mackenzie and northern Alaska at present unexplored.

The geographical work in British Columbia has been of a more detailed character, and has resulted in the production of several topographical sheets in the more important mining districts of that province. These surveys have been under the charge of Brock, Boyd, Leach, McEvoy, and Gwillam, and the sheet maps cover portions of Atlin district in the northern part of the province, with West Kootenay, Boundary Creek, Greenwood, Lardeau, and Rossland districts to the south of the main line of the Canadian Pacific railway: also the important Crow's Nest coalfields and other coal areas of the province. Examinations have also been made of restricted areas of portions of Vancouver and Queen Charlotte islands.

The exploratory trip of J. M. Bell and Camsell to the eastward of Great Bear lake has been the only one undertaken in Mackenzie district during the period under review. This exploration has been the subject of a paper already published in the *Geographical Journal.*

In the northern parts of Alberta and Saskatchewan, exploratory work was carried on by Camsell and J. M. Macoun, the former, in 1902, exploring the country west of Fort Smith on the Slave river, and extending northward from the Athabaska river to Great Slave lake; the latter, in 1903, examined the plateau country bordering the Peace river east of the Rocky mountains.

The exploratory surveys of McInnes, Dowling, O'Sullivan, and A. W. G. Wilson in Keewatin district have afforded much information concerning the country lying to the west of James bay, and includes the survey of the west shore of Hudson bay from Moose river to Cape Henrietta Maria, and from the mouth of the Winisk river to York Factory. These explorations also cover the country drained by the Severn, Winisk, Trout, Ekwan, Attawapiskat and Albany rivers, all draining into Hudson bay.

In northern Ontario and the western part of northern Quebec, the work of W. J. Wilson, O'Sullivan, McInnes, Parks, and Low has completed the surveys of many of the branches of the Albany, Moose, and Nottaway rivers, which empty into the southern part of James bay.

The *Neptune* expedition to Hudson bay and the Arctic islands, although primarily intended for political purposes, accomplished considerable geographical work. This included astronomically checked track surveys of the north-west coast of Hudson bay, from the mouth of Chesterfield inlet to the head of Wager inlet; the western coast of the southern half of Southampton island and the east shore of Ungava bay, from Cape Chidley to within a few miles of the mouth of George river. These surveys were made either with the ship's boats or with dog-sleds. Surveys were made from the ship of Fisher strait, between Southampton and Coats islands, the east side of Southampton island as far north as Seahorse point, the south coast of Hudson strait between Cape Wolstenholme and Douglas harbour, thus closing the gap in previous surveys. Along the north side of Salisbury island soundings of over 230 fathoms were made, showing the deepest water in Hudson strait. Tom island, in the north-west part of Hudson bay, and Griper shoal in Hudson strait, were found to be non-existent. To the north surveys were made in Cumberland gulf, Baffin bay, and Lancaster sound whenever the coast was seen, and these resulted in a number of corrections to the charts. Considerable attention was paid to the movement of ice and to the currents, which will be of value to the future navigation of Hudson bay.

The above briefly covers the purely exploratory work of the Geological Survey, but its geographical work includes the systematic mapping of the more accessible portions of Canada, and, as will be seen from the accompanying list, this work has been carried on continuously in the older provinces, resulting in the preparation and publication of sheet maps on scales from a mile to an inch upwards, of portions of Nova Scotia, New Brunswick, Quebec, Ontario, and British Columbia.

List of Maps issued by the Geological Survey of Canada during the past Five Years.

General maps	3
Yukon	7
British Columbia	9
North-West Territories	9
Ontario	16
Quebec	5
Hudson bay	4
Arctic	1
New Brunswick	2
Nova Scotia	33

The present rapid increase in the mining development of Canada is putting a heavy strain upon the staff of the Geological Survey, and, in consequence, few of its members can be allotted to exploratory work in fields distant from civilization; so that, for the present season, no purely exploratory work is being undertaken, nor can it be until there is an increase in the present staff.

THE RESULTS OF THE FOUREAU-LAMY MISSION.*

Physical Features.

The second and third parts of this work have now been completed (the first part having appeared in 1902), and form two large and beautifully illustrated volumes, full of the most valuable data for the geographer. M. Foureau confines himself to giving a very exact account of the observations—geographical, geological, and biological—made by the members of the mission, and does not attempt to formulate any generalizations grounded thereon. Nor does he draw any definite conclusions, which he feels would still be premature without further investigation, on any of the geographical problems of the Sahara; at the same time his observations will go far towards enabling others to arrive at some solution of these problems.

Setting out from Wargla, the mission had to cross first the great "dune" area of the "Grand Erg," the mass of which is exceedingly difficult to traverse owing to its compact form and the absence of any passes cutting right through its four main parallel ridges (the highest points reach 1000 feet and more). Especially striking in this region of a purely wind-formed relief, though M. Foureau feels it must impress the traveller in any part of the Sahara, is the evidence of the immense power of air-currents both as erosive agents and agents of construction; he therefore devotes some space to a consideration of the formation and character of the dunes. He finds that they are not moving, having been built up over a rocky base which holds them fast, but they are continuously growing and covering a larger area. That the growth is slow is due to constant changes in the direction of the wind, by which the amount of deposition is limited. Under these changing currents, also, the superficial forms of the sandhills are continually altering, the crest-line taking different shapes, though its general direction is constant. New dunes are in process of formation, and small hills may be seen cutting right across an ancient track which can be clearly traced on either side of them. The sand has a large admixture of quartz with a calcareous cement; these are the chief destructive elements in the wind-carried material, and, as they are not lifted much above the ground, the greatest amount of "grinding" work is done near the base of the heights, producing the frequent steep slopes. Beyond the southern foot of the dune region the rocky plateau of the Hammada of Tinghert rises in a gentle slope, dropping about 250 feet in a steep escarpment to the south-west, below which lies the Wad Ohanet (or Jua), joining the great Wad Igharghar to the westward—the one easy route across the Tinghert plateau. This plateau is oriented south-west and north-east, as is the Grand Erg and the other main feature-lines of the Sahara, and is mainly composed of rocks of the Upper Cretaceous series, the escarpment being dolomite. A smaller region of sandhills (Erg d'Issawan) separates this from the next plateau of Tassili. These dunes rest, in the northern part, on a platform of calcareous sandstone, very friable, and in the south on a ferruginous sandstone of Devonian age, while in the central area a belt of Carboniferous rocks, about 625 miles long, extends in a north-west to south-easterly direction, outcropping at various points along this line. The massif of Tassili stretches from Amgid on the banks of Igharghar as far as Ghat, and has an orientation approaching north and south, with two successive lines of escarpment to the east. It is crossed only by a few goat-tracks, and is far from being easy to traverse.

* Foureau, F., 'Documents scientifiques de la Mission Saharienne' (Publication de la Société de Géographie). 3 *volumes and* 1 *book of maps*. Paris: Masson & Cie. 1905.

The Devonian sandstone of which it is composed has been carved into rugged and fantastic shapes; a mass of turretted heights and sharp peaks reaching 4800 feet, and forming an impressive spectacle. South of Tassili the igneous region of the Central Sahara begins in the lava and basaltic plateaux of Adrar and Anahef, the former with hills of sandstone and diabase, and the latter strewn with *débris* and mamelons of granite, quartz, mica-schist, and gneiss.

M. Foureau's investigations have shown him that the divide between the Atlantic and Mediterranean drainage is along this plateau of Adrar, considerably further south than has hitherto been supposed, and thus the Wad Afara and other valleys south of the Tassili escarpment drain to the north instead of to the south. From Anahef southwards to the mountains of Aïr stretches the great desolate plain of Tiniri, almost entirely covered with blocks of granite, crossed by some low rounded granite hills, and destitute of all vegetation. Aïr is a somewhat confused mass of chains, with a varying orientation, largely composed of granite and gneiss, the average height of the plateau being about 2000 feet, the crests of the main ranges 1500 feet above that level, and the chief peaks as much as 5800 feet, their sharp outlines showing evidence of great erosion.

The question of the drainage of Aïr is not yet completely worked out. Are its wadis all affluents of Tafassasset, the great artery of the Atlantic system? M. Foureau does not think this likely, but reserves opinion till further investigation has been made. It is always extremely difficult to trace out the courses of the rivers after they leave the mountains and open out on the plains, and this is especially so in Aïr, and the present mission did not pursue these thalwegs far enough to decide their ultimate destination. With regard to the upper course of the great Wadi Tafassasset, M. Foureau confirms, with a few minor exceptions, the opinion of Duveyrier—the first to map this region in any detail—as to the position of the three large branches which join at Assiu, taking thence a direction south-south-west. Having collected the drainage of the southern Sahara, it is presumable that this river, under the name of Tamanghasset, passes west, north of Sokoto to the Niger. But, again, this interesting and important problem remains to be solved. After the floods caused by the infrequent storms of the Sahara, which occur every four or six years, pools of water are left standing for longer or shorter periods, according to the nature of the soil in the beds. The people of the country report that the water remains sometimes for over a year, and that the supply underground in these depressions is practically perennial, existing for three years after a flood. But, as M. Foureau says, these people are "les rois de l'emphase"!

The plateaux of Tagama and Damergu, which terminate the plain of Agades south of Aïr, are flat uninteresting levels of sandstone with clay belts, the clay being covered in parts of Damergu with laterite. Such relief as does exist consists of low lines of hills of granite and quartzite, as those which surround the town of Zinder. There is little more diversity in the country passing from here to Chad, the only rock exposed amongst the sand being laterite. Nearing the lake, the monotony is broken by the two or three lines of woody hills which surround its margin beyond the reed belt, and mark the outside limit of high water-level. M. Foureau does not consider that the fluctuations in the level of the lake are very great, and estimates the extreme difference as 4 feet, while in many years Chad does not reach its highest flood-level, and he has no doubt that, like the other great lakes of the world, it is passing through a period of retrogression owing to a diminution in the general volume of rainfall. He finds no evidence to support the theory advanced by Nachtigal that Chad is shifting towards the north and west; in fact, M. Foureau travelled round the lake with the map made by Barth fifty years ago in his hand, and found every curve and bend of the shore-line exactly as then delineated. Further, the little fishing villages on the western bank are the same distance from the water as indicated by the latter traveller, and have occupied the same position from the times of the earliest European explorers. The eastern shores of Lake Chad are, as M. Foureau observed, higher than those on the west by 40 feet or so, indicating that the general slope of the plateau is from east to west, and if, as he is fully convinced, this has always been so, the stream of the now dry Bahr-el-Ghazal must have drained into, not out of, the lake. On this disputed question, therefore, M. Foureau again joins issue with Nachtigal, who held, on the contrary, that the original drainage of the country was northwards, but a rapid rising of the land in its northern part had changed the direction—a contention rather subversive of his other theory of the advance of Chad to the north!

The course of the upper Shari is not yet fully established. M. Foureau's observations lead him to agree with those who consider the Bahr Sara the true headwaters of that river, and not the Gribingi or Bamingi, for, though the latter flow in the same direction as the Shari after the confluence, the former is about 60 miles longer, and, coming from a region of heavier rainfall than, for example, the steppes, which the Bamingi traverses, brings down a greater volume of water. The banks of the Shari and Gribingi are sandy, with hard clay or laterite interbedded, usually horizontal, but sometimes tilted till the latter rock is exposed at the surface, a fact that may be noticed at once by the absence of vegetation due to the lack of soil. The clays are formed by the decomposition of the underlying granite, and a series of low granite hills approach the river-banks, while the same rock causes frequent rapids in the stream.

It will be seen that sedimentary rocks play but a small part in that region of the Sahara traversed by the Foureau-Lamy mission. They are almost confined to siliceous sandstones of two types. One of Devonian age, found in the north in Tassili, with a great quantity of quartz and very metalliferous, and the other of uncertain age and more homogeneous in composition, found in Tagama and Damergu. Crystalline rocks cover the greater part of the country from Tassili to Chad, and these belong to many types, from the most acid (mica-schists, etc.) to the basic (gneiss, hornblende, etc.).

Vegetation and Cultivation.

We find in these "documents" some interesting facts about the distribution of vegetation in the Sahara. In the sandy desert the amount of plant-life is greatest on the slopes of the dunes exposed to the east, while the density of vegetation is in inverse ratio to the number of valleys and depressions. Unbroken compact dunes are well clothed with scrub on their lower slopes; but among the more broken sandhills, where the depressions serve to drain off the moisture, the vegetation is only in patches. It is interesting to note that, though as a rule the higher parts of the dunes are bare, there is a small region in the north of Erg Issawan where they are covered with vegetation to their summits. On the rocky plateau the scanty growth is confined to the river-courses, and it is not till the plain of Agades, south of Aïr, is reached that trees begin to be generally distributed over the country. The vegetation in Aïr is indeed richer and taller than in Tinghert or Tassili, owing to the amount of soil brought down by the rivers, which covers the "thalweg" and preserves some underground water. The *Acacia arabica* appears here for the first time, and is the best and largest of the various gum-trees of Aïr. But it is when general cultivation becomes possible that the scene really changes, and the true desert appearance is lost. This is in

Damergu, which not only supplies its own comparatively dense population, but is also the granary of Aïr, and even sends grain to Ghat. Millet and sorghum are cultivated over a large portion of the surface, and where pools of water occur cotton is planted. The above two cereals form the chief crops in Bornu also, and though a little wheat and barley is grown, it is not important. Date palms are cultivated in the more favourable spots, and round Zinder yield two crops a year. Near Chad the baobab, which becomes important on the great savanas of the Shari plateau, first appears, though here only a dwarf species.

INHABITANTS.

M. Foureau gives a minute account of all he has observed and gathered with regard to the people of the Sahara, but his remarks are, as he says, more of the nature of detached notes than a connected story. It is difficult, therefore, to single out any particular points in these interesting descriptions, but they illustrate clearly the fact that, though a certain difficulty of living will induce energy and enterprise, and have a beneficial effect on character, there is a line beyond which the struggle for existence is too hard to allow any such development. This is the conditions of the Tuaregs of the north—a life of misery and frequent and always possible starvation; at the best a diet of milk and such grasses as exist in the sand, as well as a state of constant "offence and defence" as regards other groups of people. But in Aïr the richer vegetation, allowing the keeping of cows and some horses (as well as goats and camels), and the possibility of a small amount of cultivation, added to the nearness of the grain market of Damergu, make life a better thing, and there is some definite organization. A regular "traushumance" takes place between Aïr and Damergu, which takes on something of commercial character. The Tuaregs move south from Aïr for the dry season in June and July, taking with them the salt from Bilma which they have collected for the purpose, for distribution in the Sudan, and bringing back on their return for the wet season to Aïr in November, the wheat, rice, and other commodities of the south.

Reviewing the possibilities of development in the Sahara, M. Foureau gives a decided opinion that very little more can be done, even in the south, in the way of agriculture. The yield of the crops could doubtless be increased in Damergou, but millet and sorghum are the only grains that can be grown, and these will not bear long transportation, and therefore a surplus production beyond the needs of the inhabitants would be of no use. But in the development of its mineral potentialities may lie a rich future for the desert, and M. Foureau considers it quite worth while for France to undertake the work of systematic prospecting.

REVIEWS.

ASIA.

THE MALAY PENINSULA.

'Die Inlandstämme der Malayischen Halbinsel.' Von Dr. Rudolf Martin. Jena: G. Fischer. 1905.

THIS monumental work marks, or perhaps one should say makes, an epoch in the study of the subject to which it is devoted. What has hitherto been written about the wild tribes of the Malay Peninsula amounts, indeed, to a considerable bulk; but most of it lies scattered through the back numbers of various periodical publications and in casual notices contained in books of travel, and the like, so that it is not easily accessible. Here we have the first attempt ever made to put together in monograph form an adequate account of these races, based partly on a critical survey of the older authorities, partly on the writer's own observations made during a journey specially undertaken for that purpose.

The point of view is in the main anthropological, and a large part of the work consists of a detailed analysis and comparison of measurements made upon the bodies of representative individuals and the rather limited number of skulls and skeletons available. But this is by no means all; the technically anthropological part is preceded by a section dealing briefly with the geography, geology, climatology, flora, fauna, prehistoric remains, and historic development of the peninsula (this last being traced in outline from the earliest times to the present day). The progress of exploration and research in relation to these tribes is then reviewed in detail, the various names under which they have been known are discussed, and the geographical distribution of the tribes is explained. Though here and there subject to correction in matters of secondary importance, this part of the work has been very well done, and displays exceptional mastery of the subject. It has evidently involved a vast amount of research, for the authorities referred to are very numerous, and often of a very special and out-of-the-way character.

The third section of the book deals, under the name of "Ergologie," with the mode of life of these aborigines. Their dwellings, clothing and ornaments, food-supply, methods of hunting, tools and utensils, decorative art, social organization, habits and customs, religious beliefs and superstitions receive detailed and critical treatment. There is also a short chapter on their languages. Particularly good is the account of their decorative art, a subject which has hitherto been much misunderstood. A previous explorer, misled apparently by his own preconceptions and his inadequate knowledge of the vernacular, had evolved a most elaborate symbolic explanation of the designs with which these simple savages decorate their various utensils; the author of the work now under review does good service in showing the baselessness of the whole theory. The fact is that these tribes are amongst the most primitive specimens of the human race. Living as they do in a country of thick and almost impenetrable forests (a circumstance to which, without doubt, they owe their survival, in spite of the stronger races that surround them), they are still, for the most part, in what may be called the Bamboo Age. Most of their utensils are made (and very ingeniously made) from this and other trees. Such pottery and metal tools as they possess have been acquired by barter from surrounding races of higher development, and, although neolithic tools have been found in the peninsula in considerable numbers, it is very doubtful whether they were made or even used by the ancestors of these wild tribes. Their whole social organization and mode of life testify to their simplicity of character—a simplicity which is accompanied by honesty, gentleness, and a high standard of morality in general, that have called forth the sympathetic comments of every European traveller who has come into contact with them.

The work closes with a chapter summarizing the conclusions at which the author arrives. Briefly, there are three distinct types among the aborigines here dealt with. In the north of the peninsula the woolly-haired Negritos, in the south a straight-haired type representing a primitive Malayan race, and, most important of all, in the centre a wavy-haired race bearing a considerable resemblance to the Veddas of Ceylon, the Toálas of Celebes, and a number of more or less uncivilized tribes in Central and Eastern Indo-China. In most of the extensive literature relating to the subject, these types have hitherto been hopelessly jumbled up together; even the most recent works, *e.g.* Annandale and Robinson's 'Fasciculi

Malayenses' (not to mention popular works such as 'Living Races of Mankind'), fail to distinguish the wavy-haired type from the other two, or treat it as a cross between the Negrito and some other race. It is the peculiar merit of the present work that it definitely establishes the independent existence of this type, and foreshadows the probability that it may eventually be linked up with other dispersed fragments of a similar type in India and Ceylon, Indo-China, and the Eastern Archipelago.

There are still plenty of knotty points left to unravel. How is it, for instance, that the Negritos and the wavy-haired Sakai (or Sĕnoi, as the author prefers to call them), though distinct races inhabiting different but adjoining districts, nevertheless speak dialects of a common tongue, and one that has its nearest allies right in the heart of Southern Indo-China? The author does not profess to deal with the linguistic problems which these tribes present, and some of his "ergological" conclusions may require to be reconsidered in the light of the linguistic evidence. For instance, his contention that the primitive agriculture practised by some of these tribes has been borrowed from their Malay neighbours, cannot be reconciled with the fact that some of the words relating thereto are of undoubtedly Indo-Chinese affinity.

The book contains a very full bibliography, and, though it has no index, the want of one is to some extent made good by a very detailed table of contents. The illustrations, nearly all from the author's own photographs, are numerous and of really superlative excellence; and altogether the book is a first-rate piece of work.

C. O. Blagden.

AUSTRALASIA.

Central Australia.

'The Dead Heart of Australia.' A journey around Lake Eyre in the summer of 1901–1902, with some account of the Lake Eyre basin and the flowing wells of Central Australia. By J. W. Gregory, F.R.S., D.SC., Professor of Geology in the University of Glasgow. *With Maps and Illustrations.* London: John Murray. 1906.

A new book by the author of the 'Great Rift Valley' will be opened with pleasurable expectation as certain to be interesting and suggestive. Prof. Gregory's present volume is an account of a recent expedition in a region far from his previous successful explorations in East Africa. It deals with a journey, conducted with characteristic ardour, into Central Australia to the region round Lake Eyre, during the hot season of 1901–02—a very difficult period of the year for exploration, but the only one the members had free from University engagements. The expedition was undertaken in company with Mr. Grayson, Prof. Gregory's assistant, and several students of geology of Melbourne University (in which at that time the author held the chair of Geology), in the hope that it would be the first of a series for the study of South-Eastern Australia. We may trust that, although Dr. Gregory has been translated to the University of Glasgow, the projected expeditions may not be discontinued, but that his successors may from time to time have to present us with as successful a record of work as is the book now under notice.

It was the narration of the native legend of the Kadimakara, told to our impressionable author by Dr. Howitt, the distinguished Australian anthropologist, that fired his spirit and was the direct cause of the expedition. These Kadimakara were strange monsters which once on a time lived on the roof of vegetation upholding the sky which then covered Central Australia. The sweet scent of the earth and its pastures would often tempt them down from their bowery home, till on an evil day it befell that their retreat was cut off by the destruction of the mighty pillared gum trees of the sky, when "they were obliged to roam on earth and wallow in the marshes of Lake Eyre till they died, and to this day their bones lie where they fell"—to prove the truth of the legend. The objects of the expedition to Lake Eyre were, therefore, to secure a collection of the fossil Kadimakara in that area; to determine with greater precision the age at which these giant marsupials lived there; to gain further information as to the geological history of Central Australia, and to see what light geology could throw on the legends and original home of the aborigines.

Following an introductory chapter, Part ii. contains the "Narrative" of the journey, which began in earnest only at Hergott Springs, a station on the Great Northern railway, some 440 miles north of Adelaide, where a caravan of nine camels was in readiness for them. Their route lay at first north-westerly to Lake Kopperamanna, on Cooper's creek, across the Stony desert. "The Stony desert is due to the absence of water," and is not an old sea-floor, as was at one time supposed. "The country where it occurs was once covered with a sheet of the rock known as Desert Sandstone, in which there are abundant pebbles of quartz, sandstone, and other hard materials. The Desert Sandstone has slowly decayed under the action of the weather, the loose sandstone has been blown away by the wind, and the hard fragments remain scattered over the ground," "sometimes so closely packed that a cart leaves no wheel-ruts." From Kopperamanna the expedition travelled westwards down the creek to Lake Eyre, studying the geology and geography of the country and searching for fossil Kadimakara. Dr. Gregory notes the very interesting fact of the extraordinary abundance of old stone flakes, scrapers, and quartzite chips littered over the ground on the Cooper flats, dropped, for want of pockets, by the Dieri tribe with "the same extravagant untidiness as are the palæolithic flakes in some English gravels." This stage of their journey occupied over a week, and was full of "experiences"—if not of the adventurous order, yet trying enough—of land-storms, "big-fellow hot" days, and dearth of water. In the creek-bed and in the loams of its banks a considerable number of fossils was obtained; but their search was entirely unrewarded in the "lake," where "not even with the telescope" could they "detect any sign of water." Returning upon their route as far as Markoni, where they had a base-camp, their next stage lay north across the Tirari desert, 50 miles of waterless sandhill country to Kalamurina, in the Diamantina valley. Along their route to the river the native vegetation was all dead, and there was little to observe and less to collect. From Kalamurina they carried their quest eastward for some distance with moderate success, then back westward down the valley through scenery which one hardly expects to hear of—"full of variety and often beautiful," "with fine views of long serpentine reaches of salt water," full of swarms of birds—to the northern end of Lake Eyre. Thence a hundred miles of trackless, waterless wild had to be crossed to Warina, on the western side of Lake Eyre, where they had to catch the train for Adelaide which passed there once a fortnight. Notwithstanding various time-consuming disasters, dust- and rain-storms, the sagacious leader brought his expedition safely to the railway with seven hours to spare, having thrown into the programme an attendance at a corroboree through the small hours of one night.

Part iii. deals with "The Lake Eyre Basin," which has played so important a part in the botany, zoology, and anthropology of Australia. Once "a fertile and creative region," it has now become barren and inert. Its geological history is traced from Palæozoic times, during which, by subsidence of the land, a great central sea extended from the Gulf of Carpentaria through West Queensland over the northern region of South Australia; this sea, subsequently retreating, exposed the marine deposits overlaid by sand, loams, and gravels, whose disintegration now forms the

Desert Sandstone. The elevation of Queensland followed, and the subsidence of the coast lands of South Australia and Victoria, while a double set of parallel faults across Southern Australia produced its great Rift Valley. A second subsidence of the Lake Eyre region produced a vast inland fresh-water sea three times its present size, whose waters and shores harboured the now extinct great marsupials, the crocodiles and the mud-fish (*Ceratodus*), whose bones now lie within the area. Finally, the rainfall dwindled, the lake decreased till its margin is now nearly 40 feet below sea-level, and became so salt that the vegetation withered and all the land and water animals died, and "the fertile basin of Lake Eyre was blasted into desert"—now the "dead heart of Australia." Prof. Gregory argues, from his study of the fossil remains, that probably the great climatic changes on Lake Eyre occurred after the introduction of the dingo and before the advent of man to this region; and since the remains of the dingo were found in association with those of the *Thylacinus*, which is known now only from Tasmania, it is probable "that Bass strait was formed after the development of *Thylacinus* and before the arrival of the dingo," "that there is considerable evidence to show that the older marsupial beds of Lake Eyre belong to the Pliocene;" and the age of the desiccation of Central Australia began . . . in . . . the Pleistocene."

An interesting chapter is devoted to the aborigines of the Lake Eyre region, in regard to whom the author's conclusions will probably not meet with entire acceptance. He strenuously fights for his "black brother" against the wide-spread belief that they are the most depraved members of the human family. He calls various distinguished authorities as witnesses on his side—Pickering, on behalf of their being "the finest models of the human proportions;" Huxley, that they are not negroes, but nearly related to the ancient Egyptians and the hill tribes of the Dekkan; and Spencer and Gillen, that they are a generous and kindly people. He asserts there is little evidence for their mental degradation, and that they have a real belief "in the immortality of their souls and in the existence of a spiritual world." In regard to moral character and religious beliefs, much depends on the interpreter of the ideas of the aborigines. Dr. Gregory's opinions must always carry great weight; but one cannot help thinking that here they are somewhat kindly prejudiced by his favourable experience in finding those natives he met with (who appear to have been select specimens with a considerable experience of whites and civilization) so much better than his fancy (founded on the reports of others) had painted them. In regard to their religious beliefs, Howitt states that their interpretation has often been built up on a "superstructure which represents Christian dogmas." He asserts that the aborigines "do not recognize any divinity, good or evil." All natives believe more or less in spirits, from the very fact of their seeing dead or living friends in their dreams. As to their mental attainments, in the present writer's own experience, and that of several competent born-Australians communicated to him, they are lower than those of Negroes or Papuans. Has any aboriginal ever approached the mental attainments of the Crowthers (the father a bishop, and his son an archdeacon), of senators and congressmen in America, or of many of the administrators in Liberia? Brough Smyth, Dr. Lumholtz, and Dr. Semon, to mention only a few who speak with first-hand knowledge, have recorded much that must be placed to the *contra* account. Dr. Gregory further has become convinced that the Australian aborigines are Caucasians. He cites Mr. Lydekker as of the same opinion. If our memory serves us, however, we think that this anthropologist has not committed himself to this view. It seems to us that, whether the Australian be a Negro or not, it does violence to one's classificatory sense to group him with his white fellow-countryman as a Caucasian. In the physical characters of palate, prognathous jaws, nasal notch, thick lips, spinal curvatures, form of pelvis, cranial capacity, and brain itself, the Australian differs greatly from those to whom the term Caucasian has been applied. The straight hair of the aborigines, and their hirsuteness of body, however acquired, which are their specially Caucasian characters, do not counterbalance the number of non-Caucasian—mostly negroid—characters they possess. The straight hair, moreover, is not universal among them. The present writer has seen abundant examples of frizzly-haired natives with naked bodies in Northern Queensland as far south as Cooktown and Townsville. He has before him a photographic group of New South Wales aborigines, in which the cranial hair *appears* to be as frizzled as that of any Tasmanian or Banks islander. It is unquestionable that in many cases the Australian profile (cf. plate facing p. 164, lower left-hand figure) is not very dissimilar from that of some Caucasians; but close study of the shape of the head and contour of the forehead discloses to the eye differences, not easily expressed in words, demarking the Australian from the Caucasian physiognomy. In New Guinea and New Zealand the writer has seen faces of undoubted Papuans and Maoris that would, but for their colour, have passed for Europeans. This occurs among all races. The sum of the characters of the Australian aborigines, however, is more negroid than Caucasian. It is not improbable that his pedigree may lie near to that of the Neanderthal, Cro magnon, and Grimaldi races, on the undifferentiated stock of mankind.

It is impossible, in the space at our disposal, to discuss the author's observations on exogamy, totemism, and marriage rules, except to say that we do not seem yet to have reached any satisfying explanation of the origin of either exogamy or totemism. Would a people in the primitive savage condition trouble themselves whether inbreeding were injurious or not, or incest were immoral? Or would they be capable of detecting cause of the harm if the custom were injurious, when the highly civilized Egyptian monarchs who wedded their sisters failed to discover the fact? In this section of the book we have a most interesting account of the corroboree that the party witnessed at the Peak to the north-west of Lake Eyre. This form of corroboree had, it seems, *only just arrived in that region*, having been invented in Northern Queensland some years previously, and gradually migrated south and west. This interesting fact will cause the investigator of Australian customs to ask, Is there any certainty that the present corroboree ceremonies are of any high antiquity? Have they any real motive or significance beyond amusement? And is it possible to eliminate the old from the new formulæ? Chapters full of interest are devoted to geography and myths, in which the author tries to eliminate from the myths the past condition of the country; the origin of the people, who, he concludes, are probably immigrants from a tropical forest country to the north; to the geographical plan of South Australia; and to the story of the discovery and exploration of Lake Eyre.

The fourth and concluding Part discusses the chances of the revival of the Heart of Australia, now dead for lack of water, but which, with its nutrient soil, might be a fertile garden. The tapping of the colossal reservoirs under East Central Australia, so far as irrigating the soil, has been a failure. Its main result—no small one, however—has been to enable stock to be conveyed from the east coast with safety across the central waterless plains to the southern coast. It has been suggested to flood the great central basin of Lake Eyre from the Indian ocean, so as to produce a humid atmosphere, and thus stimulate vegetation, which would increase the rainfall, while the change in vegetation would secure more effective use of the rain that would fall in the region, at all events round—though perhaps not very far round—the inland sea. The expense of this project is its only drawback; and this is likely to be overcome only, as the author grimly remarks, "if the land were stocked with the sheep that grew the golden fleece." A timely and serious warning, also, is given by the author as to the probable failure of the subterranean reservoirs, which, at present, are allowed to discharge uncontrolled thousands of gallons an hour throughout the year.

This volume, which, as we have already remarked, is very interesting and broaches many difficult problems, is well printed, beautifully illustrated with views taken during the expedition, and furnished with several maps. The index of subjects is perhaps not as full as it might be, while some of the places referred to in the text are omitted from the maps.

H. O. F.

THE MONTHLY RECORD.

ASIA.

The Shanghai-Nanking Railway.—The new railway just opened (on July 18) in China traverses a fertile and populous tract of alluvial country in the province of Kiangsu. It runs for a distance of about 200 miles from Shanghai to Nanking in a generally north-westerly direction through the towns of Su-chou, Wu-sieh, and Chin-kiang. The section actually opened to traffic, however, is from Shanghai to Su-chou and Wu-sich, a total distance of 85 miles. The remaining portion to Chin-kiang and Nanking enters into more hilly country, where some tunnelling is necessary, and this, it is anticipated, will not be completed and opened for traffic until 1908. The country round about is one of the most thickly inhabited and productive parts of China. It is intersected with numerous creeks, canals, and tributary streams draining into the Su-chou creek, the Hwang Pu river, and the Yang-tse Kiang. Cotton, rice, and mulberry trees are grown extensively, and there is a great passenger traffic along the Grand canal, as well as endless junks freighted with timber, stone, grain, pottery, bamboos, and miscellaneous goods. The length of time occupied by passengers in travelling from Shanghai to Nanking will be reduced from about twenty-eight hours to eight or ten hours, and the goods traffic, which now occupies several days, will gain in an even greater degree. Su-chou and Chin-kiang, in addition, of course, to Shanghai and Nanking, the termini of the line, are treaty ports. The first named has been called the Venice of the Far East, owing to the network of canals that pass through its curious narrow streets. It was besieged by Colonel Gordon during the Taiping rebellion, and is now a great centre of the silk industry. Wu-sieh and Chin-kiang are also busy marts, the latter, as well as Nanking, being a regular calling place for the steamers that ply on the Yang-tse. It may thus be fairly anticipated that the new line will conduce powerfully towards opening up this part of China to European trade and also to travellers, as there is much of interest to be seen in Nanking and the neighbourhood.

The Gold-mines of Formosa.—A British Consular Report (Miscel. Series, No. 649) gives an account of the gold-mines of Formosa. Though the discovery of gold in the island dates from the fifteenth century, the Chinese were not aware of its existence till 1890, and not till after the cession of Formosa to the Japanese was its gold-mining put under government regulation. The output of placer-mining having dwindled from 20,424 ozs. in 1902 to some 3000 in 1905, gold-mining is now practically restricted to quartz mining, the output from which, 18,735 ozs. in 1901, amounted in 1905 to the estimated figure of 62,730 ozs. Whereas, again, the estimated output of gold from the whole of Japan amounted in 1905 to but 95,173 ozs., no notable increase on previous years' outputs, Formosa's output amounted in that year to 66,177 ozs., the culmination of a series of rapid annual increases. Soon, therefore, the gold-mining of Formosa promises to exceed in value that of the whole of Japan. There are three mines worked in Formosa: Kyufun, Kinkwasek, and Botanko, all contiguous to one another, some 10 miles east of Keluug. Botanko mine, the smallest of the three, is said to contain the richest ore, but its refining plant is at present inadequate. The three mines employ over 2500 men, Japanese and natives.

Statistics of the Tunguses.—Schrenck's account of the Tunguses in the Amur region represents a situation no longer extant, owing to the tide of Russian immigration, which set in about 1858, and has amounted latterly to some 200,000 annually. By 1897 the Russians constituted 86 per cent. of the Amurskaya province, and 51 per cent. of Primorskaya. New postal roads, lines of steamers, and the railway introduced unwonted bustle of life. Large works in docks, ports, on the railway, in mining districts, attracted troops of labourers from China and Korea, while to the fast-developing towns streamed numbers of active Japanese. The weak and scattered savages had thus to yield up one belt of land after another. Till recently the Russians kept to the great rivers and highways, and the natives were left in possession of the waste regions. Now, however, numerous settlements of goldminers, mostly Russian, are to be found in the remotest parts. In many places epidemics and hunger have wiped out the natives, and in many regions where they used to be the only inhabitants, they now constitute but a small percentage of a population composed mostly of Russians, Chinese, and Koreans. With a view to bringing up to date our knowledge of the Tunguses and their distribution, a book by M. S. Patkanov has been published by the Hungarian Committee of the International Association for the Exploration of Central Asia. The author, who took part in the elaboration of the census material of 1897, utilized it for the purpose of elucidating the geography of the Tunguses, while supplementing it by a study of the whole literature of the subject. The present publication (264 pp., 8vo.) constitutes but a part of a larger and yet unpublished work. Having taken stock of the Tunguses, group by group, M. Patkanov, summing up, finds that outside the southern circles of the Yenesei Government and the Primorskaya province, Tunguses are to be met with in greater or less numbers in all parts of Eastern Siberia not claimed by other nationalities. Irrespective of numerous outrunners and ramifications and insular groups, the main body occupies a broad semi-circular belt stretching from the Yenesei to the Okhotsk circle, and attaining its southern extension in the Transbaikal and Amur provinces. In this immense region there live, according to the Census of 1897—which, however, omits three small categories—62,068 Tunguses, of whom 31,375 are males. In the Transbaikal province there are 101 females to 100 males, but in the Amur province and Sakhalin only 77 and 72 females to 100 males. A Tungus household averages 5·5 persons.

AFRICA.

The Turco-Egyptian Frontier.—A parliamentary paper issued in July (Cd. 3006) brings together the facts of importance relative to the question of the frontier between Egypt and Turkey, which earlier in the year created such a grave situation between the latter and Great Britain. Of special interest is the summary of the past relations between Egypt and the Sinai peninsula, which are a matter of some obscurity. A despatch of Lord Cromer's points out that Egypt has, in fact, been in possession of the disputed territory for many centuries, and the starting-point of the frontier on the Mediterranean has always been recognized to be at Rafeh, east of El Arish, which was mentioned as such by the Arab geographer and historian Abulfeda, though his definition of the rest of the frontier seems not quite so clear as might be wished. In more modern times, the most important documents are the firmans of 1841, confirming Mehemet Ali and his heirs in the possession of the Pashalik, and the map drawn up at the same time, in which, according to the Turkish contention, the eastern frontier of "the privileged Province of Egypt," runs from El Arish to Suez; and the recent attempted encroachments on the part of Turkey have been founded on this fact. The hold of Egypt on the territory east of that line had, however, been strengthened early in the nineteenth century by the services of Mehemet Ali and his son Ibrahim Pasha in suppressing the Wahabi rebellion, whereby they saved Arabia for the Sultan; and this was recognized in 1841 by the definite grant of the Administration of Sinai to the Egyptian ruler. Nor was the claim of Egypt ever questioned until the accession of the present Khedive in 1892, when the Firman of Investiture was so worded as to appear to exclude the Sinai peninsula from Egyptian influence. The matter was then settled in favour of Egypt by a telegram from the Grand Vizier to the Khedive, dated April 8, 1892, which recognized the maintenance of the *status quo* in the peninsula, though replacing under Turkish rule certain posts previously garrisoned by Egypt on the eastern side of the Gulf of Akaba. In the recent dispute the validity of this telegram was allowed by the Sultan, but an unjustifiable attempt was made to limit the Sinai peninsula by a line running direct from Akaba to Suez, all the area north of this and east of a line from Suez to El Arish being claimed by Turkey, with the offer of an alternative line running south from El Arish to Ras Mohammed, the southernmost point of the peninsula. The line eventually obtained by Egypt, and to be delimited by a mixed commission, is that running from a point not less than 3 miles west of Akaba to Rafeh. The immediate cause of the difficulty had been the strengthening of the administrative hold of Egypt over the peninsula last year, owing to ferment among the tribes, in which Turkey professed to see ulterior designs of an aggressive nature.

The Forest Districts of Uganda.—An interesting journey of inspection through all the most important forest areas of the Uganda protectorate has lately been made by Mr. M. T. Dawe, officer in charge of the Forestry and Scientific Department, who gives the results of his observations in a parliamentary paper issued in April last (Cd. 2904). The largest forests (as shown in a sketch-map accompanying the report) lie along two strips of country, one running near the west and north-west shores of the Victoria Nyanza, the other following a more or less parallel line through the extreme west of the protectorate. Mr. Dawe describes each forest in turn, and though his point of view is mainly economic, and less is said than might be wished on the ecological side of the subject, many details of geographical interest can be gleaned from the report. An important discovery was that of the Lagos silk rubber tree (*Funtumia elastica*) as an indigenous element, while several new species of *Landolphia*, some of economic importance, were also brought to light. Of the first forests visited, that of Bujeju in Buddu occupies a low-lying tract near the lake, some parts of which seem once to have formed part of the latter. The forest seems comparatively new, and to be gradually encroaching on the interior plains. It contains no good rubber-vines, though they are found in adjoining areas. One of the trees found in this district, though not of large size, is a variety of the valuable *Podocarpus milanjianus*, which occurs practically on the lake-shore. Of the western forests, that of western Ankole occupies a large area east of Lake Albert Edward. It is largely composed of three trees—*Carapa grandiflora*, *Symphonia globulifera*, and *Parinarium excelsum*. Mr. Dawe remarks that almost every forest in Uganda possesses its own special character, due to the predominance of one or two particular trees. In Toro, the Kibale forest covers a considerable area. The most common tree is one nearly allied to *Maba abyssinica*, with ebony-like markings in the centre. An interesting tree with resinous bark and a timber much resembling sandal-wood proved to be unknown, and has been placed in a new genus (*Dawea*), as well as in a new tribe of *Bixineæ*. To the south this forest touches the northern end of Lake Ruisamba (or Kyanja, as Mr. Dawe heard it named exclusively). An account is given of the types of vegetation on the Ruwenzori range, agreeing generally with those of previous travellers, though more detailed as regards species met with. Here, too, the *Podocarpus milanjianus* occurs. The tree-*Senecio* growing near the lower glaciers proved to be a new species, which has been named *adnivalis*. From the point reached near the base of the glacier no snow was visible (in July), and Mr. Dawe concludes that there are much colder seasons. The country comprising the Semliki plains, with the Ruwenzori and Mboga ranges on either side, is described as one of the finest districts for cultivation in the protectorate, the hot Semliki valley being especially adapted for tropical products,* such as Para rubber. The climate of the Mboga hills seems more bracing than that of Ruwenzori. In the Semliki forest (which is largely composed of *Cynometra*), the oil palm of West Africa is found, and is said to be abundant in certain localities. The Bwamba of this region are very destructive to forest land, as they are constantly making new clearings. In the Bugoma forest of Unyoro the *Cynometra Alexandri* is again abundant, and where this is the case there is little rubber. Further north, the Budongo forest is said to cover an area of 350 square miles. It is well watered. The growth of trees is very dense, and it is certainly the most valuable timber forest seen in the protectorate, the most important trees belonging to the mahogany order. Unyoro is regarded by Mr. Dawe as offering great possibilities for agriculture, and as admirably adapted for cotton so far as the soil is concerned. The statement that plaintains form the staple food of the people is erroneous.

Economic Condition and Resources of Abyssinia.—On the basis of first-hand observations made during a recent German embassy to Abyssinia, which resulted in the conclusion of a commercial treaty between Germany and Abyssinia, the official *Berichte über Handel u. Industrie* (vol. 9, No. 1) gives a well-digested and all-round appreciation of the actual economic condition and resources of the land. It comprehends an account of such economic factors as soil, climate, population, language, branches of industry, communications with and within the country, waterways, caravan freights, customs, post, currency, bank, exports, and imports. A sketch-map is appended. Of excellent natural resources, Abyssinia is as yet very imperfectly developed. Exceeding in area the German Empire, it has a population of but 9 to 11 millions at the most. Almost everywhere is a good layer of humus, and regular rains supply needed moisture. But by regular burning in the dry season, natural forest and grassy steppe-lands are being converted into desert. Of an average elevation of 6500 to 8000 feet, Abyssinia grows barley to a height of 10,000 feet. The lowlying lands (*kolla*), now mostly desert, are still in large part capable of cultivation if irrigated. There is, however, no provision for saving the water even at the most frequented wells. In almost all parts of the plateau there is a uniformly excellent climate, fresh mountain air, constantly cool nights, and no malaria, such as render residence under normal conditions possible to any European nation. What might be made of Abyssinia at large is exampled in the present comparatively very flourishing colony of Eritrea. Besides the native population—Abyssinians proper, Semitic; Hamitic Gallas and Somalis; Negroes (*Shankala*) in south-west; and Falasha (Jews)—there are in Abyssinia Indians, Arabs, Greeks, and Armenians, as also a few Europeans in Adis Abeba and Harrar. Except Harrar, of Arabic origin, there are

* Mr. Dawe says "extra-tropical," but as he elsewhere contrasts this term with "subtropical" and "temperate," its use would seem to be an error.

no towns proper, but only collections of straw-thatched huts, with no connecting streets nor shops. Trade is confined to weekly markets. The Saturday market of Adis Abeba is thronged by 30,000 to 50,000 people. But outside the market there is not a shop, and on other days than Saturdays the market-place is empty. With its exuberant meadows and excellent climate, Abyssinia lends itself to cattle-rearing, which is the most general industry, flesh being the main food, and little as is the care bestowed on them, you meet many strikingly fine cattle. Sheep and goats are everywhere. The land is capable of producing endless wealth of wool, but the actual stock of sheep and goats is very inferior. Next to cattle-rearing comes agriculture. In the higher regions the soil is of extraordinary fertility, yielding, in parts, a treble harvest yearly. But agriculture is in the most primitive stage imaginable. There is very little terrace-building or irrigation, and implements in some places are only of wood or stone. Abyssinia is one of the Arcadian lands that may still claim immunity from over-specialization of industry. It has no millers, for its corn is ground between stones at home; no bakers, for its bread is baked at home; no weavers, for its cotton cloth is woven at home; no tailors, for its scanty wardrobe is pieced together at home; no shoemakers, for its people go barefoot; no smiths, for its horses go unshod.

Nomadism in Algeria.—An article in the *Annales de Géographie* (15th year, No. 80), by MM. Augustin Bernard and N. Lacroix, setting forth the history and present position of nomadism in Algeria, supplies incidentally a useful contribution to the general question of the relations between nomadic and settled life. A part of the native population of Barbary has always led a pastoral life. During the three centuries of Roman dominion nomadism had to yield ground in favour of agriculture. But from the fifth century the natives returned to their ancient condition. Anarchy and war loosened from the soil the population imperfectly attached to it in the preceding period. The devastation was intensified when in the eleventh century the Arabs, like a cloud of locusts, swooped on North Africa. Their sheep, camels, and goats ate up the country. The Turks aggravated the mischief. Altogether there have always existed in North Africa both nomadic and settled populations, because there are regions there lending themselves, some to settled, some to nomadic life. But at the junction of the two zones districts have vacillated between the two forms. Whether a particular region will be nomadic or settled is an affair of climate influenced by history. Since 1830 deforestation has advanced more rapidly than ever, and that in regions such as the littoral belt of the cork tree in Constantine department, most favourable to the growth of trees. Forest gives way to underwood, underwood to grass, grass to bare soil. French domination has penetrated to the wooded regions, whither colonization and their habits have driven the natives. Access to the forest is for cattle at certain places and periods a question of life, as for the forest itself it is often a question of death. The article proceeds to treat of the mutual adjustment of forest and pasture, showing how, as the settled natives recede before civilization from the better to the inferior lands, the area of culture extends, and next of the mutual adjustment of tillage and pasture, a problem which awaits the conclusion of an official inquiry, the results of which will be summed up in a map of the pasturages. It also discusses the distribution of ox, camel, and sheep; the amelioration of pasture lands by irrigation; growing restriction of the area of pasture; the economic value of nomadism, and other similar questions.

AMERICA.

Indian Affairs in Canada.—The Annual Report on Indian Affairs in Canada for year ending June 30, 1905, which bulks as a Blue Book of 452 pages of text and 167 pages of appended tables, gives a detailed account of the varied conditions of Indian life, which are summed up, not quite so systematically as might be wished, in an introductory section. The population, including the long unrevised figures of population outside Treaty Limits, reached a total of 107,854, an increase of 316 over the population of 1904. The births were 2699—273 in excess of the deaths, or 11 more than in 1903–4. The high death-rate, attributed chiefly to the "white plague," is, under the gradual improvement in food, clothing, and housing, etc., somewhat abating. The low-roofed cabin of logs, with mud floor, hole in centre for fireplace, opening in roof for outlet of smoke, in some cases no opening at all to serve as window, is yet an advance on the nomadic wigwam. Thanks to industrial schools, Indian dwellings are now to be found not only passable economically, but indicating a tendency towards attractiveness. Withal, however, the appreciation of light, ventilation, and partitionment in Indian domestic arrangements develops at a slow pace. As regards agriculture, more propitious than less stable industries to Indian civilization, the 44,196 acres under cultivation in 1905 produced 1,264,705 bushels of grain and roots, a slight decrease on 1904. Horned stock and horses both showed increases in 1905 on the previous year. Ontario shows far the largest farming acreage and produce, but the North-West Territories have one and a quarter times the aggregate horned stock held by Indians in all the rest of Canada. A considerable source of revenue, particularly in the eastern provinces, is the manufacture, mostly by women, of native wares and fancy work. Along the British Columbian coast the Indians engage largely in salt-water fishing. The fishing staple, however, is salmon, which yields the Indians food, not only directly, but indirectly through the canning industry, the men catching the salmon, and the women cutting up and cleaning them for the factories.

AUSTRALASIA AND PACIFIC ISLANDS.

Journey across Viti Levu.—Sir Everard Im Thurn, Governor of Fiji, made an interesting journey last November across the mountainous interior of Viti Levu, from the mouth of the Sigatoka river on the one side to Ba on the opposite coast. The coast at the river-mouth is unprotected by a reef, and the big ocean waves, locally called *lokas*, continually roll in, making the narrow rocky entrance precarious even for small boats, and piling up the great swelling sand-dunes characteristic of this part of Fiji only. An entrance was, however, successfully made in the steam-launch of the *Ranadi*, perhaps the first steam-craft to enter the river. After presiding at the installation of a new Roko, or native chief, the governor and his party proceeded along the bridle-road which crosses the flats of the Sigatoka and winds over the rugged interior ranges. The flats, which extend up to Fort Carnarvon, seem capable of great development agriculturally. The route led through the scenes of the war of 1876, in which Sir Arthur Gordon finally ended the long strife waged by the mountain tribes against the coast natives and Europeans. On the present occasion the travellers met everywhere with a most hospitable reception, and the outer hills struck the governor as offering great opportunities for sheep-rearing, if the native system of firing the whole country-side in search of wild yams were stopped. Further on the Nalotu range, with a wonderfully serrated crest of dolomitic rock, was crossed by a small but well-marked nick in the knife-edge, the steep descent leading through thick trees to the flats along the Ba river. On this, the north-west side of the island, is the great sugar estate of the Colonial Sugar Refining Company, extending some 40 miles between the Ba and Nadi rivers, the capabilities of which considerably impressed the governor. At one of the more recently opened centres, Lautoka, the mill is one of the most up-to-date in the world, and the place has also the advantage of possessing sheltered anchorage and an excellent wharf. What is wanted, however, is the connection of its tram system with that at the other end of the estate. An interesting experiment in the reclamation of coast swamp-land has lately been made, the great difficulty being the washing of the salt out of the soil. From Ba the governor rode up by the excellent bridle-path to Nadarivatu (which it is hoped to develop as a sanatorium), through some of the finest mountain scenery imaginable. Sir Everard expresses the hope that this track may before long be made passable at least for bullock-waggons.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Cold Water on the West Coast of the United States.—The west coast of the United States, like many other continental coast-lines, especially on the west side, is marked by the belt of abnormally cold water lying along it, and usually explained (as, *e.g.*, by Mr. J. Y. Buchanan, in *Proc. R.G.S.*, December, 1886) as due to upwelling of cold water from the depths when the surface water is blown away from the coast by off-shore winds. Mr. R. S. Holway has lately examined the particular case referred to in the *University of California Publications*, Geology, vol. 4, No. 13, 1905, and comes to the conclusion that the above explanation is incorrect in this instance. Previous authorities have, he says, been mistaken, both in extending the cold-water belt southward to the coast of Lower California, and in supposing that trade winds blowing off-shore are associated with the occurrence of the said cold water. He points out that the pilot charts show, at all seasons of the year, a belt of north-west winds between the southern California coast and the trade winds, and that just where the latter are nearest to the coast is the very locality that fails to show a definite belt of cold coast-water. In order to arrive at a possible explanation, he examines the general temperature conditions of the north-eastern Pacific, laying stress on the fact that the coldest bottom water, as mapped by Sir John Murray, occurs, not at the greatest depths, but on the continental slope. This would be intelligible on the supposition (which he allows to be at present unsupported by sufficient evidence, but which it may be permissible to take as a working hypothesis) that the general surface drift of this part of the ocean also extends to great depths. The distribution of the cold bottom-water shows a close agreement with the direction of such surface drifts, while the fact that the coldest water of all is found off the coast between Capes Blanco and Mendocino is explained, on the above hypothesis, by the submarine contours, which show that a great submarine valley heads just under Cape Blanco, and opens broadly out to the northward and westward. The writer thinks that other points in the temperature distribution of the North Pacific fit in with the idea that the drifts are generally continued from the surface to great depths. He shows that the isotherms at depths of 400 and 700 metres, so far as they can be drawn from available data, give an indication of a south-east flowing portion of the cold Kamchatka current which has underrun the warm Japan stream, and thinks that to this may be due the large area of cold bottom water in the south-central portion of the North Pacific. These are, of course, at present mere suggestions, but they are of interest as pointing out important lines of inquiry in connection with oceanic circulation.

Prof. W. Láska on the Earth's Interior.—Prof. W. Láska, of Lemberg (Galicia), Referee of the Seismological Commission of the Imperial Academy of Sciences in Vienna, has put forward some considerations on the constitution of the Earth's interior, which are all the more interesting inasmuch as they deal with a subject of which there is yet but little definitely known. He takes his point of departure from the investigations of Emil Wiechert (Göttingen) and Dr. J. Milne. Both assume a bipartite interior, and differ only in the mutual relation assigned by them to the two parts crust and core. More particularly in his method of treatment

Prof. Láska supplements the investigations of Milne. Like the latter, he makes use of seismic observations as a basis for his conclusions, but he also puts under contribution observations carried out with other than seismic apparatus. One of the main conclusions he arrives at is that the distributional velocity of the seismic waves increases rapidly in proximity to the Earth's surface, but slowly towards the centre of the Earth. Another, drawn from the mode of the propagation of the waves, is that the Earth cannot consist of an approximately homogeneous core and a crust likewise in itself almost homogeneous, *i.e.* that the Earth cannot be of bipartite structure. The Earth's interior, on the contrary, is in all probability to be conceived as displaying, in its successive layers, a regular continuity of transition. On the basis of accessory assumptions, he now lays down formulæ respecting the law of such continuity. Once sufficient data in the way of seismic observations have been accumulated, the accuracy of these formulæ will be tested. With the attainment of positive results, it would be demonstrated that for geophysics seismology may have an importance corresponding to that of spectral analysis for astronomy. It might then at last be possible to construct a physical scheme of the Earth's interior.

GENERAL.

The Botany of the British Empire.—Those not behind the scenes hardly, perhaps, recognize the amount of painstaking work which has been devoted in an unostentatious way to improving our knowledge of the botany and vegetable resources of the various colonies and dependencies which form the British Empire. The work, which throughout has received the energetic support of the authorities at Kew, from the time of Sir William Hooker onwards, has been in progress for over half a century, and although made up of separate undertakings not immediately connected with each other, the whole has been carried out so far on a consistent plan that it virtually constitutes a botanical survey of the empire, the gaps in which are relatively few and unimportant. A recent number of the Kew *Bulletin* (No. 2, 1905) puts on record the principal facts connected with the inception and progress of the various parts of the work. While the basis of the whole has been the labours of the staff at Kew in arranging and co-ordinating the vast amount of material there preserved, the actual preparation of successive works for the press has been accomplished largely through the assistance of independent botanists. The first publication which may justly be included in the series was the 'Flora Boreali-Americana,' brought out by Sir William Hooker under the authority of the Secretary of State for Colonial Affairs (1829–1840), and based chiefly on the collections made during the northern land journeys of Franklin and others. Next in order may be placed the botany of the voyage of the *Erebus* and *Terror*, prepared by Sir Joseph Hooker, which included the floras of New Zealand and Tasmania, as well as of other southern lands. These were large and expensive works, and the idea of continuing the series in a cheaper and more practical form originated with Sir William Hooker in 1857, its result being the grant of £300 for a flora of the West Indies by Dr. Griesbach, which was published in 1864. An interesting point connected with this is the warm support given to the scheme by the late Mr. John Ball, who for a short time held the office of Parliamentary Secretary for the Colonies. In 1859 Sir William Denison, Governor-in-Chief of Australia, had suggested to the Colonial Office the publication of a scientific history of the Australian and other colonies, and though the scheme was too vast to be practicable in its entirety, it was taken up as far as botany was concerned by the Duke of Newcastle, and the series of colonial floras (of which that statesman continued a warm supporter) was thus fairly launched. The publication, in 1861, of a flora of Hong

Kong, prepared by Mr. George Bentham, was followed by grants for floras of Australia and New Zealand, while official support was eventually given to those of Ceylon and South Africa, commenced by independent workers. A flora of Mauritius was also prepared by Mr. Baker, of Kew, under the authority of the Colonial Government. A flora of Tropical Africa, originally planned to include the collections of Livingstone's and other expeditions, and placed under the editorship of Prof. Oliver, has, after various vicissitudes, been extended under the charge of Sir W. Thiselton-Dyer so as to form ten volumes, of which the greater part has now been issued. One of the most important of the whole series is the 'Flora of British India,' a monument to the persevering labours of Sir Joseph Hooker, which was completed in 1897; while that of the Malay peninsula has for some time been in active preparation. A similar undertaking will no doubt be carried out eventually by Canada without outside assistance, while, apart from this, the most important gaps still remaining relate to British Guiana and Honduras.

OBITUARY.

Khan Bahadur Yusuf Sharif.

On June 20 last, at Jabalpur, in India, there passed away one of the best of the native geographers who learned their work in the Indian Survey Department. Khan Bahadur Yusuf Sharif was a Mohammedan gentleman of the best type. Clever and persevering, possessed of considerable mathematical talent, and a genuine thirst for geographical exploration, he was almost typical in these modern days of those splendid Mohammedan geographers who have left us so many valuable records of Asiatic travel in mediæval times. Yusuf Sharif won the good opinion of all officials with whom he had to deal, and would have been a distinguished servant of the Government in any capacity in which he might have been employed. He was one of the small band of native surveyors attached to the Russo-Afghan Boundary Commission of 1884-85, where his skill as a topographer and his power of making friends with all sorts and conditions of men were most useful factors in the acquisition of a large store of geographical knowledge which was new then and has never yet been superseded or revised. Subsequently he was employed in Persia, and was especially successful in dealing with the difficult country of the Bakhtiari tribes. He carried out a rough triangulation from the coast, and gave us our first indications of the nature of the hill districts that intervene between the coasts and Kirman. The great value of his work as a geographer lies in its thoroughness. He was in all respects a most able and trustworthy servant of the Indian Government, who rewarded him with the title of Khan Bahadur. He also received the recognition of the Royal Geographical Society for his excellent work on more than one occasion.

CORRESPONDENCE.

"On the Pretended Phœnician Circumnavigation of Africa."

Many of those who claim a pre-Hellenic antiquity for Zimbabwe and other South African ruins appeal to the Phœnician legend as a confirmation of their views.*

* Dr. A. H. Keane, *Geographical Journal*, vol. 27, p. 338; Dr. Carl Peters, 'The Eldorado of the Ancients,' p. 317; Messrs. Hall and Neal, 'Ancient Ruins of Rhodesia,' p. 29; 'World's History,' vol. 2, p. 590 (English version).

Could they be convinced that this legend tells, not for, but against their theory, they would perhaps be ready to subject it to a somewhat more searching criticism.

It has often been remarked that modern believers accept the story for the very reason which caused Herodotus to hesitate, the mention of a sun on the right hand, which is usually, if somewhat boldly, interpreted to mean a sun seen in the north at noon. It is less generally observed that what made Herodotus himself a believer—namely, the tale that the Phœnicians were able to achieve so enormous an enterprise by raising crops on whatever part of the coast they might have reached when seed-time came round—is so little credible to his followers, that, while professing to accept his story, they generally reject this essential part of it.

Thus Rennell's elaborate argument * is a plea for a story of which Rennell himself, and not Herodotus, is the author. In order to find a really possible method by which his Phœnicians could have renewed their supplies, he was compelled to assume, like modern advocates of a South African Ophir, that a trade with Sofala had already been long in existence. Neither he nor they seem to perceive that, if this theory of a pre-established African trade be true, then the mention of a northerly sun, which was supposed to be of irresistible strength, ceases to have any force whatever. At Sofala, in lat. 20° S., the midday sun is to be seen in the north for much the greater part of the year, and it is ridiculous to suppose that people trading regularly with that port did not know this. If the Phœnicians came back from the far south to startle the world with the tale of a northerly sun, it shows very clearly that they can never have been to the far south before.

Really, however, the modern idea that this tale of a northerly sun must be true because it could not have been invented is largely due to modern ignorance of elementary astronomy. To see the noonday sun *always* in the north one must be south of the southern tropic; to see it there *generally* one must be south of the equator. But merely to have seen it there proves no more than that the observer has been south of the Tropic of Cancer. And so much had been accomplished by civilized man long before Herodotus. That the midsummer sun was vertical at Syene must have been a well-known fact ages before Eratosthenes made use of it to measure the Earth's circumference. And surely the people further south still, as at Meroe, must have known that with them the shadow fell, not to the north, as in Lower Egypt, but to the south. Now, the southern coast of Africa, wherever it was, could not but lie further south still than Meroe.

Why, if Herodotus is to be believed when he speaks of a Phœnician circumnavigation,† does no one believe him when he goes on to speak of a Carthaginian one? How is it that a voyage which should have proved the vast southerly prolongation of Africa came to be cited as a proof that this prolongation was small? How, if even Sofala were known to civilized men, could a theory have long prevailed among geographers that the equatorial region was impassable? Posidonius, who denied this theory,‡ and believed that Africa could be circumnavigated,§ yet rejected the Phœnician legend. Posidonius must have understood the argument from the northerly sun as well as we. Have not we moderns shown ourselves in this matter somewhat less wisely critical than Posidonius?

E. J. WEBB.

Burghclere, Newbury.

* 'Geographical System of Herodotus,' pp. 673 *sqq.*

† Herodotus, iv. 42, 43. ‡ Cleomedes, i. 6. § Strabo, ii. p. 98

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *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.
Col. = Colonies.
Com. = Commerce.
C. R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Is. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological, etc.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
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. **Whymper.**
The Valley of Zermatt and the Matterhorn. A Guide. By Edward Whymper. Tenth Edition. Chamonix and the Range of Mount Blanc. By the same. Eleventh Edition. London: John Murray, 1906. Size 7½ × 5. *Maps and Illustrations. Price 3s. each. Presented by the Publisher.*

France. **Demangeon.**
Les sources de la Géographie de la France aux Archives Nationales. Par A. Demangeon. Paris: G. Bellais, 1905. Size 9 × 6, pp. 120. *Price 2s. 3d.*

An interesting study of the way in which historical documents may throw light on the past geography of a country. The author takes stock of the various collections of records in France which are valuable from this point of view, and then gives instances of the light thrown by them on geographical questions.

Norway—Historical. *Norske G.S. Aarbog* **16**, 1904–1905 (1905): 137–155. **Nielsen.**
Middelalderske Samfærselslinier i Norge, langs Kysten og paa Indsøer og Elve. Af Professor Dr. Yngvar Nielsen. *With Maps.*

On mediæval lines of communication.

Norway and Sweden. *Norske G.S. Aarbog* **16**, 1904–1905 (1905): 55–69. **Reusch.**
Norges forhold til Sverige fra et geografisk synspunkt af Dr. Hans Reusch.

Russia. *Scottish G. Mag.* **22** (1906): 194–205. **Sarolea.**
The Geographical Foundations of Russian Politics. By Charles Sarolea.

Sweden. *Arkiv. Botanik K. Svensk. Vet. A. Stockholm* **5** (1) (1905): pp. 152. **Birger.**
De 1882–1886 nybildade Hjälmaröarnas vegetation. Af S. Birger. *With Map and Illustrations.*

On the vegetation which sprang up on the ground laid bare by a fall in the level of Lake Hjälmar.

Sweden. *Ymer* (1906): 83–92. **De Geer.**
Dalälfven och dess utskärnigar nedom Alfkarlebyfallen. Af Sten De Geer. *With Plans.*

On the Dalälfven river and the channel excavated below the Alfkarleby falls.

Sweden—Language. **Poestion.**
Lehrbuch der Schwedischen Sprache für den Selbstunterricht . . . Nach den neuesten und besten Quellen bearbeitet von J. C. Poestion. Dritte Auflage. Wien und Leipzig: A. Hartleben, [not dated]. Size 7 × 4½, pp. viii. and 180. *Price 2m. Presented by the Publisher.*

Sweden—Phytogeography. **Hesselman.**
Zur Kenntnis des Pflanzenlebens schwedischer Laubwiesen. Eine physiologisch-biologische und pflanzengeographische Studie. Inaugural-Dissertation . . . . von Henrick Hesselman. (Sonderabdruck aus den Beiheften zum botanischen Centralblatt, Jahrgang 1904.) Jena: Gustav Fischer, 1904. Size 9¾ × 6, pp. [151]. *Maps, Plates, and Illustrations.*

Switzerland. *Jahresb. G. Ges. Bern* **19**, 1903–4 (1905): 1–78. **Groll.**
Der Oeschinensee. Von Dr. Max Groll. *With Illustration and Diagrams.*

Switzerland—Census. ——
Résultats provisoires du recensement fédéral des entreprises agricoles, industrielles et commerciales. 9 août 1905. (Statistique de la Suisse, 147ᵉ liv.) Bern: Neukomm & Zimmermann. Size 11 × 9, pp. viii. and 184.

Switzerland—Relief. *B.S. Neuchatel. G.* **16** (1905): 5–16. **Gobet.**
Quelques réflexions sur la répartition de la hauteur moyenne en Suisse d'après le travail du Dr. Liez. Par L. Gobet. *With Maps.*
This has been noticed in the Monthly Record.

United Kingdom—Dorset. **Strahan.**
Memoirs of the Geological Survey: England and Wales. Guide to the Geological Model of the Isle of Purbeck. By Aubrey Strahan. London, 1906. Size 9¾ × 6½, pp. 26. *Maps and Sections.*

United Kingdom—Dorset. **Treves.**
Highways and Byways in Dorset. By Sir Frederick Treves, Bart. With Illustrations by Joseph Pennell. London: Macmillan & Co., 1906. Size 8 × 5½, pp. xviii. and 376. *Map and Illustrations. Price 6s. Presented by the Publishers.*

United Kingdom—Earthquakes. *Nineteenth Century* **59** (1906): 458–470. **Davison.**
Earthquakes in Great Britain. By Dr. Charles Davison.

United Kingdom—Meteorology. ——
The Weather of 1905 at Hodsock Priory, Worksop. With Summaries for the 30 years 1876 to 1905. Size 8½ × 5½, pp. 30. *Diagrams.*

United Kingdom—Thames. *P.R.S.*, Ser. A., **76** (1905): 494–506. **Lockyer.**
The Flow of the River Thames in Relation to British Pressure and Rainfall Changes. By Sir Norman Lockyer, K.C.B., etc., and William J. S. Lockyer, PH.D. *With Diagrams.*

ASIA.

Mongolia and Tibet. **Kozloff.**
Mongolia and Kham. Works of the Expedition of the Imperial Russian Geographical Society during 1899–1901, under the direction of P. K. Kozloff. Vol. 1. [In Russian.] St. Petersburg, 1905–6. Size 12 × 9, pp. x. and 734. *Maps and Plates. Presented by the Imperial Russian Geographical Society.* [To be reviewed.]

Russia—Caucasus. *Deutsch. Rundschau G.* **28** (1906): 244–259. **Weinberg.**
Die Bevölkerung des Kaukasus in statistischer und ethnischer Beziehung. Von Dr. R. Weinberg.

Russian Central Asia. *Norske G.S. Aarbog.* **16**, 1904–1905 (1905): 77–127. **Bjerkan.**
Fra en reise i Vest-Turkestan. Af Paul Bjerkan. *With Illustrations.*

Turkey—Palestine. **Macalister.**
Palestine Exploration Fund, Quarterly Statement (1906): 133–142.
Browne's Travels in Palestine, 1797. By R. A. Stewart Macalister.

Turkey—Palestine and Syria. **Baedeker.**
Palestine and Syria, with the chief routes through Mesopotamia and Babylonia. Handbook for Travellers. By Karl Baedeker. Fourth edition. Leipzig: K. Baedeker; London: Dulau & Co., 1906. Size 6½ × 4½, pp. c. and 436. *Maps, Plans, and Panorama. Price 12m. Presented by Messrs. Dulau & Co.*

AFRICA.

Abyssinia—Historical. **Beccari.**

Rerum Æthiopicarum Scriptores occidentales inediti a sæculo xvi. ad xix. curante C. Beccari S.I. Vols. 2 and 3. P. Petri Paez S.I. Historia Æthiopiæ. Liber i. et ii., and iii. et iv. Romæ: C. de Luigi, 1905, 1906. Size 11 × 8, pp. (vol. 2) xlii. and 644; (vol. 3) xiv. and 586. *Plates.*

Paez's famous work is here printed for the first time (cf. review of the introductory volume in *Journal*, vol. 24, p. 213).

French Congo. **Rouget.**

L'expansion Coloniale au Congo français. Par F. Rouget. Avec une Introduction par E. Gentil, et une Lettre-Préface de A. Duchêne. 2^me^ édn. Paris: E. Larose, 1906. Size 10 × 6½, pp. viii. and 942. *Maps and Illustrations. Price* 8*s.* 6*d.*

A systematic account of French Congo and its people, and of the administrative developments under French rule.

North-West Africa. *La G., B.S.G. Paris* 13 (1906): 148–149. **Arnaud.**

Chasseurs et pêcheurs du Tagant et du Hodh. Par Robert Arnaud.

Sahara. *C.R.* 142 (1906): 241–243, 530–531. **Chudeau.**

Nouvelles observations sur la géologie du Sahara. D'Iférouane à Zinder. Notes de René Chudeau.

Noticed in the May number (p. 505).

South Africa. *T. Geol. S. South Africa* 8 (1905): 110–134. **Harger.**

The Diamond Pipes and Fissures of South Africa. By H. S. Harger.

South Africa—Boers. *Rev. Française* 31 (1906): 149–161. **Demanche.**

La formation de la nation Boer. Par G. Demanche. *With Maps.*

South and East Africa. ———

The Africa Pilot. Part III. South and East Coasts of Africa from the Cape of Good Hope to Ras Asir (Cape Guardafui), including the Comoro Islands. Originally compiled by Captain Algernon F. R. De Horsey. Seventh edition. London: J. D. Potter, 1905. Size 9½ × 6, pp. xxvi. and 622. *Index-charts. Price* 3*s.*

Spanish Colonies. *Questions Dipl.* 21 (1906): 193–205. **Lorin.**

Les colonies espagnoles du golfe de Guinée. Par H. Lorin. *With Map.*

West Africa. **Delevoye.**

Enseigne de Vaisseau Delevoye, Second de la Mission Lenfant (1903–1904). En Afrique Centrale (Niger—Bénoué—Tchad). Lettre-Préface de M. Lucien Hubert. Paris: H. Le Soudier, 1906. Size 7½ × 5, pp. viii. and 276. *Map and Illustrations. Price* 3.50 *fr.*

West Africa. **Gruvel and Bouyat.**

Les Pêcheries de la Côte occidentale d'Afrique. Par A. Gruvel et A. Bouyat. Paris: A. Challamel, 1906. Size 10 × 6½, pp. 280. *Maps and Illustrations. Price* 8*s.*

West Africa—Historical. **Machat.**

Documents sur les établissements Français de l'Afrique occidentale au XVIII^e^ siècle. Par J. Machat. Paris: A. Challamel, 1906. Size 10 × 6½, pp. 140. *Map. Price* 2*s.* 6*d.*

NORTH AMERICA.

America. **Muller.**

Door het Land van Columbus. Een Reisverhaal door Dr. H. P. N. Muller. Haarlem: De Erven F. Bohn, 1905. Size 10 × 6½, pp. x. and 504. *Illustrations. Presented by the Author.*

Narrative of an extensive journey through North and Central America, including the Dutch West Indies.

Canada—Anticosti. **Schmitt.**

Monographie de l'Ile d'Anticosti (Golfe Saint-Laurent). Par Joseph Schmitt. Paris: A. Hermann, 1904. Size 10 × 6½, pp. vi. and 370. *Maps and Illustrations. Price* 12*s.*

A systematic account of the island, its climate and natural history.

Canada—Historical. **Baxter.**

— A Memoir of Jacques Cartier, Sieur de Limoilou. His Voyages to the St. Lawrence, a Bibliography and a Facsimile of the Manuscript of 1534, with Annotations, etc. By Dr. J. P. Baxter. New York: Dodd, Mead & Co.; London: H. Stevens, 1906. Size 10 × 6½, pp. 464. *Facsimile Maps and Illustrations. Price* 42*s*.

The first adequate edition of Cartier's voyages that has appeared.

United States—Massachusetts. **Sears.**

The Physical Geography, Geology, Mineralogy, and Paleontology of Essex County, Massachusetts. By John Henry Sears. Salem, Mass.: Published by the Essex Institute, 1905. Size 11½ × 8½, pp. 418. *Map and Illustrations.*

United States—Surveys. **Waterhouse.**

Report on the United States Government Surveys. By Major-General J. Waterhouse (late Survey of India). Published by Colonel F. B. Longe, Surveyor-General of India. Calcutta, 1906. Size 13½ × 8½, pp. 48. *Illustrations. Presented by the Author.*

United States—Utah. **Davis.**

B. Museum Comp. Zoology, Harvard Coll., Geol. Ser. 8 (1905): 13–58.

The Wasatch, Canyon, and House Ranges, Utah. By W. M. Davis. *With Illustrations.*

CENTRAL AND SOUTH AMERICA.

Dutch Guiana. **Cappelle.**

Au travers des Forêts vierges de la Guyane Hollandaise. Par H. van Cappelle. Baarn; Paris: C. Béranger, 1905. Size 11 × 8, pp. 198. *Map and Illustrations. Price* 16*s*.

Account of an exploration of the Nikeri river, apparently in 1900, though the year seems nowhere to be definitely stated.

AUSTRALASIA AND PACIFIC ISLANDS.

Australia. **Lee.**

The Coming of the British to Australia, 1788 to 1829. By Ida Lee (Mrs. Charles Bruce Marriott). Preface by the Right Hon. the Marquis of Linlithgow. London: Longmans & Co., 1906. Size 9 × 6, pp. xviii. and 350. *Illustrations. Price* 7*s*. 6*d*. *net. Presented by the Publishers.*

[To be reviewed.]

New Zealand. **MacDonald.**

Geography of New Zealand for Senior Pupils in the Public Schools, Scholarship Candidates, and Pupil Teachers. By J. R. MacDonald. Wellington and Christchurch, N.Z.: Gordon & Gotch Proprietary, 1903. Size 7½ × 5, pp. 118. *Maps and Illustrations. Price* 1*s*. 6*d*. *Presented by the New Zealand Government.*

The treatment appears, on the whole, satisfactory, the main surface features of the islands being clearly and adequately described.

POLAR REGIONS.

Arctic—Norwegian Expedition. **Nansen.**

The Norwegian North Polar Expedition, 1893–1896. Scientific Results. Edited by Fridtjof Nansen. Vol. 5. London: Longmans & Co., 1906. Size 12 × 9½, pp. 62, x. and 152, and 22. *Maps and Plates. Presented by the Fridtjof Nansen Fund.*

Includes Memoirs on the Bottom Deposits of the North Polar Sea; on "Dead Water"; and on Protozoa of the northern ice-floes.

MATHEMATICAL GEOGRAPHY.

Refraction. **Ball.**

Refraktionstafeln. Von Dr. L. de Ball. Leipzig: W. Engelmann, 1906. Size 12½ × 8, pp. xiv. and 18. *Price* 2*s*. 6*d*.

Give the results of recalculations on the basis of Radau's theory.

Surveying. **Flemer.**

An Elementary Treatise on Photographic Methods and Instruments, including a Concise Review of executed Photographic Surveys and of Publications of this

Subject. By J. A. Flemer. New York: J. Wiley & Sons; London: Chapman & Hall, 1906. Size 9½ × 6, pp. xx. and 438. *Plates.* 21*s. net.* *Presented by Messrs. Chapman & Hall.* [To be reviewed.]

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Oceanography. **Herwig.**

Die Beteiligung Deutschlands an der Internationalen Meeresforschung. III. Jahresbericht, erstattet von dem Vorsitzenden der Wissenschaftlichen Kommission Dr. W. Herwig. Berlin: Otto Salle, 1906. Size 11½ × 8, pp. vi. and 192. *Charts and Diagrams.* *Presented by the Deutschen Wissenschaftlichen Kommission für die Internationale Meeresforschung.*

Oceanography—Current-meter. **Witting.**

Conseil Perm. Int. Explor. Mer, Publ. Circonstance, No. 30 (1905): pp. 8.

Kurze Beschreibung eines elektrisch registrierenden Strommessers. Von Rolf J. Witting. *With Illustrations.*

Oceanography—Currents. **Nansen and Ekman.**

Conseil Perm. Int. Explor. Mer, Publ. Circonstance, No. 34 (1906): pp. 42.

Fridtjof Nansen. Methods for measuring direction and velocity of Currents in the Sea. With an Appendix by Dr. V. Walfrid Ekman. *With Illustrations.*

Oceanography—Currents. *C.R.* **142** (1906): 245–246. **Thoulet and Chevallier.**

Sur la circulation océanique. Note de MM. Thoulet et Chevallier.

Oceanography—Methods. **Kofoid.**

Conseil Perm. Int. Explor. Mer, Publ. Circonstance, No. 32 (1905): pp. 10.

Charles Atwood Kofoid. A self-closing Water Bucket for Plankton Investigations. *With Illustrations.*

Oceanography—Tides. *B. Musée Océanog. de Monaco,* No. 68 (1906): pp. 20. **Berget.**

Cours d'Océanographie fondé à Paris par S. & S. le Prince de Monaco; 2ᵉ Année. Les Marées. Par A. Berget. *With Diagrams.*

Soils. **Ramann.**

Bodenkunde. Von Dr. E. Ramann. Zweite Aufl. Berlin: J. Springer, 1905. Size 9½ × 6½, pp. xii. and 432. *Price* 9*s.*

Speleology. **Knebel.**

Höhlenkunde mit Berücksichtigung der Karstphänomene. Von Dr. Walther von Knebel. (Der Wissenschaft, Heft 15.) Braunschweig: F. Vieweg u. Sohn, 1906. Size 9 × 6, pp. xvi. and 222. *Illustrations.* *Price* 5*s.* 6*d.*

A systematic text-book of speleology.

Volcanoes. *Verh.* 15 *Deutsch. Geographentages Danzig* (1905): 135–150. **Friederichsen.**

Dr. Moritz Alphons Stübels Verdienste um die moderne Vulkanologie. Von Dr. Max Friederichsen.

Zoogeography—Fishes. **Trybom.**

Conseil Perm. Int. Explor. Mer, Publ. Circonstance, No. 28 (1905): pp. 34.

Bericht über die Anstalten zur Vermehrung des Lachses und der Meerforellen in den Flüssen der Ostsee . . . bearbeitet von Dr. Fil. Trybom.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Anthropogeography. **Reclus.**

Élisée Reclus. L'Homme et la Terre, Tome 1ᵉʳ, Les Primitifs, Histoire Ancienne. Origines, Milieux telluriques, Travail, Peuples attardés, Familles, Classes, Peuplades, Rythme de l'Histoire, Iranie, Caucasie, Potamie. Paris: Librairie Universelle, [*not dated*]. Size 11½ × 8½, pp. iv. and 580. *Maps and Illustrations.* *Price* 15 *fr.* *Presented by M. Paul Reclus.* [To be reviewed.]

Commercial—Cocoa-nut. **Prudhomme.**

Le Cocotier, Culture, Industrie et Commerce dans les principaux pays de production. Coprah, Huile, Fibre de Coco et dérivés divers. Par E. Prudhomme. Paris: A. Challamel, 1906. Size 10 × 6½, pp. 492. *Illustrations.* *Price* 11*s.* 6*d.*

Historical—Early Travels. **Purchas.**

Hakluytus Posthumus, or Purchas His Pilgrimes. By Samuel Purchas, B.D. Vols.

13 and 14. Glasgow: J. MacLehose & Sons, 1906. Size 9 × 6, pp. (vol. 13) xx. and 560; (vol. 14) xx. and 592. *Facsimile Maps.*

These volumes embrace the conclusion of the early English and Dutch voyages to the north, and the beginning of the American section.

Historical—Maps. *Riv. G. Italiana* **12** (1905): 585–601. **Marinelli.**
Esame di sei carte nautiche dei secoli XVI. e XVII. Appunti di Olinto Marinelli.

Discusses the sources and relationships of six Italian maps of the Mediterranean, or parts of it, with dates between 1556 and 1615.

Historical—Sakas. *J.R. Asiatic S.* (1906): 460–464. **Thomas.**
Sakastana. By F. W. Thomas.
Supplementary notes (cf. May number, p. 522).

Historical—Vinland Voyages. **Nielsen.**
Norske G.S. Aarbog **16**, 1904–1905 (1905): 1–41.
Nordmænd og Skrælinger in Vinland. Af Professor Dr. Yngvar Nielsen.

History of Geography. **Lefranc.**
Les Navigations de Pantagruel. Étude sur le Géographie Rabelaisienne. Par Abel Lefranc. Paris: H. Leclerc, 1905. Size 10 × 6½, pp. 334. *Facsimile Maps and Illustrations. Price* 9*s.*

Interesting as throwing light on the geographical knowledge of the time of Rabelais and the actual sources from which he drew his descriptions.

History of Geography. *G.Z.* **12** (1906): 20–37. **Berger.**
Die Lehre von der Kugelgestalt der Erde im Altertum. Vortrag, gehalten im Verein für Erdkunde in Halle, von Hugo Berger.

History of Geography. **d'Eça.**
Sociedade de Geographia de Lisboa. Algumas Cartas ineditas do Visconde de Santarem, com uma introducção e notas por Vicente Almeida d'Eça. Lisboa, 1906. Size 10 × 6½.

Religions—Historical. **Magnaghi.**
Riv. G. Italiana **12** (1905): 257–266, 369–375, 464–475, 523–530.
La Statistica delle Religioni ai primi del Secolo XVII. secondo Giovanni Botero, di Alberto Magnaghi.

BIOGRAPHY.

Ferrari. *Riv. G. Italiana* **12** (1905): 329–339, 450–463. **Almagià.**
Le opinioni e le conoscenze geografiche di Antonio de Ferrariis. Memoria di Roberto Almagià.

Antonio Ferrari, surnamed Galateo, lived in the latter half of the fifteenth and early part of the sixteenth century, and among his various writings paid some attention to geography and map-making.

Gordon. **Gordon.**
A Varied Life. A Record of Military and Civil Service, of Sport and of Travel in India, Central Asia, and Persia, 1849–1902. By General Sir Thomas Edward Gordon, K.C.B., etc. London: John Murray, 1906. Size 9 × 6, pp. xvi. and 358. *Illustrations. Price* 15*s. net. Presented by the Publisher.* [To be reviewed.]

Reclus. *G.Z.* **12** (1906): 65–79. **Girardin and Brunhes.**
Elisée Reclus' Leben und Wirken (1830–1905). Von Paul Girardin und Jean Brunhes.

Richthofen. *G.Z.* **12** (1906): 1–11. **Hettner.**
Ferdinand von Richthofens Bedeutung für die Geographie. Von Alfred Hettner.

Richthofen. *Riv. G. Italiana* **12** (1905): 577–584. **Porena.**
Ferdinando von Richthofen e la sua opera scientifica. Nota del Prof. Filippo Porena.

Wissmann. *G.Z.* **12** (1906): 12–20. **Kirchhoff.**
Hermann v. Wissmann zum Gedächtnis. Von Alfred Kirchhoff.

GENERAL.

Bibliography. ——

International Catalogue of Scientific Literature. Fourth Annual Issue. H. Geology. London: Harrison & Sons, 1906. Size $8\frac{1}{2} \times 5\frac{1}{2}$, pp. viii. and 250. *Price* 16*s*. 6*d*.

British Empire. *R. Engineers J.* 3 (1906): 319–338. **Maguire.**

The Frontiers of the British Empire. By Dr. T. Miller Maguire. *With Maps.*

British Empire. *Kew B.* (1905): 9–43. ——

Botanical Survey of the Empire.

Sketches the work done during the last half-century (cf. *ante*, p. 296).

Catalogue of Maps. **[Soulsby.]**

British Museum. Catalogue of Maps. Accessions. Part xxxix. March, 1906. London: Printed by William Clowes & Sons, 1906. Size $11\frac{1}{2} \times 9$, pp. 274. *Presented by the Superintendent of the Map Room, British Museum.*

A most useful catalogue, including maps in printed books as well as those published separately. It is not only a guide to recent maps, but gives the titles of all older maps lately added to the national collection.

Educational. ——

Report of the Felsted School Scientific Society (founded 1877) for the year 1905. Earls Colne, 1906. Size $8\frac{1}{2} \times 5\frac{1}{2}$, pp. 16.

The society includes a geographical section.

Educational—Cartography. *J.G.* 5 (1906): 161–175. **Jefferson.**

About Nets for Map Drawing. By M. S. W. Jefferson. *With Illustrations.*

Exhibition. **Spielmann.**

Royal Commission St. Louis International Exhibition, 1904. The British Section. Compiled by Sir Isidore Spielmann. Issued by the Royal Commission, 1906. Size 14×11, pp. 392. *Illustrations. Presented by the Commission.*

Geographical Memoirs. **Ratzel and Helmolt.**

Kleine Schriften von Friedrich Ratzel. Ausgewählt und herausgegeben durch Hans Helmolt. Mit einer Bibliographie von Viktor Hantzsch. 2 vols. München und Berlin: R. Oldenbourg, 1906. Size 10×7, pp. (vol. 1) xxxvi. and 530; (vol. 2) x., 542, and lxii. *Portraits. Price* 22*s*. 6*d*.

A collection of articles and memoirs from a variety of scattered sources, some of them not generally accessible.

Geographical Society. *B.S. Khédiviale de G.*, 6 Ser. (1906): 435–459. **Abbate and Zéki.**

Centenaire de Mohamed Ali et trentième anniversaire de la fondation de la Société de Géographie. Par Dr. Abbate Pacha et Zéki Bey. *With Portrait.*

Geography. ——

The "Round the World" Series. Our Planet. London: T. C. & E. C. Jack, [*not dated*]. Size $7\frac{1}{2} \times 5$, pp. 256. *Maps and Illustrations. Price* 1*s*. 6*d*. *Presented by the Publishers.*

This volume treats of the Earth in relation to other heavenly bodies, and of the broader distributions on its surface.

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France. **Ministre de l'Intérieur, Paris.**

Carte de la France dressée par ordre du Ministre de l'Intérieur. Scale: 1:100,000 or 1 inch to 1·6 stat. mile. Sheets (new editions): XVIII.–12, Crépy-en-Valois; XVIII.–26, Isoire; XXIII.–33, Apt; XXXI.–38, Bastia. Paris: Ministère de l'Intérieur, Service Vicinal, 1906. *Price* 0.80 *fr. each sheet.*

Glasgow. **Johnston.**

Plan of Glasgow. Scale: 1:10,560 or 6 inches to one stat. mile. Edinburgh: W. & A. K. Johnston, [1906]. *Price* 2*s., mounted on cloth. Presented by the Publisher.*

A good useful plan of Glasgow, clearly drawn and printed in colours. For the purpose of general reference, an index might have been added with advantage.

Scandinavia. **Roth.**

Norden af Dr. Magnus Roth. Scale 1:1,000,000 or 1 inch to 15·8 stat. miles. 8 sheets. Stockholm: P. A. Norstedt & Sons, 1906.

A new edition of an orographically coloured wall-map of Norway, Sweden and Denmark which first appeared in 1883. It is boldly executed, the names of all important places being printed in large type so as to be seen at a distance, while the smaller names can be read upon close inspection.

ASIA.

China. **Topographical Section, General Staff.**

Province of Ché-Chiang (provisional issue). Scale 1:1,000,000 or 1 inch to 15·8 stat. miles. London: Topographical Section, General Staff, War Office, 1906. *Price 2s. Presented by the Director of Military Operations.*

Indian Government Surveys. **Surveyor-General of India.**

Indian Atlas, 1 inch to 4 miles. Sheets: 2 N.E., parts of districts Larkhana, Karachi, and Hyderabad (Sind, Bombay Presidency), additions and corrections to 1903. 16 N.W., parts of districts Dera Ismail Khan (N.W. Frontier Province), Mianwali, and Shahpur (Punjab), corrections to 1905. 24 N.E., parts of districts Surat, Thana, and Nasik, and of Dharampor, Bansda, Jawhar, and Surgana States (Bombay Presidency), and Daman (Portuguese Territory), additions to 1902. 36 S.E., parts of States Ali Rajpur, Jobat, Jhabua, Gwalior, Indore, and Dhar (C.I. 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Korea. **Zveginzof and Korf.**

Map of Northern Korea, constructed by A. I. Zveginzof and Baron N. A. Korf. Scale 1 : 840,154 or 1 inch to 13·3 stat. miles. 1904. [In Russian.] *Presented by Colonel J. de Shokalsky.*

A short time before the outbreak of the Russo-Japanese war, M. A. Zveginzof and Baron N. A. Korf made an extensive journey through Northern Korea, during which surveying was carried on as well as circumstances would admit, the result of which work, combined with that of earlier travellers, is shown on this map. The positions of thirteen points were determined astronomically by M. Zveginzof, and these, together with other determinations by Colonel Strelbitzki, enabled the authors to adjust their route-traverses. The relief is shown by approximate contours or form-lines, resulting from many barometric observations taken during the journeys. Although necessarily incomplete in many parts, this map is, in some respects, an advance on others of the same region which have appeared.

Siberia. **Tillo.**

Carte des bassins des océans, mers, fleuves et lacs de la Russie d'Asie et des pays limitrophes, dressée par le Sénateur, général-lieutenant d'Etat-Major A. de Tillo. Scale 1 : 4,200,000 or 1 inch to 66·3 stat. miles to an inch. 4 sheets. St. Petersburg: Ministère des Voies et Communications, 1905. *Presented by Colonel J. de Shokalsky.*

This large map of Asiatic Russia and surrounding regions has been published as a supplement to the memoir, in Russian, 'Superficie de la Russie d'Asie.' The various river-basins are clearly marked out by coloured lines, the larger drainage areas being shown by broad lines of colour, and the basins of the tributaries by narrower lines. It is far more than a rough diagram, as the special colouring is superimposed on what is really a most useful general map of Asiatic Russia, giving many place-names and much general information, although without hills, which would only have tended to confuse.

AFRICA.

Egypt. **Survey Department, Cairo.**

Map of Egypt. Scale 1 : 50,000 or 1 inch to 1·3 stat. miles. Sheets: S.E. I–1, III.–1. Cairo: Public Works Ministry, Survey Department, 1906. *Presented by the Director-General, Survey Department, Cairo.*

Egypt. **Survey Department, Cairo.**

Topographical map of Giza Province. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Sheets: N.E. I–2; S.E. I–5, I–6. Cairo: Public Works Ministry, Survey Department, 1904–05. *Presented by the Director-General, Survey Department, Cairo.*

French Congo. **Barralier.**

Carte du Congo Français dressée par Emmanuel Barralier. Scale 1 : 5,000,000 or 1 inch to 78·9 stat. miles. Paris: Service Géographique des Colonies, 1906.

Kamerun. **Moisel.**

Das Zwischenstromland des Logone und Schari von Lai-Nielim bis Kusseri-Ft. Lamy bearbeitet und gezeichnet von M. Moisel. Scale 1 : 750,000 or 1 inch to 11·8 stat. miles. *Mitteilungen aus den deutschen Schutzgebieten*, Band XIX., Karte 2. Berlin: E. S. Mittler & Son, 1906.

Kamerun. **Moisel.**

Provisorische Karte der Gebirgslandschaften des Militärbezirkes Fontem bearbeitet von M. Moisel. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. *Mitteilungen aus den deutschen Schutzgebieten*, Band XIX., Karte 1. Berlin: E. S. Mittler & Son, 1906.

AMERICA.

Canada. **Department of the Interior, Ottawa.**

Sectional map of Canada. Scale 1 : 190,080 or 1 inch to 3 stat. miles. Sheets: 21, Turtle mountain, revised to April 17, 1906; 22, Dufferin, revised to April 26, 1906; 73, Winnipeg, revised to May 26, 1906; 316, Vermilion, revised to May 18, 1906. Ottawa: Department of the Interior, Topographical Surveys Branch, 1906. *Presented by the Canadian Department of the Interior.*

United States. **U.S. Geological Survey.**

Geologic Atlas of the United States. Scale 1 : 125,000 or 1 inch to 1·9 stat. mile. Folios: 128, Aladdin, Wyoming—South Dakota—Montana, 1905; 129, Clifton, Arizona, 1905; 130, Rico, Colorado, 1905; 131, Needle mountains, Colorado, 1905; 132, Muscogee, Indian Territory, 1906; 133, Ebensburg, Pennsylvania, 1905; 134, Beaver, Pennsylvania, 1905; 135, Nepesta, Colorado, 1906. Washington: Department of the Interior, U.S. Geological Survey. *Price 25 cents each folio. Presented by the U.S. Geological Survey.*

AUSTRALIA.

New South Wales. **Department of Lands, Sydney.**

New South Wales, including Lord Howe Island. Scale 1 : 1,013,760 or 1 inch to 16 stat. miles. 4 sheets. Sydney: Department of Lands, 1905. *Presented by the Under-Secretary for Lands, New South Wales.*

New South Wales. **Department of Lands, Sydney.**

Wheat map of New South Wales, showing boundaries of wheat districts, with actual acreage for grain and average yield per acre in such districts for the ten years ending March 31, 1904. Scale 1 : 1,013,760 or 1 inch to 16 stat. miles. 4 sheets. Sydney: Department of Lands, 1905. *Price 10s. Presented by the Under-Secretary for Lands, New South Wales.*

New South Wales. **Department of Lands, Sydney.**

Tourist map of the south coast, New South Wales. Scale 1 : 633,600 or 1 inch to 10 stat. miles. Sydney: Department of Lands, 1906. *Presented by the Under-Secretary for Lands, New South Wales.*

New South Wales. **Department of Lands, Sydney.**

Map of New South Wales, indicating Eastern, Central, and Western Divisions. Scale 1 : 3,168,000 or 1 inch to 50 stat. miles. Sydney: Department of Lands, 1906. *Presented by the Under-Secretary for Lands, New South Wales.*

New South Wales. **Dept. of Lands, Sydney.**

Map of New South Wales Railways, showing coach and other routes from the various stations, together with mileage from Sydney. Scale 1 : 1,837,440 or 1 inch to 29 stat. miles. Sydney: Department of Lands, 1906. *Presented by the Under-Secretary for Lands, New South Wales.*

South Australia. **Surveyor-General, South Australia.**

Plan showing pastoral leases in the Northern Territory of South Australia. Compiled in the Surveyor-General's Office, Adelaide, 1905. Scale 1 : 1,013,760 or 1 inch to 16 stat. miles. 3 sheets. Adelaide: Surveyor-General's Office, 1905. *Presented by the Surveyor-General of South Australia.*

Western Australia. **Dept. of Lands and Surveys, Perth.**

Map of Western Australia. Scale 1 : 1,584,000 or 1 inch to 25 stat. miles. 4 sheets. Perth: Department of Lands and Surveys, 1906. *Presented by the Surveyor-General of Western Australia.*

POLAR REGIONS.

Greenland. **Danish Survey Commission.**

Kort over Grönland udgivet af Commissionen for Ledelsen af de geologiske og geographiske Undersögelser i Grönland. Scale 1 : 2,000,000 or 1 inch to 31·6 stat. miles. 4 sheets. Copenhagen: Kommissionen for Ledelsen af de geologiske og geographiske Undersøgelser i Grønland, 1906. *Presented by the Danish Survey Commission.*

This is the best general map of Greenland that has hitherto been published. It is on a large scale, and shows the results of all recent expeditions. The printing is in four colours, and has been most carefully carried out. Heights of coast land and of the great ice-cap are given where they are known, but there are no soundings, which is, perhaps, to be regretted.

Swedish Arctic Expedition. **Nathorst.**

Svenska Polarexpedition under A. G. Nathorst, 1898–1899.—Karta öfver "Antarctics" Kurs under de svenska polarexpeditionerno 1898 och 1899.—Karte der Baie Recherche und Van Keulen Bay auf Spitzbergen. Scale 1 : 100,000.—Karta öfver Van Mijens Bay och Belsund. Scale 1 : 200,000.—Karta öfver Kung Karls Land. Scale 1 : 200,000.—Geologisk Karta öfver Kung Karls Land. Scale 1 : 250,000.—Karta öfver Konung Oscars Fjord och Kejsar Frans Josefs Fjord. Scale 1 : 500,000.—Karta öfver Beeren Eiland. Scale 1 : 100,000. Stockholm: Generalstabens. *Presented by Dr. A. G. Nathorst.*

A series of maps and charts, from various publications, showing the exploration and survey work in Spitsbergen and on the east coast of Greenland, accomplished by the Swedish Arctic Expedition of 1898–99, under the leadership of Dr. A. G. Nathorst. The first is a general chart of the North Polar basin between Greenland, Spitsbergen, and Norway, showing the complete track of the exploring vessel *Antarctic*, and the others are special charts and plans, as shown by the titles above.

GENERAL.

World. **Bartholomew.**

Atlas of the World's Commerce. A new series of maps, with descriptive text and diagrams, showing products, imports, exports, commercial conditions, and economic statistics of the countries of the world. Compiled from the latest official returns at the Edinburgh Geographical Institute, and edited by J. G. Bartholomew, F.R.G.S., F.R.S.E. Part vi. London: George Newnes, Limited. *Presented by the Publishers.*

World. **Philip.**

Philips' Model Duplex Maps. Nos.: 2, Asia; 4, Australasia; 6, South America; 7, British Isles; 8, England and Wales; 9, Scotland; 10, Ireland; 14, the Indian Empire. London: George Philip & Son, Ltd. *Price 1d. net. each. Presented by the Publisher.*

Each of the above consists of two maps in one cover, one coloured to show political boundaries, and the other representing the relief as it would appear in the photograph ...del with a greatly exaggerated vertical scale. The idea seems good, but the ...tion of the vertical scale is far too great.

World. **Stanford.**

Stanford's London Atlas of Universal Geography. Quarto Edition. Fifty coloured maps, and an alphabetical list of names with latitudes and longitudes. Sixth edition. London: Edward Stanford, 1906. *Price 25s. Presented by the Publisher.*

A new edition of a useful little general atlas, which was first published in 1882. No alteration has been made in the general arrangement of the maps, although one or two have been added. The bathy-orographical map of the world in hemispheres, the geological maps of Europe and the British Isles, and the orographical map of the British Isles, are worthy of special attention. A full index to place-names is given at the end of the atlas, with latitudes and longitudes, so that it is possible to locate the place on the map even if the name is not given on the map itself. The atlas may be obtained in 8vo size, bound in the same style and at the same price as the above, which is in quarto.

World. **Stieler.**

Neunten, von Grund aus neubearbeiteten und neugestochenen Auflage von Stielers Hand-Atlas. 100 Karten auf 200 Seiten mit 162 Nebenkarten in Kupferstich und einem alphabetischen Verzeichnis aller im Atlas vorkommenden Namen (ungefähr 240,000 Namen enthaltend) herausgegeben von Justus Perthes' Geographischer Anstalt in Gotha. Lieferungen 9–12. Gotha: Justus Perthes, 1906. *Price 60 pf. each part.*

CHARTS.

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

Charts and Plans published by the Hydrographic Department, Admiralty, during June, 1906. *Presented by the Hydrographer, Admiralty.*

No.	Inches.	
2852 m =	6·80	Ireland, west coast:—Sligo harbour and approach. 4*s*.
1875 m =	0·5	North sea, Germany:—Elbe, Weser, and Jade rivers. 3*s*.
3570 m =	7·29	Leeward islands:—Puerto Rico, Yabucoa harbour. 2*s*.
3572 m =	2·42, 2·40, 5·27, 1·44	West Indies:—Plans in Aruba, Buen-Ayre, and Little Curaçoa, Orangestadt to North point, Little Curaçoa, Paarden bay, Kralendyk road. 2*s*.
3111 m =	4·85	Central America:—Colon harbour. 3*s*.
3569 m =	1·62	Alaska:—Port Valdez. 2*s*.
3493 m =	0·49	Bay of Bengal:—Cox's Bazar to Mayu river. 3*s*.
200 m =	11·95	Adriatic coast of Italy from Ortona to the river Po. New plans:—Rimini entrance, Pesaro.
3523 m =	6·0	British Columbia. Plans on the east coast of Vancouver island. Plan added:—Chemainus bay.
3334 m =	1·96	Japan. Tokyo to Sendai bay. Plan added:—Onahama wan.
1020 m =	8·97	Australia, east coast. Plan added:—Port Kembla.

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

Charts Cancelled.

No.	Cancelled by	No.
1875 North sea, Germany. Elbe, Weser, and Jade rivers.	New chart. Elbe, Weser, and Jade rivers	1875
513 West Indies. Plan of Orangestadt harbour on this sheet.	New plan. Orangestadt to North point on new chart	3572
3111 Central America. Colon or Navy bay.	New chart. Colon harbour	3111

Charts that have received Important Corrections.

No. 2045, England, south coast:—Owers to Christchurch with Spithead and the Isle of Wight. 1887, Germany:—Eider river to Blaavand point. 2990, France, north coast:—Le Havre and entrance to the Seine. 1306, South America, Magellan strait:—Plans in Barbara channel and Magdalen sound. 1373, South America, Magellan strait:—Tierra de Fuego, south-eastern part. 3327, Mexico, south-west coast:—Cape San Lucas to San Diego bay with the gulf of California. 1923*a*, British Columbia:—Cape Caution to Port Simpson, etc., northern portion. 1923*b*, British Columbia:—Cape Caution to Port Simpson, etc., southern portion. 2430,

Queen Charlotte island and adjacent coast of British Columbia. 1257, Korea:—Approaches to Ping Yang inlet. 1656, Korea:—Ping Yang inlet.
(*J. D. Potter, Agent.*)

Indian Ocean and Red Sea. **Meteorological Office.**

Meteorological Chart of the Indian Ocean north of 15° S. lat. and Red Sea for August, 1906. London: Meteorological Office, 1906. *Price 6d. Presented by the Meteorological Office.*

North Atlantic and Mediterranean. **Meteorological Office.**

Meteorological Chart of the North Atlantic and Mediterranean for August, 1906. London: Meteorological Office, 1906. *Price 6d. Presented by the Meteorological Office.*

North Atlantic. **U.S. Hydrographic Office.**

Pilot Chart of the North Atlantic Ocean for July, 1906. Washington: U.S. Hydrographic Office, 1906. *Presented by the U.S. Hydrographic Office.*

North Pacific. **U.S. Hydrographic Office.**

Pilot Chart of the North Pacific Ocean for August, 1906. Washington: U.S. Hydrographic Office, 1906. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Bombay Presidency. **Dwane.**

Twenty-three photographs of North Kanara and Bijapur Districts, taken by H. M. Dwane, Esq. *Presented by H. M. Dwane, Esq.*

These photographs have been presented by Mr. Dwane through Mr. F. J. Varley, in response to a request for geographical views of the peninsula of India.

(1) Back bay, Marmugao; (2) The headland, Marmugao; (3) Boatmen cutting up fish in the breakwater, Marmugao; (4) Scene at Vasco da Gama bay, south side, looking out to sea; (5) The landing-place, Downapowla; (6) The Fort moat, Bijapur; (7) The Boli Gombez, Bijapur; (8) Old cannon, Bijapur; (9) View 2 miles from Castle Rock railway station; (10) View from S.M. railway bungalow, 2 miles from Castle Rock station; (11) Dugh Sagar station, West of India-Portuguese railway; (12) Dharwar fort gate; (13) A well, Dharwar; (14) Dharwar bazaar; (15) Approach to main gate, Dharwar fort; (16) Inner gate, Dharwar fort; (17) The bottle dealer, Dharwar bazaar; (18) The money-changer, Dharwar bazaar; (19) The spice-sellers, Dharwar bazaar; (20) The rice-sellers, Dharwar bazaar; (21) The miscellaneous bazaar, Dharwar; (22) The vegetable-sellers, Dharwar bazaar; (23) The village boot-maker mends boots while you wait, Dharwar bazaar.

Mysore. **Barton.**

Seven photographs of the Elephant Keddah, arranged for the Prince of Wales in Mysore, in February, 1906, taken by Messrs. Barton, Son & Co., Bangalore. *Presented by the Right Hon. Lord Curzon of Kedleston, G.C.S.I., G.C.I.E.*

An interesting series of platinotypes, of different sizes. The titles are as follows:—

(1) Elephants in the outer stockade, the beginning of the drive; (2) Elephants entering the Keddah from the outer stockade; (3) The "koomkies" entering the inner stockade; (4) The koomkies punishing a troublesome cow; (5) A captured elephant being taken to water; (6) Tying up a big tusker; (7) The tusker hobbled and secured to a post.

Vegetation Types. **Karsten and Schenck.**

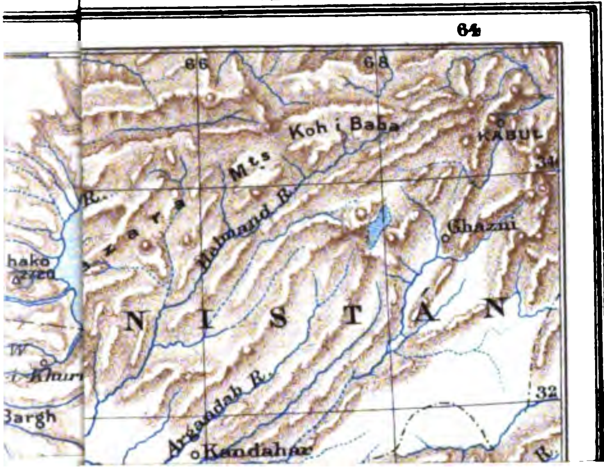
Vegetationsbilder herausgegeben von Dr. G. Karsten und Dr. H. Schenck. Dritte Reihe, Heft 7 u. 8. Vegetationstypen von der Insel Koh Chang im Meerbusen von Siam. Von Dr. Johs. Schmidt. Vierte Reihe, Heft 1. Ameisenpflanzen des Amazonasgebietes. Von E. Ule. Jena: Gustav Fischer, 1906. *Price 2.50 marks each part.*

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.

SEISTAN.

M^c MAHON.

THE GEOGRAPHICAL JOURNAL 1906.



The
Geographical Journal.

No. 4. OCTOBER, 1906. Vol. XXVIII.

THE INDIAN OCEAN.

Being Results largely based on the Work of the Percy Sladen Expedition in H.M.S. "Sealark," Comm. B. T. Somerville, 1905.*

By J. STANLEY GARDINER, M.A., Fellow of Gonville and Caius College, and Demonstrator of Animal Morphology in the University of Cambridge.

Perchance of no area of our great oceans do we at the present day know less than of the Indian ocean within the tropics. Fifty years ago, in the days of the great China and Indian clippers, it was, save for a small area to the north of Madagascar, alive with white wings, anxious to take advantage of every slant of wind or the smallest current. Its minutest characteristics were then the subject of anxious study, whereas now its greater part is to most navigators an unknown sea. With the opening of the Suez canal there was a profound alteration of trade, and the most important routes now start, not from Mauritius or the Cape, but from the Red sea. Hundreds of steamers, laughing at winds and currents, pass annually from Aden to Bombay and Colombo on the one hand, and to East African ports, to Madagascar, Mauritius, and Seychelles on the other. From Colombo, again, there are regular lines to Calcutta, Singapore, West Australia, Mauritius, and South Africa. But, except on the lines from the Red sea to Colombo, and from the latter to the Far East and to Australia, there is a relative absence of competition, a want of that necessity for accurate knowledge of the winds, currents, and topography, which is only called forth by a keen desire for saving time or mileage. The routes across her surface are also wide apart, and her islands are commercially unimportant. Great areas are seldom or never crossed by ships; in our six months' cruise on H.M.S. *Sealark* we never saw,

* Read at the Royal Geographical Society, June 11, 1906. Map, p. 424.

except in port, a single steamer, and only one solitary brig, a small trader from Mauritius to the Chagos.

Scientific expeditions, for the most part, avoided the Indian ocean. Closed in by land to the north, to the east, and to the west, their leaders deemed her problems of lesser importance than those of the Pacific and Atlantic. The possibility of such extensive movements of water as in the greater oceans was not to be considered. The biological conditions of her shores were deemed to present little variation, and her islets to be mainly coralline, mainly oceanic, and *therefore* all the same. Yet it was these same conditions which appealed to us in arranging our route. We felt that the day of vast expeditions, ranging through two or three oceans, was passed. Knowing some of the problems to be solved, we decided to attack them in a restricted area, as free as possible from the complications brought in by wide ranges and variations in temperature, currents, winds, and indeed all physical conditions.

The distribution of marine animals and plants was a main feature in our work, since from the geographical side no real investigation has as yet been attempted. Many organisms are purely littoral, and many are restricted in depth. Many, again, are adapted only to peculiar conditions, to particular environments. Yet we must consider how far the arrangement of marine animals and plants over the globe has been occasioned by the past changes of land and sea, and, conversely, how far it elucidates such changes (as undoubtedly does the present distribution of land organisms). For this purpose marine littoral life, restricted in its bathymetrical range, promises the best results. We have to know, in the first instance, what forms occur in each locality we are considering, and in what environment each can dwell, temperature, range of depth, nature of bottom, etc.; then we inquire how far each can be distributed by its larvæ, eggs, or spores, or how long such larvæ, eggs, or spores can continue to exist as such in the open ocean. Experimentally, we cannot simulate the conditions of the ocean, nor can we estimate satisfactorily accidental means of dispersal, such as by floating timber or weed. Indeed, to obtain accurate knowledge under this head, we have to find islands separated by deep sea and with no suspicion of ancient land within the bathymetrical limits of their organisms, and then to compare extensive collections from such with similar collections from neighbouring continental lands. As the smaller islands of the Indian ocean (with the possible exception of the Seychelles) seemed in this sense to be purely oceanic, their littoral organisms appeared to be particularly suitable for comparison with those of the surrounding continents, of which many accurate lists have been made. We may in this connection refer to the work by naturalists of all countries, particularly German, on the fauna of East Africa and the Red sea; to the fauna of South Africa, now being undertaken by the Cape Colony; to the work of the R.I.M.S. *Investigator* under Colonel

Alcock around India; to the Ceylon Oyster Reports by Prof. Herdman; to the Maldive expedition of Prof. Agassiz, and to an elaborate report on the fauna and geography of the Maldive and Laccadive archipelagoes by the author, as the result of 14 months' collecting in those groups; to much work in Malaysia and off West Australia, the results of most of which will be (or have been) incorporated in the report of the Dutch *Siboga* Expedition. How far the present expedition will throw valuable light on this question of the distribution of littoral animals and plants it is impossible to say to-night, or, indeed, until the collections are worked out. Our results so far are promising, as we found great diversity of life in similar environments in different

TAKAMAKA ISLAND, SALOMON ATOLL, CHAGOS. SANDY LAGOON BEACH WITH TIDE PARTY.

localities, and a progressive increase in variety of forms as we approached continental land. In any case, the question appeared to us to be one worthy of most careful attention, and, as marine organisms are subject to less variations in conditions than land forms, to be one likely to yield important information in respect to the changes of land and sea in past geological periods.

In any question of the oceanic nature of any island or reef, it is obviously necessary for us to know accurately (1) the topography of the ocean in which it is situated; and (2) its possible and probable geographical changes, particularly the relations of land and sea to one another in the past. Our knowledge of the first of these in the Indian ocean was meagre in the extreme, certain most important belts, where ridges might naturally be supposed to exist, having been left unexplored. The *Challenger* Expedition passed to the south of the Indian ocean properly so-called. The English Admiralty has always run lines of soundings where its surveying vessels have been sailing, but India belongs to a different survey, and the lines necessarily are few, a single line from the Seychelles towards North Sumatra and certain sections run by the telegraphic companies from Africa to the Seychelles and Mauritius, and from the latter continued further to Cocos-Keeling island and Australia. The *Valdivia* Expedition made a rapid traverse along a route which ran from Kerguelen to Cocos-Keeling, Sumatra, Nicobar, Ceylon, South Maldives, Chagos, Seychelles, and Zanzibar. The author contributed a few soundings between the banks of the Maldives, while Prof. Agassiz was responsible for a more extended series in the same region and a section to the south of Addu.

The few soundings of the *Valdivia* in the west half of the Indian ocean were of primary importance, but a gap was left in the middle between the Maldive and Chagos groups, and no soundings were attempted between the banks of the latter. Her course from the Chagos was more or less north-west to lat. 2° 39′ S., and then straight to the Seychelles. Two soundings of 1499 fathoms, lat. 2° 57′ S., long. 67° 59′ E., and 1891 fathoms, lat. 2° 39′ S., long. 65° 59′ E., gave indications of a shallower bank, which might, or might not, connect with the Maldives, Chagos, or the Seychelles-Mauritius line. For the rest, the contour map published by the *Valdivia* follows between the islands of the West Indian ocean in a more detailed manner the one published by the author in connection with a previous expedition, and was based on the same evidence. While the presence of ridges or shoaler grounds between continents or islands cannot be taken as evidence of former connections or separations, yet they may give indications of such. The discovery of the *Valdivia* was accordingly of great interest, and it naturally suggested that there might be broad or narrow ridges of lesser depth even from Madagascar to India.

The land connection of South Africa and Madagascar with India can scarcely be disputed, though its duration and the changes which have taken place in it may legitimately be discussed. Parts of each continent would appear to have remained continuously as land from the Carboniferous to the present day, while the present land connection between India and South Africa through Persia and Arabia cannot have come into existence before the Middle Tertiary period. Remains of the same land fauna and flora from the Carboniferous to the Middle Secondary period are found in both South Africa and India, and must certainly be deemed to prove a land connection, which can only have extended along the Madagascar-Ceylon line. North-west and south-east of this bridge were marine faunas quite distinct yet recognizably of the same geological periods.

In the Upper Secondary (in the Middle and Upper Cretaceous), and even in the Lower Tertiary (Eocene), there was sea covering the southern part of Europe and parts of North Africa and Arabia, connecting the Atlantic ocean with the Arabian sea. On either side of the line of connection between Madagascar and India, we find still distinct marine faunas in elevated submarine deposits of the Upper Cretaceous period. This fact implies that there was no connection of the oceans until the Eocene at least, such as would have enabled the faunas of the two oceans to have seriously intermingled; in other words, that the connection between Madagascar and India continued up

JACOBIN ISLAND, SALOMON ATOLL, CHAGOS. CORAL ROCK OF SEAWARD END, WITH REEF OFF SAME.

to the Eocene, though with possibly one or two straits not sufficiently broad for the intermingling of the two marine faunas, though serving to separate the land organisms of the two regions. Africa would at this time have been an island, and it probably continued to be so until the middle or commencement of the Upper Tertiary, during which it had a wide land connection across the Red sea through Arabia to South Europe, to Asia, and so to North America and to India.

If the above be a true history—and it seems to us that all related facts with regard to the present distribution of land animals are capable of satisfactory explanation by its means—we might reasonably expect to find at the present day some traces of that great, elongated, connecting isthmus, or chain of islands, of the Eocene. In the first instance, we should be disposed to look to a subsidence to explain its destruction. On this view we might reasonably hope to find some remains of its ancient mountains still existing. With the possible exception of the Seychelles, which, it will be shown later, separated (if a connection ever existed) at an earlier date, we find no trace of such. All islands that exist are of coral formation, and are separated from one another by wide tracts of sea. If they be assumed, for the moment, to owe their existence to a slow, long-continued subsidence—a supposition which, when we examine their present topography, we can scarcely allow—it is difficult to understand their rather scanty distribution and wide separation from one another. On this view, at the commencement of the subsidence, there would have to have been relatively low belts of land between the Maldives and the Chagos, and between the latter and the Seychelles (if the connection did not run directly from the Seychelles to the Maldives), and again to the north of Madagascar, and between the individual reefs which now exist. Next, we must suppose that for some reason the life which forms coral reefs did not and could not exist at first around their shores, so that the subsidence left a series of isolated mounds of approximately the same areas as the coral reefs now occupy. Such a view is, of course, possible, but it is obviously beset with difficulties, and cannot be supported by analogy with other regions.

The difficulties, indeed, in respect to the present distribution of the coral reefs would appear to be such that we are inclined to question the possibility of subsidence being the main cause of the disappearance of our former isthmus or chain of closely connected islands. On any view the area to the north of the Seychelles, that is, the Arabian sea, has been covered by water since the Lower Secondary Period (Trias), and was for part of this time in free communication with the Atlantic by a much enlarged Mediterranean. That great sea between South Africa and Australia, up into the Bay of Bengal, has also, in all probability, existed since the same period. It can scarcely be supposed that the subsidence was purely local along the ridge dividing these two seas, the line not being one of weakness, or of any volcanic activity, so far as we know, and on neither side of it is any trace now to be found of any such subsidence. Again, we find elevations of late Secondary and Eocene rocks on the coast of Madagascar, South Africa, and India, as well as rocks of still later periods. This fact, together with the existence of deep water (2000 fathoms) round the north and east of Madagascar and round South India without any marked tailing off of the land-slope to its depth, points to the subsidence having necessarily been local, and having ceased to operate peculiarly abruptly at either end.

Granting, then, our premises of the land connection up to the early Eocene between India and Madagascar by a relatively narrow isthmus, or a chain of large islands with narrow straits between, what is the cause of the disappearance of the then existing land, if it be not due to a subsidence of the sea bottom? As far as we know the facts, as far as we know the marine deposits, we must remember that throughout the Eocene, and part, if not all, of the Miocene, there was continuous sea extending to our ridge from Panama, which not improbably did not exist as an isthmus in the Eocene, when there would have been a free connection with the Pacific. On the other side, again, there was open sea even to South America, both by the south of Australia and New Zealand, and across the Malay archipelago. Indeed, save for our isthmus, and for part of the time that of Panama, there would have

DISTRIBUTION OF LAND AND WATER IN THE JURASSIC PERIOD (AFTER NEUMAYER).

been a practically continuous water-connection around the whole world.

The tides at the present day are admittedly of comparatively small importance, since they are broken up by the three lands of America, Africa, and Malaysia; but with open sea more or less round or near the equator, they must have had extraordinary force. Indeed, with such tides it is doubtful whether any coral island, like to those of the present day, could have existed, while navigation across the equator might have been quite impossible except by a favoured coast-route. Yet, from the analogy of the existing lands, particularly of the East Indies, we can perhaps get, especially when our isthmus gave place to a series of separate land-masses, some clue as to the probable effects of these great tides, sweeping across more than half the world, to be resolved into currents through straits or over ridges.

The *Siboga* Expedition through the East Indies was primarily not an hydrographical expedition, but there were expert surveyors on board, men who knew the importance of the facts they stated, and who can be implicitly relied upon. Throughout the whole general account of the cruise we find constant references to the strength of the currents, and their effects to various depths even beyond 1000 fathoms, to the bottom being bare and hard, completely current-swept in many straits, to the action of the sea upon the various lands, to the former connection between Bali and Lombok, etc. Considering the facts collected by the *Siboga* and accumulated by geologists and others in respect to the East Indian archipelago, there seems to be a strong case for the separation of the islands, particularly of the line from Sumatra to Timor, or Timor Laut, having been occasioned, not by subsidence, but by marine actions in progress since the Pliocene period. The ultimate result should be analogous to the present condition of the Indo-Madagascar ridge, but, the Malay connection being broader and less open to the full forces of the tides, the effects would not be as great.*

We may also draw attention to the existence of important ridges in the Atlantic lying more or less parallel to the direction of tidal force—a fact surely worthy of consideration in reference to past land connections, and to the fact that ridges crossing this direction are bare and markedly current-swept. "In archipelagoes like the Canary islands, which are separated by channels having often a minimum depth of 1200 fathoms or more, the crests of these ridges are swept bare of sediment, and are hard rock, generally calcareous and manganiferous." † We may also refer to the facts relating to the Maldives, particularly the soundings established by Prof. Alexander Agassiz,

* In this connection see in the *Siboga* Reports, 'Introduction et Description de l'Expedition,' by Max Weber, pp. 14–20, 52–53, 62, 102–105, etc.; and 'Hydrographic Results of the *Siboga* Expedition,' by Commander G. F. Tydeman, "List of the Soundings," particularly pp. 85–86, and "Remarks on Currents," pp. 5–6. The following observation, made with a heavy net let down to the bottom and hauled up vertically through the water in Manipa strait, may be quoted as showing how valuable observations may be made on deep currents, even without the use of regular metres. The ship was drifting 0·5 mile per hour in a northerly direction, and 1536 metres of cable were out, pointing in a southerly direction, and making an angle of 10° with the vertical. "When the net was drawn up, the cable remained in about this position until there were still 800 metres out. From this moment the cable approached more and more the vertical position, and then passed same, so that it pointed under the ship in a northerly direction. When there were still 100 metres out, the position rapidly changed, and the cable went strongly to starboard again, *i.e.* pointing to the south, now making an angle of 25° to 30° with the vertical, until the net arrived at the surface." The deduction from this observation was that the water was at rest below 800 metres, streaming north from 800 to 100 metres, and south from 100 metres to the surface. To explain this, Commander Tydeman supposed that the great depths of Manipa strait must be interrupted by a ridge of smaller depth, of 800 metres. This was partially confirmed the same day by soundings of 1067, 1195, and 940 metres, the lead twice striking hard ground, apparently subject to strong scouring by the current.

† "A Retrospect of Oceanography," by J. Y. Buchanan, 'Report of the Sixth International Geographical Congress,' 1895, p. 25.

and to our own observations and views on the same locality, in which we considered in detail the possible formation of that whole group of atolls by the cutting up of a continuous land mass—perhaps by agencies still in progress—into separate plateaus, upon which coral reefs were subsequently built up.* Lastly, we have evidence collected by the present expedition relating to the existence and effects of deep-sea currents along the line under consideration. Some of this will be given later when the geographical characters of the banks and islands visited are discussed.

To summarize our view, we consider that up to the end of the

ANGLAISE ISLAND, SALOMON ATOLL, CHAGOS. A DRIED-UP POOL IN CENTRE OF ISLAND (AN OLD REEF-FLAT) FRINGED WITH SEAEVOLA.

Primary period India and South Africa were connected to each other by a broad belt of land, which included the areas at present covered by Madagascar and Ceylon. In the Secondary period this land-connection

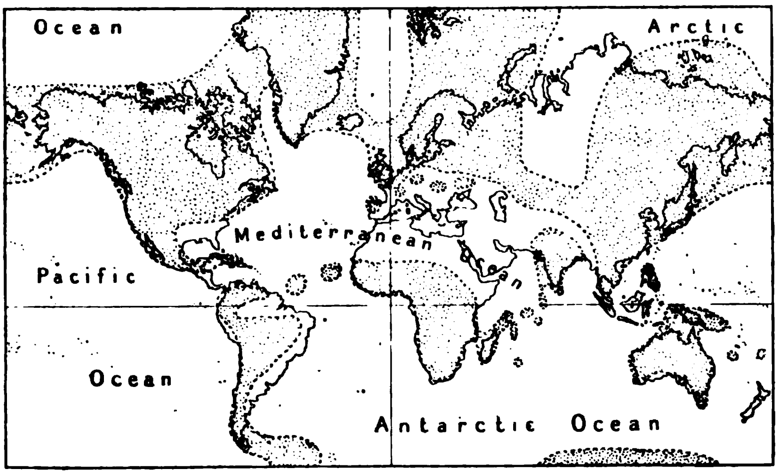
* "The Coral Reefs of the Maldives," by Alexander Agassiz, *Mem. Mus. Comp. Zool.*, Harvard, vol. 29, 1903; and "The Fauna and Geography of the Maldive and Laccadive Archipelagoes," by J. Stanley Gardiner, pp. 12-50, 146-183, 313-346, 376-423: 1902-3. It is not to be inferred that Prof. Agassiz agrees with us in our conclusions from these facts. His results in the Fiji islands, with which we largely agree, well exemplify the important part played by marine erosion on islands with broad tracts of ocean on either side, not restricted by any masses of continental land, "the submarine platforms upon which the barrier reefs have grown being merely the flats left by the denudation and erosion of the central island, while the atolls are similar flats from the surface of which the islands have at first disappeared, and the interior parts of which have next been removed. . . ." ("The Islands and Coral Reefs of Fiji," *Bull. Mus. Comp. Zool*, Harvard, vol. 33, p. 135: 1899.)

continued unbroken; but towards the end of that period, in the Cretaceous, its breadth was restricted, partially by marine action, but largely by subsidence, of which we find the remains at either end in submarine deposits of the same age subsequently upheaved. At about the commencement of the Eocene the first straits were formed, probably between the present Saya de Malha, Chagos, and Maldive banks. They were probably not of sufficient importance to cause an intermingling of the marine faunas of the east and west coasts of India and Madagascar during the lower half of the Eocene, though they would have profoundly affected the distribution of land animals. At this time there would have been continuous sea around the globe, narrowest at our straits, and we would ascribe the present conditions along our belt entirely to subsequent marine action, independent of upheaval or depression—to action which had its chief force in the Eocene and Miocene, before the ocean was cut by a land upheaval joining Asia and Africa, but which is still to some degree in force. The commencement of the formation of atoll-reefs along the belt we believe to have been due to the change of conditions brought about by this last separation, and perhaps that which formed the Sumatra-Timor land. At the present day, since the action to some degree decreases from south to north, we should find greater perfection of atoll-formation in the same direction, a series perchance of coral banks showing stages in formation, and this to some degree we believe to be the case.

The coral reefs of the west half of the Indian ocean may for our consideration be divided into four sections: (*a*) Maldive, (*b*) Chagos, (*c*) Seychelles, and (*d*) Farquhar. To (*a*) belong the Maldive and Laccadive archipelagoes, containing a large number of reefs, all with land, some of them exhibiting the atoll-ring in its typical form. The *Sealark* Expedition did not further investigate them, and we may here refer simply to the accounts published by Prof. Agassiz and ourselves (*loc. cit.*).

In (*b*) we have merely the reefs and banks of the Chagos archipelago, separated from the Maldives to the north by about 2000 fathoms of water. They comprise Diego Garcia, with a circumference of 35 miles, over 30 of which is crowned with continuous land, one large and two narrow passages to the north separated by islets; Egmont, six islands on a narrow atoll, 13 fathoms deep, 5½ miles long by 2½ broad, with a long opening to the north; Salomon, the centre of our work, an atoll with one passage to the north, a little longer and broader than the last, with eleven islands and a depth of 17 fathoms; Peros Banhos, a large square-shaped bank, 41 fathoms deep, comprising about 160 square miles of surface, its rim 50 miles long, of which only 34 is covered by surface reefs, quite open to the south-east except for two patches of reef, in all thirty-four islets and thirteen passages; Blenheim reef, a similar atoll to Salomon, but without land, 10 fathoms deep, widely open to the south; Great Chagos, an enormous bank of nearly 4000 square miles, with a depth of 45 to 50 fathoms, and a rim at 5 to 10 fathoms, with only seven patches of surface reef, each with land; Victory, a small atoll bank, with rim at 3 fathoms; Speaker and Pitt, large banks with about 24 fathoms in their centres, and rims completely covered by 5 to 10 fathoms; and, lastly, a number of small submerged patches and banks, some apparently quite flat, but not sufficiently delimited for our purposes.

The area comprised by the Chagos extends 180 miles north and south, and 120 miles east and west, in all about 21,000 square miles. Its banks, as enumerated above, give a series from almost completely enclosed atolls to shoals completely submerged and scarcely hollowed



DISTRIBUTION OF LAND AND WATER IN THE LOWER EOCENE PERIOD.

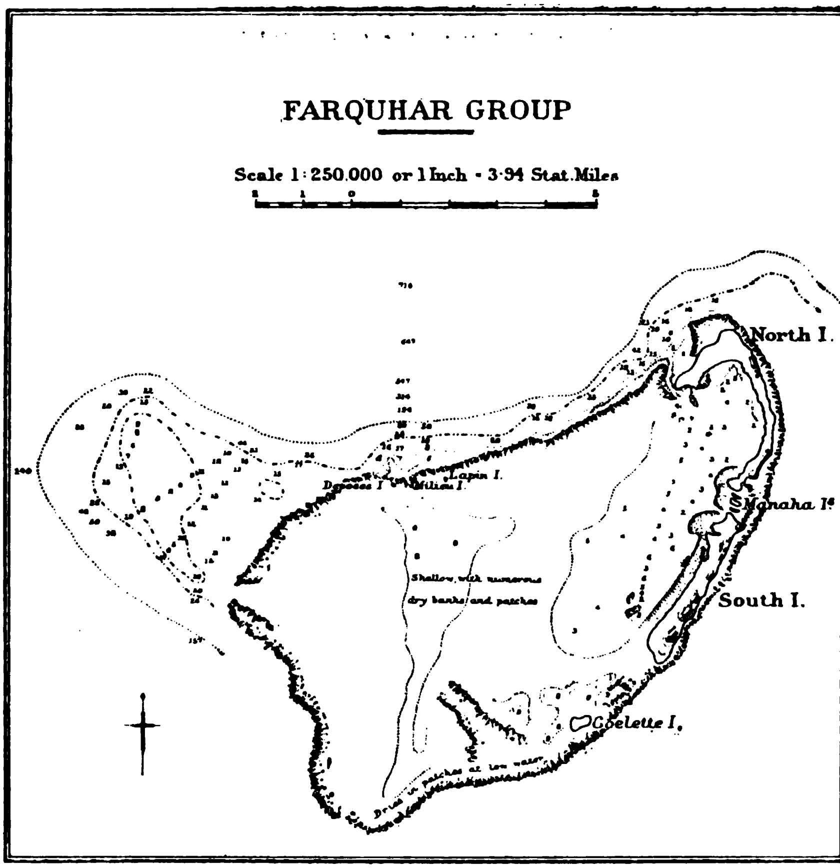
out. Individually the reefs present the same general characters as those of the Maldives. They differ, however, in detail in that their outgrowing edges are, *practically entirely*, formed of nullipores, though corals are important builders from 5 to 30 fathoms. If their fauna be compared with that of the Maldives, it is noticeably scanty in species, though the bulk of animal life is as great—a fact which leads one to hope for interesting results in the distribution of marine animals in the Indian ocean. Lastly, we found throughout the group evidence of the land having very largely been formed by some small change of level of the reefs in respect to the water in past ages, similar to what we before found in the Maldives and Minikoi.

The whole Chagos archipelago lies on a bank at about 700 fathoms, and is bounded on all sides by over 2000 fathoms of water. The depth between the different banks varies from about 350 to 800 fathoms,* to

* We are, unfortunately, unable to give a chart showing the soundings, or more accurate information, as the revised chart has not yet been submitted to the Admiralty.

which all slope in the regular manner of isolated coral reefs, gradually to 30–50 fathoms in 200–600 yards, followed by a steep to 120–200 fathoms, and a more gentle slope to the general bottom-level in the vicinity. The contour of any bank, though, may be modified in any position by that of the mound on which the whole bank arises. Thus Salomon atoll, being more or less enclosed in by banks to the north, south, and east, is not nearly so typical in this respect as Diego Garcia or Peros Banhos. The characters of the slope and of the bottom between different banks were the main objects of our investigations within the groups. We ran sections over the steep, and attempted to dredge it. For the former we used all sorts of leads, and found a hard bottom strewn with dead corals and nullipores. Dredging showed that these all belonged to kinds living on the reef above, and that they were held in position by being wedged together and cemented by sponges and other organisms. In fact, it was a talus slope, built of the remains of reef organisms, swept out by under-currents from the reefs above. At the bottom of this steep, the talus was found to continue outwards, the individual fragments getting smaller and smaller for 1 to 2 miles. The bottom then gradually became smoother between the banks, until finally it resembled almost a hard concreted road. The lead generally came up empty, sometimes with a fragment of reef coral, but *never* with any mud or ooze. With a half-inch wire rope we hauled, for several miles between Salomon and Peros, trawls and dredges, with nets and bags, and even once a plankton net. They were never caught up nor torn in any way, and their swords and sides came up polished, proving that they had been sweeping along the bottom. Their contents were practically devoid of animal life, and consisted of a few fragments of dead coral. The latter were all rounded, as if constantly rubbed, and absolutely clean, without a trace of coral mud; in fact, it was quite clear that the bottom between the banks of the Chagos was everywhere current-swept even down to 1000 fathoms. Furthermore, the difficulty experienced, when the ship was drifting, in getting our dredges and trawls, generally of quite sufficient weight, on to the bottom, until we lashed them up with fire-bars, and the way in which the sounding-wire was dragged, showed clearly the existence of strong currents at every depth. With strong winds blowing, the dredging-wire constantly dragged under the ship when drifting, proving the existence of under-currents of greater force than those of the surface. We had not the stronger dredging-wire, with which we might have anchored had the weather been propitious (which it never was), so as to make precise measurements; but we venture to think that no practical surveyor could have had any doubt as to the existence of strong currents between the atolls right down to the bottom during the whole of our stay in the Chagos. On the whole, we are inclined to consider that the present banks of the Chagos were formed in a similar manner to those of the Maldives, by the cutting down of a land by the action of the seas, and by the subsequent upgrowth of coral reefs, as the currents moderated. Subsidence may have taken a part in perhaps paving the way for this action, but in any case we can have no doubt of the importance of erosion in the past and the present day in shaping the archipelago.

Réunion, Mauritius, and Rodriguez are three isolated, volcanic



islands lying between lats. 19° and 21° 30′ S. They are respectively 10,069, 2711, and 1300 feet in height, and Réunion has a still active volcano—the only one in the Indian ocean—in Grand Brûlé, 8613 feet in height. There is nothing in the topography to indicate any special connection between the three islands, and they are probably to be regarded, together with two small shoals near them, as of quite separate formation both to one another and to the large banks that lie to the north. Their reefs are for the most part fringing, but approach the barrier condition off parts of Mauritius and Rodriguez.

Elevated coralline limestone has long been known to occur in Rodriguez, and in Mauritius we found most of the islets and some of the shore at Grand Port (where alone there is a real barrier reef) formed by an evidently recent elevation of something over 60 feet.

In passing onwards we would draw attention to that deep bight of water which lies to the east of Madagascar, and which is more or less enclosed by our third series of shoals and reefs—that of the Seychelles. We did not attempt to investigate it beyond running a few soundings to the north-east of Madagascar, as it seemed to have been sufficiently sounded. Its average depth is about 2300 fathoms, and soundings between Mauritius and South Africa clearly show it to be quite open to the south, while we found 1962 fathoms between the former and the Nazareth bank. To the north-west again there proved to be over 1800 fathoms between Cape Amber, Madagascar, and Farquhar, and 2170 fathoms between Providence and Alphonse-François. Unfortunately, our sounding-machine broke, so that we could get no depths between Alphonse and the Amirante bank; but there was already one sounding of 952 fathoms marked on the chart, on which also is recorded a depth of 1150 fathoms a little south of the direct line between the latter and the Seychelles bank. Probably both banks are included within the same 1100 or 1200 fathom-line as the Seychelles. To the north-east the wall would appear to be more complete, since we found a maximum depth of only 961 fathoms between the Seychelles and the north Saya de Malha bank, 636 and 130 fathoms between the three Saya de Malha banks, and 222 fathoms between the latter and the Nazareth bank. Considered together, these soundings would point to a remarkably close connection between the Saya de Malha and Nazareth banks and to a relationship between all the banks of the crescent from Alphonse to Cargados.

Providence and Farquhar, between which there is a depth of only 890 fathoms, would belong to a different group, which not improbably extends for 300 miles east and west, so as to include Aldabra, Assumption, Cosmoledo, and Astove. Of this group—our fourth series (*d*)—we visited Farquhar, Providence, and St. Pierre only, not deeming the question of their connection with the others to be of as great importance as the hills marked in the charts of some of the Amirante islands, and the weather being unfavourable. Aldabra, Cosmoledo, Farquhar, and Astove are all atolls, the three former of 19, 9, and 10 miles in length by 6 miles broad, while Astove is 2½ by 1½ miles. In all the outer rim is nearly perfect, such passages as there are being quite inconsiderable, and their lagoons do not exceed 8 fathoms (Farquhar) in depth. The lagoon is practically surrounded by land in Aldabra, except in three places, together not more than a mile in width, while Farquhar has less than a third of its circumference so covered. The lagoons themselves are full of shoals, and have no islets. Of the other reefs, Assumption is a crescent nearly 4 miles long, with a fringing reef, and Providence is a reef of similar shape, 24 miles long, with sand islets towards its northern and southern ends. St. Pierre lies about 17 miles west of the last, and is separated from it by nearly 1000 fathoms of water; it is merely a small islet, less than a mile in diameter, with, in some places, a narrow fringing reef.

This group of reefs and islands presents some features of consider-

ÎLE DU COIN, PEROS ATOLL, CHAGOS. MR. FORSTER COOPER AT BASE OF LARGE MAPON TREE, ON WHICH CAPTAIN MORESBY'S INITIALS WERE CUT IN 1837.

able interest. Aldabra has long been known as the home of *Testudo elephantina*, and has several rare and peculiar birds. All are regularly fished for both shell and edible turtle, for which they are famous. Aldabra has been investigated by Prof. Voeltzkow, who describes it as having been formed by a deposit of foraminiferal remains (mainly coccoliths and rhabdoliths), which has been elevated 20 to 80 feet above the sea-level.* There is a narrow fringing reef all round, against which

* *Senckenbergischen Naturforschenden Gesellschaft*, bd. xxvi., 1901.

the land presents small often undercut cliffs. Probably this fringing flat owes its existence largely to the abrasion of the land, as in so many of the Fiji islands. In any case, however the land was formed, there can be no suggestion of its ever having been connected with any other. The evidence of elevation in Cosmoledo, Astove, and Assumption is less clear, and the present islets of Providence are certainly due merely to the piling up of sand on the reef by the wind and waves. Farquhar has a series of small hillocks, and along the middle of the south island a ridge which reaches a height of 75 feet above the water-level. The first section, which we prepared with the horizontal scale half the vertical suggested elevation, but the natural section annexed (with the same scale for both), pointed to a sand-dune, piled up from either side, a conclusion amply borne out by the examination of the material of which it is formed. St. Pierre, however, differed in that it is an island of coral rock, with its summit about 50 feet above the sea, but probably twice as high when first upheaved. It is surrounded by cliffs, and such fringing reef as it has was undoubtedly formed by erosion of the land. It is now the home of countless seabirds, with extensive deposits of guano.

We have mentioned the above comparatively unimportant details, because we think they indicate that these islets lie in a district which is by no means stable, by no means at rest, or subject to the same movement all over its area. The whole series of banks now under consideration may be regarded as occupying part of the site of the Indo-Madagascar continent. Yet, allowing this to be the case, we are seriously inclined to doubt whether its different reefs represent any peaks of that land, but are not rather the result of separate volcanic eruptions. Beyond the general evidence above, perhaps scarcely worthy of the term "evidence," we would point to the result of a dredging in 844 fathoms, within 2 miles of the 100-fathom line, off the south-west of Providence reef. In this we obtained, with a large triangular dredge, a few masses of sticky, semi-consolidated mud and about 5 cwt. of stones. This mud consists of practically pure volcanic ash, while the stones are of these kinds: (1) manganese nodules formed round nuclei of ash, (2) consolidated ash, and (3) masses of coral rock from the reef above, coated with manganese. Now, round coral islands the bottom is invariably covered with masses and fragments of coral, or with coral mud, no trace of which occurs mixed up with the above deposit. In the Pacific ocean, at such depths off coral islands there would certainly be a deposit, into which the sounding-tube would be naturally driven for several inches, and we can only conclude that its absence here is due to strong under-currents, perhaps outwards from Providence reef, perhaps merely passing along the same. This view is supported by the fact that many of the rocks themselves came up with their surfaces quite polished, and with hydroids and worm-tubes attached, both of forms which cannot exist on mud. Further, the manganese of the nodules is 1 to 2 inches in thickness, and for it to have attained this, the individual nodules must have lain freely on the bottom for long periods. Without attempting to go into the question fully, we may express our conviction that here we have part of the mound on which Providence reef was built up exposed by under-currents and that we have the first definite evidence of the nature of the foundation on which a regular and typical existing coral reef has been built up.

We may, perhaps, here refer to the bottom samples obtained during the cruise, in so far as manganese is concerned. Where carbonate of lime rocks alone exist, as off coral reefs, manganese is not found either

POINT MARIANNE, DIEGO GARCIA ATOLL, CHAGOS. SALT WATER SWAMP, A SUCCULENT PLANT FORMING PEAT AND KILLING THE COCONUTS.

in nodules or as scales in the ooze or mud. Round Ceylon there is plenty, but off Chagos we found no trace, nor yet to the south, until we approached Mauritius, where certain deposits appeared as if dusted with it. Near Farquhar the bottom samples were similar, and at different places off Providence, in addition to the above, we got several coral masses more or less discoloured by it. Again, from Alphonse, through the Seychelles, right down through Saya de Malha to Cargados, we practically found no trace. Such being the case, the presence of deposits containing manganese between Farquhar and Providence, since we can scarcely suppose them to be in any way under the influence of Madagascar, does point to a marked difference in that as compared with other regions we visited.

We pass now to the third series of reefs and shoals—that of the Seychelles, which, in its crescent shape, is particularly remarkable in relation to the former connection of Madagascar and India. Its length is roughly 1300 miles included within the 1100-fathom line, and its probable total dimension is upwards of 100,000 square miles. As already pointed out, there would appear to be a special connection between the Saya de Malha and Nazareth banks, and our investigations showed a close similarity between the same. Nazareth is a bank about 225 miles long by a maximum breadth of about 90 miles, with an extraordinary surface shoal, Cargados Carajoz, at its south end, 32 miles long, crescent-shaped, with its convexity to the east. The main reef has eight islets, and there are in addition over twenty others arising on separate patches of reef within the crescent, besides two isolated islands 3 and 10 miles to the north. Nearly all these islands have (or had) deposits of guano, and were the homes of sea-birds. So far as we could see, they showed little signs of elevation, and their reefs were everywhere typical coral reefs. Unfortunately, we had to confine our investigations to this southern part, the weather being continuously unfavourable, but the rest of the bank would appear to have an average depth of 30 to 40 fathoms, with one area of 14 to 20 fathoms in the centre; in no way did it appear to show any approach to an atoll condition. Opposite Cargados the bank was about 30 miles broad, suddenly falling off, in the four places where we sounded over its edge, from about 40 to 250 fathoms in less than half a mile. Its central part was extraordinarily level, sounding after sounding being recorded between 30 and 35 fathoms. On approaching the edge, there appeared, both to the south and west, to be a decrease to about 27 fathoms, but our soundings alone would scarcely allow us to deduce the existence of any even low rim. However, our dredgings, of which we put down thirty-five, showed a marked line of coral and nullipore rubble around the edge, such as might form the foundation of a surface reef in course of time, while the centre was covered quite uniformly by the hardest of sand, covered with growing weed.

The three banks of Saya de Malha included in their 100-fathom lines are respectively from south to north of about 250, 14,000, and 1200 square miles. The south bank is a flat shoal, and the north one a basin with 40 fathoms in the centre and a nearly complete rim at less then 15 fathoms. The central bank is about 500 miles round by 120 across in any direction. It has a marked rim at less than 20 fathoms for nearly 200 miles to the north-west, and a depth of 50 to 65 fathoms in the centre. To the north of the rim, between the banks, we found the slope to be as precipitous as off Cargados, but to the south the whole bank, according to our soundings and dredgings, appeared to rise up quite gradually from the centre of the channel between it and the Nazareth bank. Our dredgings, indeed, carried us right on to the bank without any trace of any steep, and disclosed a hard bottom, and within a bight of the 100-fathom line a large area covered with coarse bivalve shells and some coral fragments swept off the reefs above.

The passages below the 100-fathom line between Nazareth and the Seychelles were of interest in respect to the currents, but, unfortunately, we could make no precise observations. The channel between the north and the central Saya de Malha banks proved to attain a maximum depth of about 636 fathoms, bottom hard with a few attached deep-sea corals. While dredging in it from 300 fathoms downwards, the ship

ÎLE DE LA PERSE, SALOMON ATOLL, CHAGOS. NULLIPORE BUTTRESS GROWING OUT FROM THE SEAWARD EDGE OF THE REEF.

drifted 6 miles to the west-north-west in three hours, while we took three hauls of a small trawl. The latter was weighted with firebars, and in each case went down almost perpendicularly for about 150 fathoms, when it began very markedly to haul out to the north-east almost at right angles to the ship's course. Probably our first attempt never reached the bottom, but after adding fresh weights and allowing more wire and as rapid a descent as possible, we succeeded in doing so. Whatever was the cause of the current in an opposite direction to the wind and surface drift we can scarcely profess to say, but of its existence there was no reasonable doubt.

The bottom again between Saya de Malha and the Seychelles would appear to be current-swept, and our impression, when watching the soundings with the ship's head to the wind, was that there existed a similar undercurrent. Taking all the soundings between 100 and 1000 fathoms in the passages from Nazareth to the Seychelles, we get the following list of bottoms: hard, 10; shell and coral, 6; sand, 8; coral mud, 1. When the actual samples are examined these soundings become of still greater significance, since in no single case was there more than a mere trace of the bottom. Indeed, the bottom throughout in these passages may be said to be hard and with no marked deposits of mud or ooze, such a bottom as could only be found in a current-swept region.

The Amirante bank has eleven patches of surface reefs and seven islets on an area of 1100 to 1200 square miles, about 86 miles long north and south; while Desroches, a round atoll bank 10 miles in diameter, lies about 8 miles to the east, the channel between attaining a depth of 874 fathoms. The bank itself has more or less the same contour as the other submerged banks, probably rising from about 700 fathoms, all round except to the north, to the 50-fathom line. Its surface is decidedly irregular, as masses of growing corals and nullipores may be found anywhere, but nowhere attains a greater depth than 37 fathoms. On its edges, where nullipores flourish, there is perhaps a greater tendency to growth, but the term "atoll" cannot as yet be applied to it. Of its reefs, Remire and St. Joseph are atolls with lagoons of less than 5 fathoms in depth. The former has no land, but there are certain masses on the reef which from the ship appeared to be the remains of such. St. Joseph has eight islands, which clearly demonstrate the increase of its lagoon at the expense of the land, showing everywhere destroyed trees and bushes, and in many places lines of old beaches. The hills marked, doubtless by an error of the draftsman, on St. Joseph and Darros do not exist, but there are indications that these islands, as well as Poivre and Desroches, owe their foundation to some change of level. Eagle island, however, shows a definite upraising of at least 20 feet, being formed of coral rock, and in many places fringed by low cliffs. African islands, lastly, are probably due to a piling up by the sea of reef material.

The Seychelles bank has lying off its south-east part several isolated masses in Fortune, Constant, Platte, and Coetivy banks, the last two only with surface reefs and land. They present no atoll features, nor any conditions markedly differing from the submerged banks which we visited. Coetivy is about 6 miles long, and has sand-dunes and ridges varying up to about 70 feet in height.

(To be continued.)

RECENT SURVEY AND EXPLORATION IN SEISTAN.*

By Colonel Sir HENRY McMAHON, K.C.I.E., C.S.I.

I HAVE said so much on the scientific aspects of Seistan that it may now interest you for a change to learn something of the personal experiences of our mission in that country.

We were a party of nearly 1500 persons, including twelve † British officers, a large staff of European and native subordinates, comprising survey, irrigation, and other civil departments, and a military escort of 200 infantry of the 124th Baluchistan Regiment and 60 sabres of the 35th Sind Horse. We were amply provided with all that was necessary for purposes of display suitable to the status of our mission, or for maintaining our position in the face of opposition or obstruction. We were well equipped for every possible contingency, for heat and cold, flooded rivers and waterless deserts. It is well that we were so equipped, for all our resources had to stand the strain of work under most difficult and varied conditions.

We left Quetta early in January, 1903, and marched across the desert to the Helmand, which a portion of the mission struck at Landi Mahd. Wala, and the rest at Khwaja Ali. A blizzard which the main party encountered before reaching the Helmand, the first of a long course of blizzards with which we were destined to become painfully familiar, burst on us while on the march. We had three men frozen to death, and lost a great number of camels.

We marched down the Helmand, and reached Seistan in the middle of February. We stayed in that country for two and a quarter years. Our life and movements were largely regulated by the climate. Seistan has only two seasons, winter and summer: spring and autumn do not exist. One jumps within a few hours from cold winter into hot summer, and from hot summer into cold winter. The summer lasts from April to November, seven months, and is a long weary period of cloudless sky and great heat, which reaches a maximum in the shade for many months of 110° to 119° Fahr. A portion of the summer, *i.e.* four months, is taken up with that terrible wind the "Bad-i-sad-o-bist roz," which mitigates the heat and prevents it becoming altogether unbearable.

During the early portion of summer the rivers are all in high

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* Continued from p. 228.

† Colonel A. H. McMahon, C.S.I., C.I.E., British Commissioner; Captain A. D. G. Ramsay, personal assistant; Major T. W. Irvine, I.M.S., medical officer; Major H. P. Walters, commanding escort; Major C. Wanliss, intelligence officer; Mr. T. R. J. Ward, irrigation officer; Mr. W. A. Johns, engineer officer; Mr. G. P. Tate, survey officer; Captain R. C. Bell, commanding camel corps; Lieut. C. R. H. P. Landon, with cavalry escort; Lieut. J. A. Brett and A. E. Stewart with infantry escort.

flood, and throughout the summer the Hamun is a big sea, and the lowlying lands of Seistan are either submerged or liable to inundation. We had, therefore, to look round for a place of safety from floods, and we had our main camp each summer on a high, bare, gravel-plain on the south bank of the Rud-i-Seistan and between that river and the Helmand. One of the pleasing features of a Seistan summer is the plague of insect life that swarms in that country. There are no wild flowers in Seistan, and, as I said, no spring season such as one finds in other countries. Nature has, I suppose, to mark the missing season in some way or other, and does so here by the outburst of insects, which come to life the day after winter ends. Midges, mosquitoes, and every kind

PORTION OF INNER LINE OF WALLS OF SAR-O-TAR RUINS, SHOWING ALSO PART OF THE CITADEL.

and sort of flying, creeping, crawling beast imaginable, large and small, fill the air, and cover the ground as evening sets in. To sit near a light is impossible, and so one has to eat one's dinner, insects and all, in semi-darkness, and find one's way to bed in the dark. Another harbinger of what ought to be the spring in Seistan is the exodus from their winter hiding-places of the snakes, which are very numerous in that country. A poisonous little viper (*Echis carinata*) is the most common of them. Four of our men were bitten, but all luckily recovered after some weeks of illness. When the big summer wind sets in, it blows away the insects, and for a time one is free from this plague; but if the wind drops any evening, out they all come again.

Horses, camels, and other animals in Seistan have a plague of their own in the form of a species of gadfly, which torment them unmercifully all the summer. Their bites draw blood and cause great pain. Worse than this, we have to thank this fly for the prevalence of the disease which proves so fatal to horses and camels in Seistan. This disease we found to be what is known in India as "sarra," and we found in the blood of the gadflies caught on horses the trypanosome of sarra (*Evansii*). To protect our horses from this scourge, we found it necessary to follow the example of the Seistan people, and keep blankets carefully wrapped round our horses' stomachs even when ridden. In the early part of summer, when the scourge is worst, our horses wore pyjamas, and looked somewhat peculiar. Notwithstanding all pre-

VIEW OF INTERIOR OF RUINS KNOWN AS TAHL DAS, NEAR SAR-O-TAR, SEISTAN.

cautions, however, we lost many hundreds of camels from this disease, and out of our 200 horses we lost no less than 120.

So much for the delights of the Seistan summer with its heat, wind, and insects. The winter offered an extraordinary contrast in the matter of temperature, for the cold was often intense, going down to within a few degrees of zero, and this was made all the harder to bear by the terrible blizzards which are so common from December to the end of March. We felt the cold all the more severely, as our work used to keep the whole mission moving about all the winters in the lowlying portions of the country along the banks of the rivers and shores of the Hamun, where our camp was nearly always pitched on damp ground. Our work made us spend the winters splashing about in rivers and

Hamuns, an extremely cold operation when blizzards were on. Necessity is the mother of invention, and our camp soon became very clever in protecting themselves by ingenious methods from the cold and wind. When reeds and branches of tamarisk were available, as they often were, thick screens used to be run up on the windward side of tents and animals, and it would sometimes have been difficult for a stranger to find our camps, so well were they thus sheltered.

To give some idea of the extent of the cold and the force of the blizzards, I may note that in January, 1905, not only the stagnant Hamuns and lakes were hard frozen over, but even the big rivers with their strong currents. The force of the blizzards was terrific. That of the end of March, 1905, showed on our anemometers a velocity of no less than 120 miles an hour, and for a whole sixteen hours the average velocity was over 88 miles an hour. The destruction caused to camels was terrible, and we lost hundreds at a time. The blizzard of March, 1905, killed in four days no less than 200 camels. I may note here that from one cause and another we lost 4900 camels during the two and a half years of our work.

Winter and summer work had to be carried on at full pressure. There were extensive topographical and hydrographical surveys to be made, and information of all kinds to be collected. The actual marking out of the boundary-line with pillars after the course of the boundary had been settled was a difficult task. One hundred and ten miles of it was through a waterless desert, both mountain and plain, where water had to be brought for men and beast from long distances, and about 100 miles lay along rivers and through swamps and lakes. The wear and tear of our work was, of course, very trying to men, and we lost fifty men in all. The mortality list itself is a record of the varying conditions of country and climate, for we lost two men from heat, seven from heat and want of water, three from being frozen to death, and four from drowning.

The history of the seven who died from heat and thirst is one of the saddest chapters of our mission history, but it affords a splendid instance of the zeal for work and devotion to duty which our Indian native fellow-servants of His Majesty possess. The disaster was due to that burning desire which possesses the breasts of geographers, British and native, to fill up those blank spaces now getting so few and far between on our maps. The Dasht-i-Margo had always been one of those blanks. Many have skirted its edge; none had entered it. To one of our most distinguished native surveyors, Khan Bahadur Mohi-uddin, fell the duty of being the first to attack this tract, and none were so keen as himself to do so. He was an old surveyor, and especially well accustomed to work in a waterless country. He started from the Helmand, near Chahar Burjak, with a well-equipped party of four chain men, two camel-men, and four guides. Zeal took him further than

A TYPICAL MOVING SAND HILL (BURKHAN).

prudence would dictate, and one evening three of the guides, after trying to persuade Sheikh Mohiuddin to give up his enterprise and return before it was too late, determined to try and save their own lives. They tied themselves on their camels, and tied their camels in a string, and let them go where instinct took them. The riders soon lost consciousness, but their camels took them to the Shand, where a hunter of wild asses providentially found them, and brought them to life, and guided them back to safety. The morning after their departure found Sheikh Mohiuddin and his party with no water left in their water-bags, under the fierce heat of the sun on a scorching plain. A portion of the party dug for water in a dry nullah-bed close by, but without success, and the only relief they got was by throwing the cool dug-out sand over their burning bodies. One of the party, their last remaining guide, collapsed, and the others went back to find Sheikh Mohiuddin lying dead, with his horse lying dead beside him. The two camel-men had disappeared, no one knew where, and the four remaining men of the party, the four chain-men, found themselves alone. One of their number, Saidu, whose name deserves to live in the annals of heroism, put duty before other considerations even at that awful crisis. He cut off from Sheikh Mohiuddin's plane-table the precious map for which so much had been risked, and, knowing he could not long retain consciousness, wrapped it round his waist in his waist-cloth, and started off with his three comrades, in the fond hope of finding water, they knew not where. They struggled on that day and all night, and the next morning three fell, unable to proceed. The brave Saidu stumbled on. He says he soon lost consciousness, and when he next came to, he found himself at night half lying in a pool of water. There a wandering Afghan found him, and carried him on his back to Chakansur, which proved to be close by. There our kind Afghan friends took great care of him, and after some days, when he was able to be moved, they brought him back to us. Thus was the first portion of the blank of the Dasht-i-Margo filled up and its survey preserved. It cost us seven valuable lives. The search parties which we subsequently sent out to recover the bodies of Sheikh Mohiuddin and his ill-fated companions filled up some other portions of this blank.

In the last winter of our stay in Seistan, a new and quite unheard-of plague visited the country and us. First the jackals, which swarm in the country in huge packs, went mad and attacked men and animals. Four of our men were attacked and bitten, of whom one died of hydrophobia. Then the numerous wolves of the country went mad too, and played havoc in the villages and encampments of the wandering nomads. Tales of damage to men and animals, and of deaths from hydrophobia poured in from all sides. Mad dogs also were most unpleasantly numerous. And as Seistan swarms with village pariah dogs and the big fierce dogs of the nomad people, Seistan had a very lively time of

TYPICAL WIND SCOURS IN THE SOR-DAGHAL TRACT OF SEISTAN.

it. The local people, much as they value dogs for protecting their flocks from wolves and themselves from thieves, killed nearly all their dogs, and a wholesale destruction of our canine companions became necessary in the mission camp, and every possible precaution was taken to protect our camps from the onslaughts of mad animals. A terrible incident, however, occurred.

On the night of March 25, 1905, when the big blizzard was raging, a mad wolf, or perhaps two wolves, time after time throughout the night attacked the camp of our camel corps. The darkness, and the chaos of noise and wind and driving sand that was raging, prevented the men from seeing the wolf or wolves and killing them. It was found next morning that a horse and no less than seventy-eight camels had been bitten and ravaged. Of these, no less than forty-eight sub-

A WINTER CAMP OF THE SEISTAN MISSION NEAR THE HAMUN, SHOWING BURNING REED-BEDS IN DISTANCE.

sequently developed hydrophobia and had to be destroyed. The horse also went mad.

All things have an end, and this merciful rule applied, I am glad to say, to our stay in Seistan. The work of arbitration was at last accomplished, and on May 15, 1905, our mission started back to India. We returned by the trade route, through Robat and Nushki, and had a very trying time crossing the desert at the very hottest season of the year. We had, of course, to march at night, for the heat in the day-time was very severe. We only lost one man on the march, a poor levy sowar, who wandered from the road, and whose dead body and that of his horse our search parties subsequently found in the waterless tract to the north of our route.

The temperature during the last week is perhaps worth notice. The daily maximum in the shade that week was 113°, 116°, 120°, 119°, 122½°, 120½°, and 119½° Fahr. You can therefore understand our pleasure in reaching the cool highlands of Quetta on June 17, and finding ourselves, after two and a half years of the wilderness, back in civilization once more.

Let me say a very few words in conclusion. Many may infer, from what I have said of the delights of life in Seistan, that it is a most undesirable place to reside in. It must be remembered that our experiences are based on a life in tents and on outdoor work carried on all the year round, generally in the wildest and worst parts of that country. If one had a comfortable house and its civilized conveniences for mitigating heat and cold, keeping out insects, and so on, Seistan would not be so very dreadful a place to live in as I may have depicted.

The old ruins that testify to the populousness, wealth, and prosperity of Seistan in the past, show that it must also have been a popular resort. Most of the evils and discomforts of present life there are due to the triumph of chaos over civilization, and nature has, as she always does in such cases, wreaked her vengeance on the country. Increase of cultivation would do much to remove the insect plague, affect the climate, and check the destructive agencies of nature, which now work their will unfettered and unrestrained. Seistan might, by human agency, be made once more a country pleasant to live in.

The extraordinary fertility of its soil, even under present conditions, makes it a country of enormous latent wealth and vast possibilities. Its geographical position and natural resources, both in grain and cattle, render it a place of great strategic, political, and commercial importance. If any one doubts this, let him study the extraordinary efforts our Russian rivals have made and are making to supplant our influence and establish their own in Seistan.

I feel painfully cognizant that this paper has many shortcomings, but Seistan, with its many aspects and problems, is too large a subject to treat in so short a space. I have not been able to allude to many of the branches of work to which we devoted our energies during our stay in Seistan. Of our political work I need say nothing, but, besides geographical and the archæological work I have referred to in this paper, much valuable ethnological, meteorological, geological, zoological, botanical, and other work was done. The results are all being carefully recorded, and will, I hope, assist future workers in this most interesting of countries.

Before the paper, the PRESIDENT: For Colonel Sir Henry McMahon there is no need whatever for any words of introduction, or that I should delay you for a moment. I will at once call upon him to read his paper on "Recent Survey and Exploration in Seistan."

After the paper, the PRESIDENT: When Sir Henry McMahon was despatched upon his journey to Seistan, he was sent there by a statesman whose name will live (so long as the English dominion remains in India) as one of the very greatest of our viceroys, Lord Curzon of Kedleston, and I am sure you will be very glad if Lord Curzon will say a few words on this occasion.

Lord Curzon of Kedleston: I have never had the ill fortune to visit Seistan myself, but yet in one way or another I have had a great deal to do with it. When I wrote a book upon Persia some fourteen or fifteen years ago, I called attention to what then seemed to me to be its very great commercial, political, and strategical importance. All subsequent investigations, of which those recorded by Sir Henry McMahon to-night are the most important, have, I think, tended to confirm the accuracy of those forecasts. Then when I was in India, it fell to my lot to do a good deal to encourage the trade route to Seistan—the latest method adopted by ourselves for increasing the beneficent influence of Great Britain in that part of Asia. I was responsible for erecting that not uncommodious building above which flew the British flag in the picture that you saw earlier in the evening. And perhaps not the least of the services that I have ever had the opportunity of rendering in connection with Seistan was in dispatching Sir Henry McMahon to conduct the mission which he has so modestly recorded to-night. The matter rose in this way. Seistan is a country, as he indicated to us, which possesses two remarkable features. The first is its physical position at a point where the dominions of Persia, Afghanistan, and Great Britain touch; the second is the fact that so much of cultivation, wealth, and possibilities for the future as it enjoys is due to the river Helmand. These conditions, however, both political and physical, are such as from time to time lead to trouble. Thirty years ago, or more, that eminent man, Sir Frederic Goldsmid, who used to be one of our foremost supporters in this Society, conducted the first Seistan Demarcation Commission, and the results of his labours have been recorded in the book which has been the *locus classicus* on the subject ever since. Circumstances subsequently changed. The river Helmand continued to wander, and part of Sir Frederic Goldsmid's demarcation had never been completed. Difficulties arose on the subject, which terminated in collision between the Persians and the Afghans. Under the terms of an old treaty, it was for Great Britain to compose these differences, and under the constitutional powers which I enjoyed, it was for me to appoint an officer to do it. Out of the whole of the officers available for the purpose in India, I had no hesitation in selecting Sir Henry McMahon for the task. I regard him as one of the very best of that able and efficient band of officers who are trained up to the work of empire on the frontiers of India, and who are capable of undertaking any task which may be placed in their hands. His frontier experience is absolutely unique along the whole line that separates India from the country either of Afghanistan or of the Baluch tribes, and upon every section of it Sir Henry McMahon has left his mark. Possessing a mastery of the sciences required for boundary demarcation, a faculty for dealing with native tribes not uncommon in India, though hardly known to those at home, and a capacity for discharging all the duties requisite in officers engaged in frontier work, I felt that Sir Henry was the man to carry through this particular job. Now we have listened to his paper this evening. I have called it a modest paper; for it appeared to me to err on the side of depreciation of the extreme difficulties and discomforts, and I might say dangers, that attended his task. You perhaps have heard enough to realize that Seistan is one of the most unattractive, the most inhospitable, I had almost said the most odious of places in the world. It is a country of marshes and swamps, of sands and solitudes, of extreme heat and extreme cold, famous for a wind, the most vile and abominable in the universe, presenting at all seasons of the year dangers to life which can scarcely be realized by those who only read of them at a distance, but the actual effect of which can be tested by the lamentable figures of mortality that Sir Henry McMahon read out just now. He told us something about the manner in which these difficulties were encountered; he told us the pathetic story of that native surveyor who perished in the gallant effort to extend the frontiers of science in the Dasht-i-Margo. But he did not tell us about the manner in which he himself, throughout two and a half years, conducted his work. It has been my lot as Viceroy of India to superintend more frontier demarcations than any other Viceroy serving the British Government in recent times. I think at one time we had no fewer than four or five boundary commissions at work, an illustration of the vastness of our range and the complexity of our undertakings. Well, at different times I have known frontier officers complain of their absence from India, or the length of their exile; the discomforts they had to experience told upon their health and spirits; they thought perhaps they were not being supported by the Government as they might be; they were confronted with local difficulties which no one at a distance could understand. From Sir Henry McMahon during the two and a half years that he served me I never heard one whisper of complaint. Throughout that time he faithfully carried out the instructions which were sent to him. He has given you no idea this evening of the degree to which he has added to the scientific knowledge possessed about that most interesting country. Only when the works which he and his colleagues have written are published at a later date, will you ascertain the actual additions to human knowledge which are the results of his mission. At the end of the time he came back, having demarcated the boundary in a manner that was satisfactory to both the Powers that were interested, and having, in addition, made an award about the difficult question of the water, which, even if it has not been accepted by both the Powers to whom I refer, will provide the basis for a settlement at no distant date. Ladies and gentlemen, I regard the Seistan mission as the model of what such a mission ought to be and of the manner in which it ought to be conducted. Seistan itself may be unknown to the majority of people of England, perhaps unknown to the majority of you before you came into the room this evening. But I believe, as Sir Henry McMahon indicated, that it is a country which has a future before it; and that on two grounds—firstly, the great political importance which was referred to by him—the very fact that Russian and British ambitions meet on this spot must render it a theatre of important diplomacy in the future; and, secondly, what concerns us more on the present occasion is this—the pictures shown by Sir Henry McMahon of the bygone wealth and prosperity of Seistan, the facts that he gave us about the fertility of the soil, and the capacity of its rivers, indicate that Seistan ought not to have a past alone, but ought one day to have a future. I myself believe there is no reason in the world—and I am very certain he will corroborate me—why, if Seistan is placed in proper hands and irrigated as it might be, it should not recover its former prosperity. I hope that day may come. I hope that the jealousy of local Powers and the rival ambitions of greater Powers outside may not retard its arrival, and when it does come, one of the facts that will best enable us to ensure the full realization of these hopes will be, I am convinced, the labours that Sir Henry McMahon has related to us to-night.

The PRESIDENT: A reference was made in the paper to Field Marshal Sir George White; perhaps he will be kind enough to address a few words to us.

Sir GEORGE WHITE: I have, not very far from Seistan, found myself more than once in a very tight place, but I have never in the course of my whole military career, which has extended now to over half a century, found myself in a position in which I felt less capable of coping with the position before me than I do at this moment. I have listened with the most intense interest to what Sir Henry McMahon has laid before us. I have listened also with delight to the eloquent and high appreciation of that officer's services which has been given to you this evening by him who of all others is in a position best to appreciate those services and to give it eloquent and full expression. I have myself often rejoiced when I have heard of the horrors of Seistán. It may be that I have taken a view which I ought to be ashamed of, but I hope, from certain indications that have been put before you this evening, that it may become more a chamber of horrors than it is at present. I cannot imagine a position such as that on the borders of Hindustan being anything but a dangerous avenue of approach for those who will not, I think, increase the civilization of that grand empire of ours which is ruled by men like his lordship who has just sat down, and by that grand civil servant to whom his lordship has paid so just and so true a tribute.

The PRESIDENT: The hour is late. We had intended to call upon several speakers, and if any one wishes to address the meeting we shall be delighted to hear him, but we have had two important ceremonies to-night, and I think we must now content ourselves by passing a hearty vote of thanks to Colonel Sir Henry McMahon for his most interesting address.

Colonel C. E. YATE, owing to the lateness of the hour, was unable to speak, but noted what he was going to say as follows:—

"I congratulate Sir Henry McMahon most heartily, not only on the wealth of geographical problems that, as he has told us, he has submitted to the Research Committee for solution, but on the large amount of information of a little-known country that he has been able to condense within the limits of a lecture of just an hour's duration.

"Sir Henry has not given us a very fascinating account of the climate of Seistan, but we must remember that blizzards and inundations, flies and winds, are not always present there, and I was glad to hear Sir Henry say at the end of his lecture that, given a good house and civilized conveniences, Seistan, after all, would not be such a very undesirable place to live in. For my own part, I have no hesitation in saying that I would much rather be quartered in Seistan than in any hot-weather station in the plains of India.

"The brief summary that Sir Henry has been able to give us of the history and antiquities of Seistan shows of itself what interest pertains to the country. Sir Henry has told us of the curious above-ground tombs that he found on the top of Koh-i-Khwajah, and he stated that the use of these tombs was obvious. They were merely the temporary resting-places of the dead till the bodies could be removed by their relations for permanent burial in the shrine at Meshed. In this, I regret to say, I cannot concur with him. When I was at Koh-i-Khwajah, I saw the bones of the dead lying in several of these tombs, and those bodies, at any rate, had not been removed. We must remember, too, that it is not only on Koh-i-Khwajah that these above-ground tombs are found. I found them at Hauzdar, Ramrud, and down the banks of the Shelah as far as the Gaud-i-Zireh, and also along the banks of the depression in which the curious ruins of Tarakun now stand. Inside the mausoleums near Tarakun the tombs were better preserved than those outside, and though they had all been opened at the end like the others, it appeared to me that they had been opened for the purpose of rifling the bodies, not of removing them. I could see the bones lying inside, and also the cloth in which the bodies had been wrapped. Now, when I saw this cloth I was at first tempted to think that these graves could not be so very old after all; but when one thinks of the vast age to which cloth in tombs in Egypt has been preserved, there is no reason why cloth in the equally dry air of Seistan should not be equally well preserved. Had these tombs been temporary resting-places only, we surely should have found similar tombs in other parts of the country around Seistan, and on the road to Meshed, but I have never seen or heard of such tombs anywhere except in this south-west corner of Seistan, and though who the people were who built them and when they were built there is nothing as yet to show, still I cannot help thinking that when built they were built as permanent graves, and not as mere temporary resting-places.

"The graphic description given us by Sir Henry of Sar-o-Tar, on the right bank of the Helmund, is the first account of that place that has been given to the world. When I was in Seistan, all the coins and seals and old relics that were brought to me were said to have come from Sar-o-Tar, and I longed to be able to explore the place, but I could not get the chance. Sir Henry and his companions have been more fortunate, and now we know that the ruins of Sar-o-Tar exceed all other ruins in Seistan in extent, and also that the eastern bank of the Helmund was the main seat of population in Seistan's most prosperous times.

"The story that Sir Henry has unfolded to us of three deltaic areas and three separate irrigation systems, each with its own hamun, or lake, for flood waters to escape into, is an entirely new revelation. First, we have the system that drained into the Lalla Nawar, a depression never heard of before, on the right bank of the Helmund, in what is now Afghan territory. Secondly, we have the Tarakun-Ramrud system, which drained into the Gaud-i-Zireh, and is now half Afghan and half Persian; and, thirdly, we have the present Band-i-Seistan system, draining into the Hamuns on the north, which is entirely Persian.

"The pity of it is that the Tarakun-Ramrud system should have been cut in two as it has been. If you look at your maps, you will see that the present boundary-line from Band-i-Seistan to Koh-i-malik Siah runs right through the middle of this system. Sir Henry has already told us of the persistent obstruction and hostility shown by the Persians to Sir Frederic Goldsmid when he was deputed to settle this frontier in 1872. His movements were restricted, and difficulties of every kind were placed in his way. I need not dilate on this further now than to say that had Sir Frederic Goldsmid been permitted by the Persians to examine the southern portion of the frontier which he was deputed to settle, I cannot help thinking that he would have drawn the line to the north of Koh-i-malik Siah, somewhere along the dividing-line between the Tarakun-Ramrud and Band-i-Seistan irrigation systems. As it was, owing to the restrictions placed upon his movements by the Persians, he was compelled to lay down his boundary at haphazard, and Koh-i-malik Siah being about the only fixed point that his survey officer had been able to get a shot at in this part of Seistan, he simply drew an imaginary line on the map from Band-i-Seistan to Koh-i-malik Siah, without ever having been able to examine the ground across which that line was to run. As the head of the canals that formerly irrigated Tarakun and Ramrud are in what is now Afghan territory, somewhere near Band-i-kamal Khan, the result is that, so long as Tarakun and Ramrud remain with Persia, they can never be cultivated, and must always lie waste, as the water to irrigate them can only be drawn from Afghan territory, and that is impossible under present conditions.

"When I was in Seistan I was told that in very high floods water from the Helmund still found its way into these old canals, and this would seem to show that, were only these canals brought under one administration from head to tail, the Tarakun-Ramrud tract might be recultivated at no very great expense. That this part of the country was once very prosperous there can be no doubt.

"Sir Henry has referred to the extraordinary profusion in which broken pottery is found in this portion of Seistan, testifying to the large population of ancient days. I was much struck by the same thing, and I specially mentioned it in my book on 'Khurasan and Sistan,' published in 1900. I can recall to mind one mound in particular, called by the Seistanis Shahr-i-Sokta, or the burnt city; not that there was any visible sign of a city, but the ground on every side, as far as the eye could reach, was one mass of broken pottery, while my local guide kept continually turning up the ground to show me that the soil was black and burnt, and that we really were on the site of a burnt city.

"Now, whether the denudation of Seistan of trees, that Sir Henry has mentioned, is due to this burning and to the general destruction and desolation that overtook Seistan at the hands of Timur Lang, or to the wind, as Sir Henry has suggested, has yet to be proved. Personally, I am of opinion that it is not due to the wind. I myself saw tall trees growing on the banks of the old bed of the Helmund at the Afghan village of Deh Ido, in the north, and if these trees can grow, others can grow. Again, at a place called Machi, near Ramrud in the south, I found the roots of date trees still visible in the ground. Apparently the town of Machi, of which the ruins now only remain, was formerly surrounded by large date groves, and if these date groves existed in former days, why should they not exist now? All that is required is good government. Under Persian government there is no security of tenure and no hope of improvement. Seistan, as Lord Curzon has just told us, undoubtedly has the capabilities of a great future before it, and, given a good and stable government, there is no reason why it should not blossom out again into the semblance of its former self, and become the populous, rich, and prosperous country that it was in the past."

The following discussion took place at a meeting of the Research Department on May 11, when Sir H. McMahon introduced the portion * of his paper dealing with the problem of the Seistan basin.

Before the paper, the CHAIRMAN (Sir THOMAS HOLDICH): It will be fresh within the memories of you all that not so very long ago Sir Henry McMahon read a paper before the Geographical Society in which he outlined some of the geographical conditions of Seistan, but on that occasion there was no time for discussing the subject further. He will now give us a few more details on the same subject, which I think ought to give rise to some very useful discussion. I will ask Sir Henry McMahon to read his paper.

After the paper, the CHAIRMAN: The interesting paper which Sir Henry has just read to us recounts to a certain extent what he put before us the other night at the larger geographical meeting. But there is just one point to which he does not refer to-night, to which, if you will allow me, I should like myself to refer. I wish to record my deep appreciation of the kind and sympathetic record which Sir Henry McMahon has given of an old and faithful servant of mine, Sheikh Mohiudin, who died whilst prosecuting his surveys under Sir Henry's direction. You may possibly remember that he died of thirst in the desert, and that one of his assistants was rescued by a passing Afghan with his plane-table sheets wrapped round him so that they might not be lost. Such devotion to duty as that, fortunately for us, is not an uncommon feature in India. Every one of us who has lived long in India must have known many instances. What is, perhaps, more rare is that such devotion, such loyalty, should be so fully and sympathetically recognized as it has been in this case by Sir Henry McMahon. I think it is that peculiar

* *Vide* portion of Sir H. McMahon's paper in brackets at pages 216 to 227 of this *Journal*.

sympathy with the native character, that grasp of the idiosyncrasies of the natives, the understanding of their manners and their methods, which have strengthened the hands of such men on the frontier as Nicolson and Sandeman; and I think it is quite possible that to those illustrious names hereafter the name of McMahon will be added, because he too possesses exactly that same grasp of the peculiar point of view from which the native regards his work in India in connection with us, and the same sympathetic spirit which leads him to make friends with natives wherever he meets them. Now, such men are bound to succeed; they will always succeed, for this reason—that they will always be well and faithfully served. And now just to refer for a minute to his geographical problem. He has put before us very much the problem which Charles II. placed before the Royal Society: "Given a bucket full of water, if you put a fish into it, why does not the water spill over?" As a matter of fact, it does spill over; and so I think that, as a matter of fact, the silt which is carried into that big Seistan depression finds its way out again, and Sir Henry himself has given us the explanation of the manner in which it is carried out. I believe myself that it is two great forces of nature, constantly acting and reacting, that keep the level of the Seistan basin tolerably constant. Sir Henry has stated that he found an abnormal amount of silt in the river Helmand, but he took his observations at the Band i Seistan, at the point where the Helmand enters the Seistan depression.

Sir Henry McMahon: We kept constantly making observations throughout the river, everywhere in the deltaic area.

The Chairman: It is a curious fact that one writer after another has recorded of the Helmand river above Seistan that it is remarkably clear, and such certainly is my impression. I should say that this is a problem of the circulation of silt within the limits of the Seistan basin. As you observe, the main course of the river within Seistan is a little west of north; that is precisely the direction, again, from which the wind blows. Now, the wind cannot get at the silt when it is under water; but there are times, after extensive evaporation, when the silt must be subjected to the action of the wind, and that extraordinary erosive action which Sir Henry has described to us so graphically is certainly sufficient to carry anything that is not absolutely consistent and solid away from Seistan. I observed myself, amongst the many ruins which surround Seistan, the curious way in which these ruins, built of sun-baked bricks, are actually blown by degrees into space; the action of the wind is such that they grow positively less year by year. So I am inclined to think that the silt of the Seistan basin may be found scattered pretty widely over the almost illimitable deserts to the south and south-east of it. I may say that the problem of the wind is by no means a local problem, for that terrific northwest wind which blows so strongly in Seistan, and has proved so exceedingly inconvenient to the working of the commission, is encountered all the way northwards from Seistan to Herat, and from Herat across the Paropamisus, until you reach the country which the people call the "home of the wind." Even there you are not at the back of it, and, so far as I know, it is really a continental wind pervading all high Asia. The same problem of scooped-out depressions, and of the accumulation of surface soil gradually moving southwards in front of the wind, is to be found all over Asia, especially in the Chol country which is north of the Paropamisus, and to a certain extent all loess formations are due to wind-action.

There is just one other thing that I should like to point out, and that is Sir Henry's reference to the extent of cultivation that once existed in that country, and to the possibility of that cultivation being revived. Now, I myself am very doubtful whether there was ever any very large massing of population in Seistan. I do not think that the number of villages which you see scattered over this map are any criterion whatsoever of the number of inhabitants that ever occupied that country. He has pointed out himself how very soon a village disappears under the influence of wind and collected sand; consequently I believe that never at any time were more than a very small fraction of those villages inhabited. I think it is quite possible that what takes place in the Takla Makan desert far to the north is what has taken place here—that villages are covered with sand and again uncovered; that they are occupied at one time, lost, and possibly recovered afterwards; but that at no one time has there ever been any vast accumulation of the human race in the Seistan basin; and, so far as I could see, when I was in that most uncomfortable country, there was no room for a vast amount of cultivation either. The area is not very large; and although Seistan originally figured in classical history as the granary of Asia, that was in the days when very small granaries went very far; and I take it that the position of Seistan, which is very much analogous to that of Herat, has given rise to an undue appreciation of its wealth, it being the only green spot in a huge illimitable waste of sand and desert. There is just one other point which is interesting, which is the curious isolation of Seistan. The map showed you how the waters overlap it on the north and on the west, and occasionally curve round in times of flood to the south. This is a very curious geographical peculiarity; I do not think that I know of any other inland country in the world so entirely shut off from communication by natural causes as Seistan. I hope that we shall have further discussion on the subject of the curious problem which Sir Henry has put before us, which I take to be this: "Why is it that the Seistan depression does not gradually diminish? How is it that it is not filled up with the extraordinary amount of silt which the rivers carry into it?" We ought to have some interesting theories put forward by some of the members present.

Dr. Teall: The paper is one of extreme interest, both from a geographical and from a geological point of view. It comes, moreover, at an opportune moment, for just now the phenomena of denudation and deposition in arid climates is exciting a considerable amount of attention. Sir Henry has given us a vivid picture of the geographical conditions of a most interesting region, and he has submitted at least two important problems for discussion. How is it that the great depression does not become filled up with sediment brought down by the rivers? and how is it that the Hamun is not a salt lake?

With regard to the first of these questions, I can see no escape from the conclusion that either the area has subsided or the material has been removed by the wind. Sir Henry gives us no direct evidence of subsidence, but he shows that the second cause is undoubtedly operative. May it not be sufficient? On this hypothesis, we should have to assume that the changes in the past history of the district were somewhat as follows. In the earlier stages the amount of material brought into the area in question would be in excess of that amount removed by the wind, and the depression would fill up, though it may not be necessary to suppose that the whole of the basin would be filled up, say, to the level of the surrounding plateau. At a later stage the amount of solid material imported by the rivers would be less than that exported by the wind, hollows would be formed, and erosion of the previously deported alluvium become possible. Sir Henry's graphic description of the effects of the wind makes it not improbable, to my mind, that the amount of solid material exported from the district as a whole by this agent may at least equal that imported by the rivers. Then as to the second question, it seems to me that we are driven to the conclusion that the Hamun is kept comparatively fresh by the periodic flushing during seasons of flood.

Mr. G. W. Lamplugh: In Europe, China, and North America, huge deposits of loess are believed to have been accumulated by the action of wind in past times;

and recently it has been brought before us by the work of Dr. S. Passarge in the Kalahari, that the wind is effective, not only in depositing material, but also in planing down the surface. Dr. Passarge believes that the large smooth plains of the interior basin of South Africa, which we had supposed to have been formed by the long-continued base-levelling action of rain and rivers may have been formed mainly by wind-erosion. If his view be correct that a peneplain can be developed by this agency, we should have little difficulty in believing that a depression such as that described by Sir Henry may have been developed by the same agency. But at present we have no measure of the amount of material that can be removed by the wind; and if Sir Henry could give us any idea of how much light material may have been carried outside this particular drainage basin in this way, it would be extremely helpful. It appears probable that much of the lighter material must be so transported, because the sand-dunes, I suppose, represent only the heavier grains of the land-waste, which one might compare with the gravels of a river-bed, while the fine dust derived from the loams and silts that are being eroded so rapidly is apparently not left in the dunes. But this dust must have gone somewhere, and one would like to know if it may possibly have been blown over the edge of the interior basin to the slopes that drain down into the ocean, where, of course, the rivers could readily carry it away to the sea. If this has happened, it might explain the deepening of the hollow.

With regard to the possibility of the depression being caused by the weight of the sediments, we find, in the geological record, many instances of deposits of great thickness that must have been piled up in water that remained persistently shallow; but we do not yet know in such cases how to distinguish between cause and effect. Whether the sediments weighed down the bottom, or were accumulated because the bottom was sinking from other causes, we should obtain practically the same result. But in the Seistan basin it seems probable that the lake-waters at one time stood much higher than at present, and were much deeper. Now, the weight of this water itself would, I take it, be greater than the weight of the sediment that has since been carried into the bottom of the basin, so that we cannot be certain that the total load has so steadily increased. On this point we may recall that the possible effect of water-load in depressing a lake-basin has been discussed by G. K. Gilbert, who found that the old beaches of the dried-up Lake Bonneville, in the Great Basin of North America, have been deformed by differential crust-movement, and now rise slightly toward the centre of the old lake where there was once the deepest water; and he therefore conjectured that the weight of water may have been effective to some extent in depressing the basin.

Prof. Garwood: I have been interested, like the rest of us, in the problems brought forward this afternoon. I am in hopes myself that Sir Henry will succeed in proving the depression of the area. It is a subject I am specially interested in, because the corollary of it, *i.e.* the possible elevation of a country where material had been removed, has come under my own notice, and consequently where you have deposition taking place you should get depression. It is rather a thorny subject, I think, to the geologist how this depression would take place. But as regards the elevation, we have very good instances where denudation has taken place; in Norway and Sweden, for instance, where the ice-sheet has melted away. There the axis of the greatest elevation coincides practically with the axis of the maximum glaciation during the glacial epoch. You have the phenomenon of the youngest trees nearest the coast, and the absence of human habitations along the coast belt. In many cases I have noted what seems to me only explicable on the supposition of recent elevation, both in the Himalayas and the Alps: the presence of such phenomena as hanging valleys, due, I must say in my opinion, to elevation, connected with the melting of ice-sheets and glaciers in old glaciated districts. The corollary of that is, that where deposition has taken place there you should get depression, and I should be very pleased to see Sir Henry McMahon prove his contention.

Mr. Strahan: One of the results of this discussion is to show, I think, the danger that we may get in of arguing in a circle. As far as I understand it, we have arrived at the conclusion that the ground is sinking in the Seistan because the sediment has been deposited in it, and we have arrived also at the conclusion that the sediment is being deposited in that depression because the ground is sinking. That is as pretty a circle as I have heard in a good deal of experience of geological argument. The Seistan reminds me to compare the very small with the very great, of what may be seen in the Val d'Arno above Florence. There what has once been a large lake has been filled with a more or less horizontal deposit to a high level. The outlet of that depression has been deepened by the river Arno, with the result that the deposit in it has been partly eroded to a lower level—the "terra nuova," as they call it, the upper and original level being known as the "terra vecchia." In the case of the Seistan we have no outlet, and the only possible reason for a lowering of the level comparable with that of the upper Val d'Arno is the falling of the level of the water in the lake; and I would ask whether there is any evidence that the water of the lake has stood at any greatly higher level than it does now. The difficulty in the way of a theory pure and simple of depression appears to me this: that the lake is more or less surrounded by an irregular cliff, I think 200 feet high in places. Now, I imagine that the depression, according to Sir Henry's theory, would affect not only the lake itself, but its surroundings. Is it to be supposed that the cliff stands at the original level, and has not shared in the depression? It is a little difficult to conceive that that can be the case. So far as regards the cause of the depression, which, of course, is an exceedingly theoretical matter, it appears to me no more difficult to conceive that a depression has taken place in the Seistan than that the mountains have been raised round it. The result, at any rate, has been a land-locked basin, the study of which to geologists is of the greatest interest, for it enables us, to a certain extent, to judge of what was taking place in such a period as that of the Trias. We have in this country good evidence of desert conditions having then prevailed, of the action of land-locked waters, of the catching of vast masses of silt or sediment, and the local deposition of beds of rock salt. Especially I was interested in the way in which it has been shown that the salt may be carried in solution to one restricted part of the basin, and there deposited, while fresh water—or drinkable water, at any rate—may prevail over other parts. In conclusion, I would only say that we are greatly indebted to one who has not only had the opportunity of studying such regions, but who has the power of bringing so graphic a description before us.

Mr. H. Yule Oldham: Several aspects of the question, which is a thorny one, have been discussed by Mr. Huntington in an interesting paper published by the Carnegie Institute, as I dare say Colonel McMahon knows, and any one interested in the question will find a good deal of information there. But I should like to be permitted to ask just one or two questions on this occasion. One is as regards the "120-day wind," which I notice both Colonel McMahon and Mr. Huntington describe as coming from a point to the west of north. As far as I remember, in Lord Curzon's interesting introduction to Morier's 'Hajji Baba,' it is referred to as being a north-east wind at Quetta. Perhaps Sir Henry McMahon could kindly say whether it is north-east in Quetta. No doubt it is produced by the low barometric depression in summer over India, and the wind being drawn in from the north in the Seistan district, the mountains naturally direct it as a north-west wind; possibly, in the same way it may be north-east at Quetta, but east and west are easily interchanged by accident. Another question is as regards the spelling of Seistan. Sir John Malcolm used to spell it with two *e*'s—Seestan. I notice the Americans spell it "Si," and we have it "Sei." The two *e*'s certainly suggest the sound Seestan as does Sístan, if you use the Italian pronunciation; but the "Sei" spelling gives a certain amount of uncertainty. Finally, if I might offer one suggestion as regards that interesting question raised as to the fresh-water nature of the Hamun. I should like further information, but I rather gather that the lake is apt to dry up fairly frequently. When Colonel McMahon first went there I believe there was no water at all, but that it very rapidly filled up. Now, if the lake is liable to dry up frequently, I think it is possible that the saline deposit which has been laid down there would be blown away by the strong wind before the next flood filled it up. That to a certain extent might account for the very remarkable freshness of the water. But that, of course, depends on the frequency with which the lake is liable to dry up. Desiccation, deposition, dispersal would express the cycle of events.

Sir HENRY McMAHON: I must thank Sir Thomas Holdich for the kind remarks he has made about myself personally and regarding my mission. I now proceed to take up a few points that have been raised by gentlemen who have so kindly joined in the discussion. As regards what has been said by Sir Thomas Holdich himself, I will take first his remarks about the clearness of the Helmand river. That is an important point in this discussion, and I must emphasize my reply. Sir Thomas Holdich and others who have visited Seistan and written about it have nearly always happened to go there in the autumn. That particular time of the year, *i.e.* from about the last week in September to the end of October, is the only period of the year in which the water of the Helmand can be said—at any rate, the portion that we know of it, some 100 miles or so—to be at all clear. In proof of this, I may mention a fact which will appeal to those who indulge in the gentle art of fishing, *i.e.* that this is the only period of the year in which the water is clear enough for the successful use of a spoon. During the rest of the year the river is very thick and muddy. The river begins to rise early in November, goes on gradually rising, getting muddier and muddier, until it becomes after Christmas a thick chocolate-coloured flood. We know that a lot of silt comes down the river, and I have mentioned to you an instance of where ruins have been buried under 18 feet of silt. We were in Seistan nearly two and a half years, and Mr. Ward took observations of silt steadily through all that time, and has calculated that the average deposit of silt brought down by the Helmand alone in one year is sufficient to cover 10 square miles a foot deep. Then you have the other rivers to consider as well. I must emphasize this point, because if there is no silt coming into Seistan, then it is obviously unnecessary to explain what becomes of it. I repeat, therefore, that the Helmand is a river with an extraordinary amount of silt, taking it month in and month out throughout the year. But apart from the silt that now comes down in the river, what has become of the *débris* of the cliffs? Then the next important factor in this problem is the wind. Sir Thomas Holdich rightly points out that the 120-day wind is a continental wind. I do not claim for one moment a monopoly of that heavy wind for Seistan by itself. We made very particular and careful inquiries about the wind for scientific purposes. I had with me representatives of Herat and other distant parts of the country, and the consensus of opinion, never disputed by any of those who knew the country, was that this wind prevails northwards, right away into Russian territory. It is very strong at Herat; it is not felt in the mountains on the east border of Persia; and (I now come to an interesting point) the place of its maximum velocity and force is at Lash Jowain, just at the north end of the Seistan area. It continues in great strength throughout Seistan, but south of Seistan it diminishes, until when you come down to the trade route you hardly feel it at all. You do get winds along the trade route during the period of the 120-day wind, but these are not of the same strength or constancy, and, moreover, blow in varying directions. We kept a very careful record of the Seistan wind, and find that it blows from between 316½° and 333¾°, *i.e.* from a little west of north. I will not go into the question of the extent of past cultivation in Seistan, beyond simply saying that Seistan has been much written about from the very earliest times of Eastern literature, and we have in these old records repeated references to the great prosperity and wealth of Seistan. I do not for a moment say that there is not a natural tendency to exaggerate the population and the wealth of the past; but we have a lot of records which refer to it. It was striking enough, at the times in which those records were made, to be mentioned by the writers. As regards the past extent of cultivation, I must note that when Sir Thomas Holdich passed through Seistan, by far the greater portion of the country, and the portion where the greatest cultivation and prosperity of the past existed, *i.e.* the Tarakun and Sarotar tracts, was a *terra incognita.* Dr. Teale goes into technical details, and he speaks about the absence of direct evidence of subsidence. Mr. Garwood, later on, hopes that I shall be able to prove some evidence of subsidence. Well, it is a hard job to give me. The only direct evidence I can give of a gradual subsidence of that area is the fact that I mentioned *i.e.* that the older river-beds are at a higher level, and yet at approximately the same easy grade as the present river down below them. This fact, in my mind, would tend to show that when those rivers were running, the level of the lake-bed was higher than it is now, and therefore those rivers had no cause to hurry themselves, or to go down a steep slope into a hole, but were going into a depression of the same relative depth below them, and therefore at the same leisurely pace as the present rivers go into the present Hamun. That is the only evidence I can give, and I give it for what it is worth. Then Dr. Teale asked if the deposit of silt is greater than that removed by the wind. I am afraid, over such a big area and with a wind like we had to deal with, I have no data on which to really give a definite answer. As regards the wind being less in the Gaud-i-Zirreh, and the suggestion that the focus of the wind may have changed, that is extremely likely; but of that we know nothing. One thing we do know about the wind is that the old ruins, so far back as we find them—the very oldest of them—are, like the recent ones, all built at the same angle to the wind. Their side walls are at the same angle as the present direction of the wind, their end walls at right angles to that direction of the wind, which would show that the wind, during historic periods of which we have traces in ruins, has remained at a constant angle throughout. I cannot answer Mr. Lamplugh's question as to about how much light material the wind has transported. In all the vast Baluchistan desert south of Seistan, on which I read a paper about nine years ago, what strikes one most forcibly is the enormous accumulations of sand-hills and sand-mountains piled up all over the country. That would be, as he says, the heavier material, the sand (silica), not the finer silt. I do not know what becomes of the lighter material. About Mr. Strahan's query : "Has water in the lake stood at a much higher level than now ?" I do not know whether he means if the actual water was deeper, or whether the bed on which the water stood was higher than now. On the latter point I have already made a reply with regard to the level of the river-beds. But if he asks whether the water was deeper, and whether there was more water in these lakes in old days than now, I am unable to give a definite reply, at any rate regarding prehistoric times. If, however, we go back to old historic records, it is a very curious thing that, as far back as I have had access to them or had them quoted to me, everybody writing about the lake of Seistan nearly always describes it as being 100 miles long and about 15 miles wide. This is how one would describe it now, and so it does not seem to have been materially larger than it is now. The old river-beds, the old canals, bear about the same proportion to the river as the present beds and canals do now. As regards other questions, of course we studied Mr. Huntington's paper very carefully. Mr. Huntington was not long enough in this country to give a very definite opinion on the various points, and he ascribes these various phenomena which I am talking of to climatic oscillations, and to glacial and interglacial periods, and he suggested as a possibility that the river itself had oscillated from side to side in Seistan. If I had known his doubt on this point, I could have told him that the Halmand and the Hamun have oscillated time after time from one side of Seistan to the other. The following spelling of the word, "Seistan," is the right one, because the name is a later form of the old "Sejistan," which again comes from the older form "Sakæstan," *i.e.* "land of the Scythians" (Sakæ). The Seistan lake is only known to have completely dried up once. The area of water contracts and expands according to the seasons of high and low river. The suggestion that has just been made, that the wind plays an important part in removing the salt, is a good one.

I think that is all I have to say. I am not in a position, nor would I dare, to give a final verdict as to which is the correct solution of the problem under discussion—subsidence or removal by the wind. I thank you very much for your remarks on my paper.

The CHAIRMAN: I think you will cordially support a vote of thanks to Sir Henry for this very interesting paper.

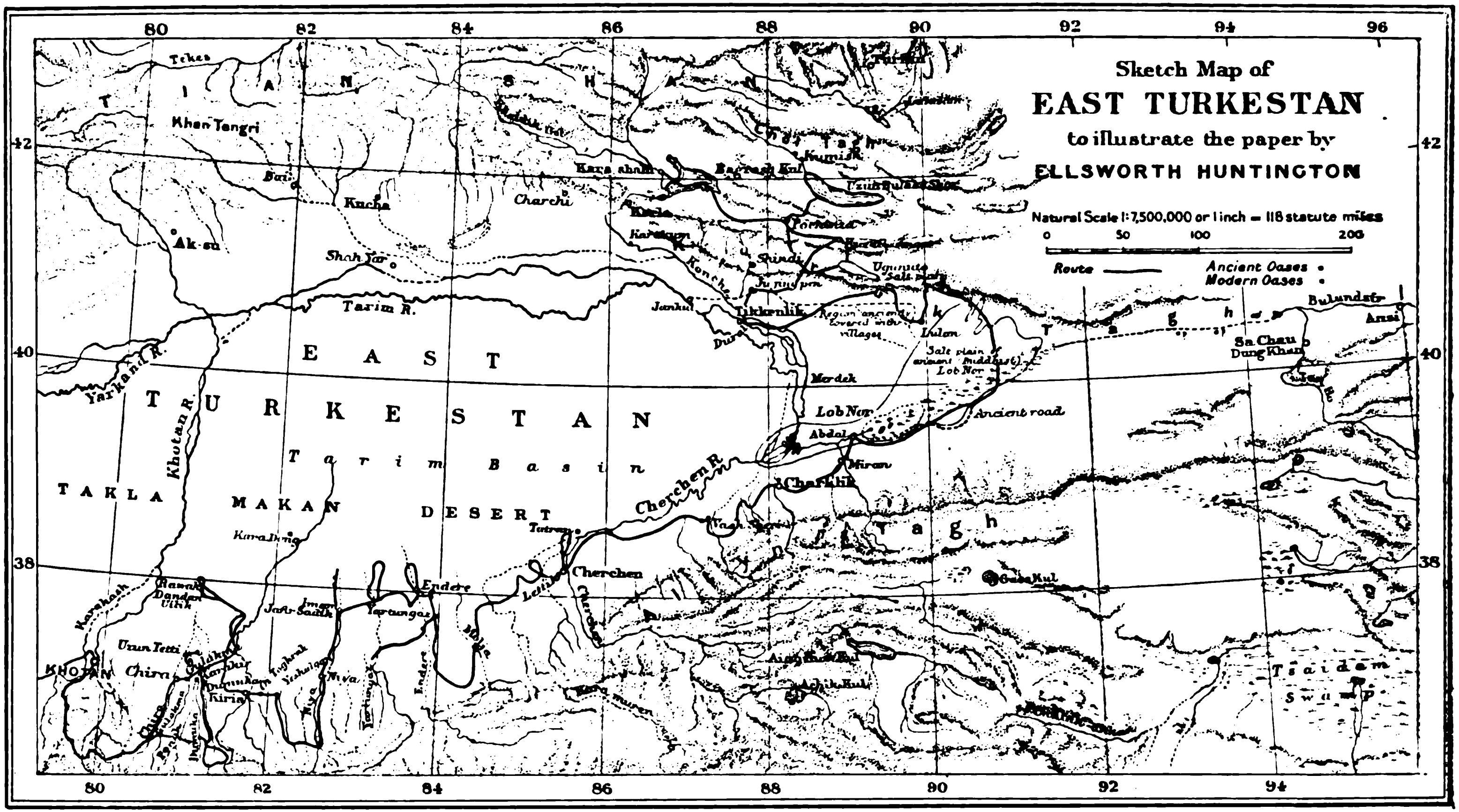
THE RIVERS OF CHINESE TURKESTAN AND THE DESICCATION OF ASIA.

By ELLSWORTH HUNTINGTON.

"THE desiccation of Asia" is a phrase frequently used but rarely well defined. With some writers it means the retirement of Tertiary inland seas because of warping of the Earth's crust—a process essentially completed long before the appearance of man; with others, who usually disregard the division of the Glacial Period into alternate cold and warm epochs through several of which man probably existed, it denotes the change from the coldness or moisture of glacial times to the aridity of to-day; while with still a third group it indicates a gradual change of climate, supposed to have taken place during the period covered by history, and to have been a potent factor in causing great human migrations, such as the invasion of Europe by the Huns, or of western Asia by the Turks. The reality of the first two types of desiccation is established almost beyond question by geological evidence; a study of the geography and archæology of eastern Persia, Transcaspia, and Turkestan during the past three years has led me to believe that the third type is equally real, and that during the last two thousand years there has been in progress a desiccation of Asia which is the last faint undulation of the great climatic waves of the Glacial Period. In the reports of the Pumpelly Expedition, I have considered the question as it applies to Persia and Transcaspia. More recently, during 1905, as a member of the Barrett Expedition to Chinese Turkestan, I have been able to carry the investigation into regions where the evidence is more conclusive.

The rivers of East Turkestan fall into two main groups. One, including most of the large streams, comprises those which rise among the lofty mountains on the south-west, west, and north of the Tarim, or Lop, basin, from Khotan around through Kashgar to Korla, and join to form the so-called Tarim terminating in the historic lake of Lob Nor. The other comprises a multitude of smaller streams which rush down from the mountains, chiefly in the southern and eastern parts of the basin, and, for the most part, wither away in the desert. The latter belong to a highly specialized type peculiarly sensitive to changes in the water-supply. In the southern part of the basin, from Khotan eastward to Lob Nor, where the type is most perfectly developed, the larger withering streams, rising among snowy mountains, flow at first in zigzags or in east-and-west courses among the shallow longitudinal troughs of the northern part of the Tibetan plateau, and then, turning northward, break through the great fault-scarp of the Kwen Lun mountains in narrow gorges; while the smaller, rising on the north side of the Kwen Luns, flow down the face of the escarpment as rushing summer torrents. Reaching the sharply defined, squarely cut base of the mountains, all the streams, large or small, enter the zone of Piedmont gravels, a sloping plain from 15 to 50 miles wide. At first they flow in deep terraced trenches cut in their own gravel fans, and often difficult to cross; but soon the fans decrease in size, the terraces die out, and the streams spread into such broad and numerous channels that the water completely disappears, partly by evaporation, and still more by sinking into the gravel. To judge from the map, this is the end of the smaller streams. In reality, they continue underground as a confluent sheet, deeply buried where the gravels prevail, but coming close to the surface where the latter give place to clays and sands. Here water, often saline, can be obtained in wells at a depth of from 3 to 6 feet, and its widespread presence is shown by the abundance of reeds, tamarisks, and poplars which form a zone of vegetation from 1 to 20 miles wide, skirting the northern edge of the gravels for nearly 1000 miles. The larger streams succeed in crossing the Piedmont gravels during the three or four months of the flood season from May to August, and either lose themselves among reed-beds in the zone of vegetation, or pass on and gradually dwindle to nothing in the sand of the Takla-makan desert. The only exceptions are the Cherchen river, which, being diverted eastward along the zone of vegetation, succeeds in reaching Lob Nor, and the smaller streams farther east which in extreme flood join the Cherchen. During the drier part of the year all the streams, except those of Chira, Keriya, and Charklik, disappear in the gravels, but reappear lower down in springs seeping out in the river-beds. Typically each main stream irrigates an oasis on the southern edge of the zone of vegetation, and formerly irrigated another, which, because of salinity or lack of water, it cannot now support. As a whole, the withering rivers show signs of having decreased in size during the last two or three thousand years, the evidence lying partly in diminished length, as shown by dead vegetation, and partly in diminished volume and increased salinity, as shown by ruins.

In the 700 miles eastward from Khotan to the eastern end of Lob Nor, seventeen rivers are worthy of notice by reason of their size or because they support oases. The test of diminished length as measured by vegetation, however, can only be applied to five of the seventeen, or possibly six, since the rest formerly united with one of the other five or with the Cherchen, which reaches Lob Nor. The possible sixth river is the small Yes Yulghun, the lower end of which has never been explored. The Molja is also doubtful. It now terminates in the zone of vegetation, but an old channel suggests that it formerly may have joined the Endere to the west, although now it is too small to flow so far. The Chira, the most westerly to which the test is applicable, appears formerly to have been joined by the three or four streams to the east of it, and to have flowed to the sand-buried towns of Dandan-Uilik and Rawak described by Stein. A strip of dead tamarisks, typical river jungle, extends even beyond Rawak, the northern town, to a point 60 miles from the Chira's present terminus, and over 50 miles from the limit of living vegetation. Farther east the Keriya river is reported by Hedin and Stein to have dead jungle extending 20 miles north of the present end of the stream. On the Niya and Yartungaz rivers I found that similar dead vegetation extends equally far or farther, and on the Endere at least 8 miles and possibly much more. In brief, of the six rivers to which the test of the extent of dead vegetation can be applied, one has not been explored; and the other five all show that within times so recent that the dead reeds, tamarisks, and poplars have not yet disappeared, the rivers flowed from 8 to 60 miles farther than to-day. The Endere and Yartungaz rivers are the most important, for they each support but a handful of farmers, eight or ten families, and the amount of water diverted for irrigation is insignificant. The Yartungaz river is now artificially constrained to flow wholly in one channel, although formerly during floods it spread into two or three. Thus the main stream has been appreciably lengthened. Yet in spite of this, the reeds, the form of vegetation responding most quickly to changes in the water-supply, are dead for a distance of 25 miles along


Sketch Map of
EAST TURKESTAN
to illustrate the paper by
ELLSWORTH HUNTINGTON
Natural Scale 1:7,500,000 or 1 inch = 118 statute miles
0 50 100 200
Route
Ancient Oases
Modern Oases
T I A N S H A N
Khan Tengri
Kucha
Charchi
Ak-su
Shah Yar
Tarim R.
E A S T
T U R K E S T A N
Tarim Basin
TAKLA MAKAN DESERT
Yarkand R.
Khotan R.
Cherchen R.
Cherchen
Endere
Lob Nor
Abdal
Miran
Charklik
Ancient road
Sa Chau
Dung Khan
Ansi
KHOTAN
Chira
Keriya
Niya
Yartungaz
Tsaidam Swamp
Bagrash Kul
Korla
Merdek
Dandan Uilik
Kara Dong
Gas Kul
Achik Kul
Salt plain of ancient Lob Nor

the northward continuation of the main channel, which as yet is buried in sand only in the narrower parts.

The minor streams, wherever I have examined their lower ends in the zone of Piedmont gravel, have old channels never occupied now by running water, and therefore in process of being filled with sand. The channels indicate that the streams were once larger and ran farther, but in the absence of vegetation and ruins, the time of this greater size cannot be determined. The true ends of the small streams, however, as has already been said, are found in the zone of vegetation. If the streams have diminished within recent times, that is, within the period covered by history, the vegetation ought to show it. Between Khotan and Charklik, where the zone of vegetation varies in width from 10 to 20 miles, I crossed it seven times in places several miles from the larger rivers, and therefore dependent on the water coming underground from the smaller streams. In every case the vegetation of parts of the zone—usually the northern parts, more remote from the mountains—is dead or dying; and in some cases half-dead vegetation extends over the whole width of the zone. Frequently for many miles one traverses reed-beds, evidently vigorous and thick at some former time, but now consisting only of a few struggling shoots not a tenth as numerous as those of the past, the rest being mere stubble undermined by the wind. Elsewhere there are large tracts of dead and dying poplars, or of tamarisks, either dead or forming a type of mound characteristic of places where the water-supply is lessened. The death of the vegetation is often attributed to the encroachment of sand, but in the cases under consideration that has little to do with it. Often the ground is almost free from sand, there being only a few inches, or at most scattered dunes a foot or two high. And even this in most cases is not derived from a distance, but is the heavier residue left by the wind as it carries away the soil no longer held in place by living vegetation. The very form of the stems shows that death is not due to sand. In the limited region where sand is manifestly encroaching upon living plants, the reeds and tamarisks shoot up abnormally to two, three, or even four times their usual height, in a vigorous and often successful attempt to keep their heads above the dunes. In the far larger areas of little or no sand the dead tamarisks and reeds show nothing of such tall slender growth, but tend, on the contrary, to become short and stunted. The widespread death in the zone of vegetation seems to be to the smaller streams what the dead channels in the sand are to the larger—an expression of gradual desiccation.

The most unexpected and perhaps the most significant characteristic of the typical river is its ancient towns. Thirteen of the seventeen larger rivers have on their lower courses the ruins of towns dating usually from the Buddhist era, a thousand or more years ago. On six of the thirteen rivers the ruins appear to be of only one age; on five, the Dumuka, Niya, Cherchen, Vash Sheri, and Miran, of two ages; and on the Chira and Endere rivers, of three ages. In general, the older ruins are the larger, and lie farther down-stream. Also, on the whole the ancient towns were larger than their modern successors, this being notably true of Yartungaz, Endere, Cherchen, Vash Sheri, and Miran. And lastly, with the exception of old Cherchen and Charklik, and possibly of Kara Dong at the end of the Keriya river, which I have not visited, the older ruins are situated so far out in the desert, or upon rivers so small or so saline, that it would be impossible again to locate towns of equal size in the same places, unless a far better system of irrigation were introduced.

A brief description of the ruins of Niya, Endere, Vash Sheri, and Miran will give a fair idea of the whole. Modern Niya is a town of about three thousand people, located on the southern edge of the zone of vegetation 60 miles east-north-east of Keriya. The town, like all those east of Keriya, is young, having been founded in the early part of the nineteenth century; but though it has been fairly prosperous, decay has already begun. During part of the season of irrigation the water does not come direct from the mountains, but from springs a few miles above the town. Accordingly it is slightly saline, so that the fields farthest down-stream are gradually becoming unfit for cultivation, and are being abandoned a few every year. The cultivated area, according to Stein's map, amounts to 24 square miles, including large lacunæ. Below Niya the river-bed is almost dry, but water seeps in from springs until a good-sized stream is formed, only to disappear again in the course of 20 to 25 miles. Forty miles from Niya, however, at Imam Jafir Sadik, the most famous shrine in Central Asia, the stream once more appears, but soon sinks into the earth again for the fourth and last time. In its lower course the river becomes so saline that permanent cultivation of the land along its banks is impossible. Even if there were no such town as Niya, the water, except during the flood season, would still be saline here at the river's end, and fields would become unfit for use after a short period of irrigation.

Fifty-five miles below Niya, and 4 miles below the present flood limit of the river, one comes upon the first ruins—ancient houses hidden among large tamarisk mounds, poplars, and sand. They belong to the Buddhist epoch, and have been described in part by Stein. I counted over a hundred houses extending northward for nearly 14 miles. There must be many more still to be discovered, for we found a number which were new to the guides, and one can walk within 100 feet of a house and not see it among the tamarisk mounds and sand. There must, too, be many houses buried under the latter, so that the total pretty surely amounts to several hundred. In view of the number of houses and of the large area—about 28 square miles—

apparently under cultivation—which in Chinese Turkestan always means under irrigation—the town can scarcely have been smaller than modern Niya, and must have demanded as abundant a water-supply.

At the northern end of the old town, and overlapping it for about 2 miles, there are traces of a still older ruin. No houses or walls remain, only thickly strewn pottery, bones, and slag, the pottery being of a cruder type than that of the later ruins, and broken into finer fragments. The farthest outlier of this town, so far as I could discover, lies at a distance of 24 miles from the present end of the river. Nothing is known of its history, and there is nothing by which to date it. It may represent an earlier epoch than the ruined houses, or it may merely represent the part of a single long-lived town which was first abandoned.

In either case the question arises whether with the present water-supply, which is completely utilized and is very slightly saline at Niya, it would be possible for an equally large and permanent town to grow up at a distance of from 55 to 70 miles out into the desert, and from 5 to 20 miles beyond the flood limit of to-day. Even if there were no such town as modern Niya, it appears to be impossible. In the first place, if the water at the shrine of Imam Jafir Sadik is to-day too saline to allow of permanent cultivation, it would pretty surely be as bad or worse farther down-stream. A dense population and prolonged intensive culture such as the ruins indicate would hardly be possible. In the second place, it is very doubtful whether the Niya river would reach the lower ruins even if none of the water were diverted for irrigation. A hundred years ago there were no inhabitants along the Niya river, or, at most, only a few shepherds. The river ran freely as far as it would. In the upper ruins the old channel is still visible, and the poplars and tamarisks are only beginning to die. Among the main ruins, however, and still more among the lower ones, the vegetation has been dead hundreds of years, so long that even in this dry climate the poplars are reduced to mere naked trunks, and the tamarisks have either died or grown into mounds 20 to 30 feet high. To put the matter in another way, if the Niya river was as large a hundred years ago as it was at the time of the ruins, it ought at the later epoch to have flowed not only to the ruins, but well on past the most remote of them. Vigorous vegetation ought to have accompanied it to a point at least 30 miles beyond the present end of the river—that is, 5 or 6 miles beyond the most remote ruins. But, as we have already seen, most of the vegetation among the ruins has been deprived of water for much more than one hundred years, and that at the outer limit has not only died and dried to tinder, but has been blown away by the wind so that only the stumps remain, cut off level with the soil.

The weight of the evidence of dead vegetation appears even stronger when the ruins of Niya are compared with those of old Dumuka between

Chira and Keriya. In the early part of the nineteenth century the water-supply of Dumuka gradually diminished, until about 1840 it became so scanty that all the inhabitants moved at once to the present site, 8 or 10 miles farther up-stream. Modern Niya was settled before this, but as the town grew slowly, it is safe to say that the diversion of the Niya river for irrigation did not take place on a large scale till about the time of the abandonment of old Dumuka. Since that time no surface water has reached the old site of the latter, but its vegetation is still fresh and vigorous. If an abundant water-supply was cut off from old Niya at most only twenty or thirty years earlier, it is hard to see why the vegetation should show little or no sign of death in the one case, at Dumuka, and should be completely dead and decayed in the other. It is not probable that the Niya river reached the main ruins a hundred years ago before the founding of the modern town, or that it would do so now if it were not used for irrigation. That a river of the present size could not only reach the ruins, but irrigate an area as large as that now under cultivation is still more improbable. If, however, the climate of antiquity was colder, so that evaporation was less, or moister, so that the rainfall was greater, and if the river was correspondingly larger, not only would this be possible, but the difficulty from salinity would disappear.

The Endere river, 60 to 70 miles east of the Niya, though larger, has no proper oasis. At its lower end, eight or ten shepherds have cultivated a little land during the past thirty years; but the river is too saline to admit of permanent irrigation. The shepherds say that even fresh land can only be cultivated once in three years, and any attempt at prolonged cultivation would be futile. Nevertheless, the river has on its right side—first, the ruins of a large Buddhist town of early date; second, of an almost equally large town of later Buddhist times; and third, of a small Mohammedan village; while on the left or west side it once supported a Buddhist hamlet and a fair-sized Mohammedan village. The two larger Buddhist sites resemble those of Niya in relative age and location, but are of greater size and more separated, and the older town appears to have been the more populous. The larger Mohammedan village, a walled enclosure within which the houses are still standing, is much smaller than either Buddhist site, its houses numbering 150. Like the Buddhist towns on the lower Niya and Chira rivers, and the late Mohammedan sites of old Ponak and Dumuka, it appears to have been abandoned deliberately and of set purpose, for the houses and walls were left intact, and everything of value was carried away. Disregarding the two smaller sites, we thus have on the Endere river the ruins of three towns of different ages, which grew up one after the other, the later town in each case being smaller than its predecessor. To-day there is water enough to support a large town, but it cannot be used because of the salt. The uppermost ruins lie only 12 to 15 miles further up-stream than the present shepherd hamlet, and the lowermost lie quite as far down-stream. Even if the difficulty due to the entrenchment of the river to a depth of 20 or 30 feet could be overcome, and the water could again be brought to the ancient sites, it would be too saline to support such large and permanent towns. If, however, the water-supply was once enough greater so that surface water reached the lower parts of the river three or four months each year instead of only one, the difficulty would be largely obviated, and the conditions would be like those of modern Niya, the fields would gradually become saline, but it would be many years before they would have to be abandoned. On any other supposition the location of the towns and their successive abandonment seem inexplicable.

Still further to the east, 200 miles from Endere, the Vash Sheri river rushes swiftly down from the mountains, and, after losing most of its volume in the Piedmont gravels, supports the thirty people of Vash Sheri. During the months of June, July, and August, the melting snow on the mountains—30 to 40 miles away—increases the river's volume enormously. Hearing of this large amount of water wasted among reed-beds, a considerable number of people have come to Vash Sheri during the thirty years since it was settled, but most have gone away after a year or two. In summer they had more than enough water for their fields, but during the planting season of April and May the supply often ran short. Under the present conditions of climate and irrigation, a population of thirty or forty is all that the river can support. Yet in ancient times the number of people must have been many times as great. Formerly, the river followed a more westerly course. At the end of the old channel, and at the same distance as the modern hamlet from the mountains, the ruins of a Buddhist town cover an area at least $2\frac{1}{2}$ miles long by 1 wide. Here, as at Niya, the ruins consist of two parts. The older village covered the whole area. Its houses have completely disappeared; but if it were settled as densely as the abundant pottery indicates, or as densely as the modern villages, its population must have numbered five hundred or more. The later village, or the later part of the original village, as the case may be, occupied only the upper portions of the ruins. Traces, sometimes very faint, of sixteen houses can be seen, and some must certainly have disappeared or escaped notice. It is safe to say that near the time of its abandonment the village must have had a population of a hundred souls—three times as many as the present hamlet—and that earlier it must have had far more: so large a number of people could not be supported to-day without a radical change in the system of irrigation. Fortunately, the river changed to its new course as soon as the abandonment of the village allowed the rude dam of small boulders at the head of the old channel to fall into decay. Accordingly, the irrigation works have not been subjected to the destructive influence of floods, and are still almost intact. The difficulty of keeping the river in its old bed may have been the immediate cause of the abandonment of the village, but it had nothing to do with the sufficiency of the water-supply of the past as compared with that of the present. The latter depends upon the character and width of the river-bed, which are essentially the same in both cases, the old channel being the wider, if anything, and upon the nature of the irrigation system, which, again, was precisely the same in the past as it is to-day. Then, as now, the innumerable minor channels into which the river divides were simply dammed with banks of gravel dug up close at hand. Thus all the water was gathered in a single larger channel on one side of the mile-wide flood-plain, and was led off into canals, mere ditches dug in gravel or sandy clay, as the case might be. If the river should again be turned into the old canals, the available supply of water at the ruins would apparently be essentially the same as that at the village to-day.

A hundred miles east of Vash Sheri the Miran or Miyan river rises in typical fashion in the main snowy range of Kwen Lun, breaks through the front range in a deep gorge, traverses the Piedmont gravels in a terraced trench, and disappears during much of the year in a broad gravel flood-plain. Geographically Miran closely resembles Vash Sheri, and the reasoning applied to the latter holds good with increased emphasis for the former. Archæologically Miran is more important, for the ruins are not only far larger, but a new type of architecture is developed, the chief structures being elevated 10 or 20 feet on solid pedestals of sun-dried bricks. At present Miran is not permanently inhabited, though the fisherfolk of Abdal, on Lob Nor, 20 miles to the north, come in summer to cultivate the reedy fields, and, by using all the water available in spring, raise grain for about fifteen families. The fields can only be cultivated once in three years, for in a single season of irrigation a cake of clay 2 or 3 inches thick is deposited, a cake so stiff that crops cannot grow in it till it has been softened by two years of sun and rain. The natives think that the clay is gathered after the river begins to spread over the huge gravel flood-plain, 10 miles long and 1 or 2 wide. In reality the river is charged with fine clay when it leaves the mountains, where it is said to be equal to the river which supports the large village of Charklik. On reaching the flood-plain the water sinks rapidly into the coarse gravel, but as the current is swift, the fine clay is all borne along, until at Miran the river is literally a stream of mud.

Anciently, conditions must have been far different. The old Buddhist Miran was neither a hamlet, such as to-day might be located here, nor a village like old Vash Sheri, but a large and important town. It covered an area of at least 5 square miles, all of which, judging from the canals and pottery, and still more from the number and location of public and religious structures, must have been thickly populated. The houses, being made of clay apparently, have disappeared, with two exceptions. Thirteen other structures remain, of which one is a fort, 400 feet square; one a lamasery, the outer walls of which are adorned with clay reliefs of Buddha; two are stupas, or shrines; and the other nine are solid rectangular masses of sun-dried brick, capped in most cases by the walls of what may, perhaps, have been monastic dwellings or Buddhist temples. These establishments appear to have been kept up after the rest of the town had become depopulated, or else were reoccupied after a period of abandonment, during which the fort fell into ruin, as is suggested by the flimsy repairs superposed upon the solid older structure.

Ancient Miran, in its prime, must have required a water-supply almost scores of times as large as that now available. It is reasonable to suppose that, being the most important place for hundreds of miles both from a religious and a military point of view, Miran had an irrigation system as good as the country afforded. The water at first came from an old river-channel east of the town, and later, apparently, from the present channel on the west. The dams and canals are preserved just as at Vash Sheri, and do not differ from those of to-day. The main older dam is composed of tamarisks and small boulders thrown loosely together; and there is said to be another, which I could not find, composed of boulders alone. The canals are either simple ditches, or are raised a few feet on banks; but in every case the material is that which happened to lie close at hand. On the upper Miran river there are no inhabitants, and no opportunity for the diversion of part of the water. The present supply, sufficient for fifteen or twenty families, is all that the river is capable of furnishing under the system of irrigation which prevails now, and prevailed in Buddhist times a millennium or more ago. If, however, the rainfall were increased, say, a third, the amount of water reaching Miran would be multiplied vastly. Being confined to a single channel, the water would suffer scarcely more loss from evaporation and from sinking into the ground than it now does, and all the extra supply would be available at Miran. The difficulty from the excessive amount of sediment would vanish, for though the absolute quantity might conceivably be more than now, it would be diluted with a far greater amount of water, and spread over a much larger area. The hard cake would be reduced from 2 or 3 inches to perhaps a quarter of an inch, not enough to interfere with cultivation. Miran, even more than the other ruins, seems to verify the hypothesis of a change of climate during the historic era.

The ruins of Miran, Vash Sheri, Endere, and Niya are typical of many others. Charklik and Cherchen belong to the same class as Miran and Vash Sheri, the old towns having been located at nearly the same place as the new, and having covered a larger area. This is especially the case at Cherchen, where Lellik, the southern and apparently older ancient site, covered an area three times as large as the modern town, and the northern later site may have been as large. Neither Charklik nor Cherchen is conclusive, however, for the size of the ruins at the former cannot be determined, and the whole water-supply at the latter is not now utilized. Yartungaz resembles Endere, but the river is much more saline. Accordingly, as might be expected, the ruins are old and rather small, and lie at the highest possible point, like most of the modern oases. The remaining ruins, lying west of Niya, belong to the same type as the latter. Rawak, Dandan-Uilik, and Uzun Tetti were successive towns on what appears to have been the ancient extension of the Chira river, aided more or less by the smaller streams to the east. The pottery-strewn site of Lachinata lies beyond the end of the Gulakhma river; the Buddhist ruins of Payet Beg and Khadaluck and the recently abandoned towns of old Dumuka and old Ponak indicate the former greater length of the Dumuka and Ponak rivers, and an unnamed site in the sand shows that the Karakir stream once extended 15 miles beyond its present limit.

On the northern border of the Tarim basin there is less opportunity for the occurrence of ruins of the kind described above, for most of the streams are either very small, or else, uniting in the highlands, issue from behind the mountains as large rivers which join the Tarim, and will be considered later. At Ying-pen, however, north-west of Lop-Nor, the ruins of a small fort and village described by Hedin are now waterless. I followed the old canal northward for over 3 miles to its head, and found that it was a simple ditch with two small ponds or reservoirs, into which the water was turned from the little Shindi brook, the largest stream in the Kuruk Tagh, or "Dry mountains." To-day no water reaches the ruins during the greater part of the year, and the place cannot be inhabited, yet formerly the water-supply sufficed to support a small village.

Similar instances of ancient towns located where there is now no sufficient water-supply are described by Stein as far west as Kashgar; and I found others as far north as the depression of Turfan. Eastward beyond the end of Lob Nor, on the course which the united Bulundsir and Tan-ho rivers once followed on their way to the lake, two other ruined sites of the same sort are described by the natives. The Chinese of Dung Khan (Sa Chau), higher up on the Tan Ho, say that the ruins were abandoned by their ancestors long ago because the water of the rivers would no longer reach them.

In the case of the rivers of the Tarim system, the evidence of desiccation is less clear than among those of the withering type, for the streams are so large that they still support extensive oases and terminate at a fixed point in Lob Nor. Still, the increasing salinity of the lower Tarim, and the decreasing size of the terminal lake, seem to show

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that the rivers of this group, like those of the other, have suffered desiccation. The region along the lower Tarim or Yarkand river for 400 miles, and along its parallel tributary, the Konche, for 250 miles above the mouth of the united streams in Lob Nor, is to-day practically uninhabited. The scattered little settlement of Tikkenlik is the only real village, and almost the only place where agriculture of any sort is practised; and even its five hundred inhabitants could not subsist, so they say, if it were not for their flocks and for the fish which they eat in summer with young reeds and rushes. The great difficulty is salinity in both soil and water. Indian corn, one of the great staples of Chinese Turkestan, will scarcely grow at all, and is replaced by millet. Wheat fares better, but only the first year. If a field is cultivated several years in succession, the crops rapidly dwindle just as at Endere and Yartungaz.

The same difficulty prevails all along the lower course of the Tarim and Konche rivers, and several recent attempts of the Chinese to found towns have proved abortive. About 1889 some colonists settled at Jan Kul, 30 miles west-north-west of Tikkenlik, on the Tarim. Next year the population increased to over 2000, and Jan Kul, as the people say, "became a town;" that is, a bazaar was established, and an "amban," or local governor, was installed. But the fields quickly became saline, and after two years, in 1892, the place was abandoned, most of the settlers returning whence they came. Meanwhile, however, in 1891, about 1000 people had come from Turfan to Dural, 8 miles south of Tikkenlik, and had begun to raise wheat. Accordingly a large fort was built there, and in 1893 the amban of Jan Kul was removed to Dural, which in turn "became a town." For three years the population increased, but by 1897 the soil had become so salt and the crops so poor that the colonists began to move away. In 1898 over 2000 rebellious Dungans or Mohammedan Chinese were induced, or forced, to come from Shi-ning, 800 miles to the east, and settle at Dural, but the land and water were so bad that in 1900 they migrated 90 miles north-west to Karakum, on the Konche, another site which had just been opened. Thereupon, in 1901, the amban was removed to Karakum, and in 1904 the last of the people of Dural came to Tikkenlik. Karakum became even larger than its predecessor, and from 1901 to 1903 had a population of nearly 5000, but the salt was as bad as elsewhere, and in 1904 it too was abandoned, though the amban and forty or fifty people still remain. Jan Kul, Dural, Karakum, and Tikkenlik represent four abortive attempts during sixteen years to utilize the water of the lower Tarim and Konche rivers for irrigation. Tikkenlik, being but three or four years old, still survives, but its people are moving away or else are abandoning agriculture and betaking themselves to sheep-raising and fishing, the means of livelihood of the former hamlet before the attempt to establish a town.

Turning now to the past, we find a wholly different state of affairs. In Buddhist times the Tarim and Konche rivers were deflected eastward in whole or in part between Karakum and Tikkenlik, and flowed to the ancient ruins of Lulan, discovered by Hedin. In approaching Lulan from the north-east, and in leaving toward the north-west, I rode 15 miles each way through a region where houses, pottery, and other evidences of human occupation show that the whole area was once thickly settled by an agricultural population. Farther west, on again entering the broad zone of dead vegetation which accompanies the old river-courses, I found pottery, beads, slag, and bits of iron, for a distance of nearly 40 miles, and there was a little ancient pottery in a strip of dead vegetation between two arms of the Konche only 25 miles east of Tikkenlik. It looks as though in ancient times an area 100 miles east and west, by 10 or 15 miles north and south, was thickly dotted with villages irrigated by the Tarim and Konche rivers. Even if the present water-supply would suffice for so large an area, a densely populated, flourishing district like the Lulan of history would be impossible because of the water's salinity. Here, as in so many other cases, the phenomena are easily explicable if the rivers have decreased in size.

The lake of Lob Nor agrees with the rivers, for it shows signs of having been larger at no very distant date. In this article it is not possible to consider the controverted history of the "Great Salt Lake," as the ancient Chinese called it. It must suffice to say that in travelling around it, and crossing the unexplored salt desert at its eastern end, the presence of five, or possibly six, old shore-lines at altitudes of from 12 to 600 feet above the present level, and of a thick series of lacustrine deposits, indicates that the lake has passed through a succession of epochs of expansion and contraction corresponding to those of the lake of Sistan in Eastern Persia, and less closely of Great Salt lake in North America, and to the epochs of the Glacial Period all over the world. The freshness of the dry lake-bed and bluffs, the distribution of vegetation, the presence of an ancient road, now unused and unknown, which makes a long *détour* around a bay of the old lake-bed instead of crossing it as the modern road does, and the well-known fact that the present lake or swamp has diminished in size during the past century, seem to indicate that the last notable expansion of the lake took place, or at least had not yet passed away, when historic man occupied the surrounding region.

The rivers which wither in the desert, together with those which join the Tarim and terminate in Lob Nor, drain most of the mountains around the Tarim basin, but there is one part so extremely dry that there are practically no running streams whatever, only a few scattered springs, mostly salt. This inhospitable district, as large as Great Britain, lies between Lob Nor on the south, Bagrash Kul on the west, and Turfan on the north, and stretches eastward 400 or 500 miles toward the desert of Gobi. It is a desolate region of naked mountains half buried in plains of gravel, and is well named the "Dry mountains" ("Kuruk Tagh") on the south, and the "Desert mountains" ("Chol Tagh") on the north. It is so little known that the best I can do is to quote what was said by my guide, a remarkably intelligent camel-hunter of Kuzzil Singer, the only inhabited place, who knows every spring and mountain for 100 miles in every direction. I asked him whether there was more or less water now than in the past, or just the same. In reply he told of the drought during the last four or five years which every one speaks of, and then went on, "And long, long ago, in the days of which neither my grandfathers nor their grandfathers ever heard, there must have been much more water. In the high mountains there are many places where little stone shepherd's houses, with the roofs all fallen in, stand in valleys where nobody has ever known of there being any water. The nearest water is sometimes 5 or 10 miles away. Surely no one would have built houses and kept flocks and herds in those places unless there had been water. How many such houses have I seen? Oh, many; I never counted, but the mountains are full of them. In other places, away from the higher mountains, one often finds salty deposits and a few reeds where once there must have been springs, and on every side there are old paths coming in where once the wild camels and antelopes used to come regularly to drink. Now, as there is no water and only a very few reeds, scarcely two or three animals come in a year. There were men here then, for near almost all of the dry springs there are old shelters of rocks and pieces of tamarisk, just such as we make now when we lie in wait for game. I never talked to any one about this before, and I do not know whether I am right, but I have seen these things when I have been hunting, and," as the Turki idiom puts it, "that is what I know in my stomach." My own limited observation agrees with that of the camel-hunter. Moreover, I found traces of ancient roads and of villages where there is now no water, and the basin of the Turfan, near by to the north, is full of evidences of an historic decrease in the water-supply.

The phenomena of rivers, large and small, of springs, lakes, ruins, and vegetation, all seem to point to a gradual desiccation of Chinese Turkestan for nearly 1500 miles east and west, and 500 north and south. The records of antiquity indicate that the Caspian and Aral seas were once more extensive than now, and presumably that the tributary rivers were much larger. Transcaspia, Eastern Persia, and the neighbouring regions appear to have been subject to a desiccation similar to that of Turkestan, and indicated by similar phenomena. Thus all the more arid part of Asia, from the Caspian sea eastward for over 2500 miles, appears to have been subject to a climatic change whereby it has been growing less and less habitable for the last two or three thousand years. Such a change, embracing Persia, Baluchistan, Afghanistan, Russian Turkestan, and Chinese Turkestan, and probably an even larger area, and converting thousands of square miles of habitable country into desert, can hardly fail to have had some effect upon human distribution and history. In Chinese Turkestan part, at least, of the ancient towns described above appear to have been abandoned deliberately, presumably because the water-supply became limited. Movements of the same sort are to-day taking place on a small scale all over the arid parts of Asia; as, for example, in the cases already cited of the inhabitants of Dumuka and other villages who moved in a body to a new location, or of the Dungans and people from Turfan, who wandered here and there along the lower Tarim. In 1904, 500 Kossack nomads, with their flocks and herds, came to Lob Nor, and would have settled among the reeds of the lower Cherchen river if Chinese soldiers had not driven them out with bloodshed. The nomads had come from the Altai mountains, where pasture had become too scanty either because of increasing drought or increasing population, or more probably both. Such movements only need to be magnified to cause invasions like those of the Dark Ages. That they were magnified in Turkestan when the Buddhist towns were abandoned appears highly probable. The abandonment took place in the early centuries of the Christian era, and for most of the time from that day to this the whole country from Keriya eastward for 600 miles, almost to China Proper, remained practically uninhabited, even more so than to-day. Not only the inhabitants of the towns disappeared, but also the shepherd tribes among the mountains, who, judging from names, traditions, and ancient roads and dwellings, were formerly numerous, and who would feel the pinch of aridity more quickly and keenly than the towns-people. Part of the population may have been killed in war, or have died in the epidemics which rage when a country is over-populated, but the rest must have migrated. If, though only in bands of a few thousands, they invaded regions already well populated, where the means of livelihood were growing less because of desiccation, distress and wars would ensue, and the only relief would lie in further and greater migrations. And thus, all Central Asia being under the same ever-increasing stress, a succession of dry years, or a change such as has taken place in Chinese Turkestan since 1900 from an increasing to a decreasing quantity of water in the rivers, might cause migrations equal to the greatest recorded in history.

JOURNEYS IN NORTHERN NIGERIA.

By HANS VISCHER, M.A.

For a very long time the Niger and its tributaries successfully withstood all attempts at discovery at the hands of European geographers; individuals and whole expeditions alike were killed or turned back time after time by the climate or hostile native tribes, and many lives were paid for the ultimate discovery of that river system. The student of geography who travels along the Niger or the Benue, marking his day's journey on a fairly accurate map, cannot but feel that he is treading on sacred ground. The great struggle for the clearing up of the river-system, and the subsequent contest for possession of the country which led to the division on the map as we now know it, form an interesting chapter in the history of European enterprise in Africa.

The traveller in the Benue valley is struck with the enormous variety of the apparently wholly different tribes that he finds settled on both sides of the river. Fulanis, Beriberis, Hausas, Jikums, and endless pagan tribes, all are crowded together along the river valley. The great river, with the hill ranges running parallel on both sides, formed a natural barrier to the movement of nations, thrown from their original abode in the central Sudan by the incoming hosts from the north-east, or the tribes fleeing from some mighty neighbour or a raiding chief. Thus it is that we cannot trace local history of the tribes connected in the Benue valley to any extent. We know, however, that the mild-looking Jikums once warred successfully with Kano and Bornu, and received tribute from all the countries around in the old capital Kororofa, a little south of the river, and that the empires of Bornu and Sokoto in turn largely influenced the composition of tribes along the Benue. The sultans of Bornu periodically raided the countries to the west of Chad, driving down the tribes living along the borders of their empire. These would move down to the hills, driving off in their turn the people already there. So we have along the river nearly every tribe claiming to have come down from the north—such as the Ankwes, the Montoils, the Yergums, the Burmawas, the Jemuris, and the Bashamas. Besides these, the word Beriberi, joined on to a local name, denotes a settlement of Beriberis, or Kanuris, who have come down quite lately from Bornu, and whose fathers or grandfathers still spoke the Kanuri language.

Of the Fulanis on the river, we know that in the time of Bello Emir of Sokoto Modi Mohammad, a Fulani of the Kiri tribe came down into the valley with his fanatic horsemen to wage the Jehad against the pagans. He had a banner from the great Bello, the son of Othman dan Fodio, and was the brother of Bubaero, the chief of Gombe. He defeated the heathen Jemuri, and on the site of their ancient settlement built his own town, which he called Muri. Hammarua, who received the


FRENCH WEST AFRICA
Lake Chad
Sokoto
Kano
Zaria
NORTHERN NIGERIA
Bauchi
Gujba
Ashaka
Zungeru
Bida
Keffi
Wase
Yola
Amara
R. Benue
Lokoja
Ilorin
Ibadan
LAGOS
Abeokuta
Lagos
Porto Novo
SOUTHERN NIGERIA
Benin
Asaba
KAMERUNS
Old Calabar
Bonny
Akassa
GULF OF GUINEA
Fernando Po
Scale 1:20.000.000
Statute Miles
Railways
Gujba
Bush
Mutye
R. Gongola
Gabai
Ashaka
Burmi
Tongo
TONGO HILLS
Dukul
Jurara
Doho
Kafaretti
BAUCHI
BOLAWA
Ako
Cultivation
Fali
Maimadi
Abbas
Burri
Bush
Tongolong
Duguri
TANGALI HILLS
Plateau
BAN
BURMAWA
BASHERAWA
Bashar
Dinya
MURCHISON RANGE
GUM
Bush
MONTOIL
Wase
Mata Fada
Gurkaua Hills
Mt. Shandam
Tungan Galadima
Bunbuni
Amara
R Benue
Sketch Map
showing route in
NORTHERN NIGERIA
by
HANS VISCHER M.A.
1904
Scale 1:2.000.000 or 1 Inch - 31·6 Stat. Miles
This route survey is based upon a prismatic compass traverse adjusted by astronomical observations for Latitude and chronometric differences of longitude. The positions have been made to agree with those determined by the Alexander-Gosling Expedition.
Route

Pleyad party in 1854, and Nya, the friend of Mizon, were both successors of this Modi Mohammad. After the conquest of Kona these Fulanis crossed the river and settled at Jalingo, where the present Emir Haman Mafendi now lives. Before this some of them had settled along the Tarabba river; but, broadly speaking, the Benue forms the southern limit of Mohammedan influence. These Fulanis had for a long time worried the Jikums, and at last, compelling them to abandon their capital Kororofa, had broken their power.

Quite different from these Fulanis are those cattle-breeding nomads, who are frequently met with along the Benue. They have never appeared as warriors, but as peaceful cowherds; coming from no one knows where, they passed in and out amongst the native tribes, going where they thought they would find good pasture for their cattle, inoffensive and unmolested. They did not mix with the people of the land as did their Mohammedan cousins, and thus they preserved their light skin and their Asiatic features. They never became Mohammedans. Since Andrée Brue, in 1697, encountered his Fulanis 100 miles from Timbuktu, the origin of this strange tribe has ever puzzled the European. Successively they were connected with Egypt, Carthage, Morocco, the Caucasus, and Persia.

There are several routes from the Benue to the northern territory. The more important of these are: the one leaving at Loko, and passing through Keffi to Zaria and Kano; another from Ibi to Bauchi; and a third from Yola to Bornu. It was by this middle one that I left the Benue valley for the north. The first important place that I arrived at in 1904 was Wase. This pretty walled town is situated on a ridge, and close behind it stands an enormous basalt rock, evidently the denuded stump of an ancient volcano. In shape and aspect that mighty block resembles the famous Bear Lodge in the Black Hills of Dakota. On its top thousands of birds find a resting-place, and their deposits in the dry season give it a look of a snow-covered mountain summit. Being almost inaccessible, it has given rise to many weird legends, which the Wase host retails with much relish to the new-comer. The natives call the rock Goran Dusan, *i.e.* the Kolanut-stone, measuring over 1000 feet from the base; it is visible for miles, and known to every traveller in the country, and from it the local chief takes its name of Sarlkin-dutsi, the Rock King. To the westward, at a distance of a little over 10 miles, the ragged hills of the Murchison range present a beautiful sight. The Wase river flows through the intervening plain; along its banks stretches of green pasture vary with cultivated fields, and great herds of cattle grazing everywhere give the whole an extremely pleasing aspect. The town, with its well-built houses now in ruins, its date palms and crenelated wall, has seen better days, and the local history is typical of the fitful political changes that kept the country in a perpetual state of unrest, making it a difficult field for peaceful administration.

With the advent of a Western government, a stop was put to all these local enterprises, but no power on earth could freeze this seething mass into even shape in a moment. The pagan for some time to come would look with hatred and suspicion at the Fulani chief, and the latter would find it difficult to see the native Kaffir anything else but his rightful prize. It cannot surprise any one when the savage amongst the hills, forgetting that all things have changed, lets fly an arrow at the passing caravan from sheer force of habit. The man who got the last knock not unnaturally longs to be able to hit back.

Originally there was a fairly large settlement of Jikums at the foot of Wase rock. Then when Yakoba had built Bauchi town to the north and had become powerful, his followers came south and conquered the country towards Muri and to the Benue, driving away the Jikums, and causing the native pagan tribes to take refuge in the hills. After the fashion of the Fulanis, Yakoba gave Wase to one of his chief slaves. This giving away of large newly conquered districts had its obvious advantages, for the province was ensured against falling back; the possession of large lands stimulated the servants of the chief, while it provided the necessary food and material for the upkeep of the army; moreover, the slave leaders were kept away at a safe distance from the court. Similar to our old feudal barons, they held the land from the king, to whom they paid an annual tribute, and had to keep up an army always ready to start at the command of the king.

In connection with the present dilapidated state of the town and the proverbially bad character of the Wase people, an old slave of the late Emir of Sokoto told me the following tale: "When the Emin-el-Musselmi sent his messengers round to all the various towns of the provinces, one of them arrived one evening at the town gate of Wase just as the sun went down beyond the blue hills of the west, and Salla was called from the mosques. In those days the town was crowded with people. The women wore beautiful silver bracelets and rich clothes, even the poorest of the men had his horse, and as to the horses and cattle of the chief and his slaves they could not be counted. There was no lack of grain and fruit of every kind. All was abundance and happiness. The drums and dances were kept going until the town woke up in the morning. Then the king and the chief men sent for the Sokoto messenger, and gave him one bowl full of corn; that was their contribution to the mosque at Sokoto. There on that small hill north of the town the man from Sokoto stood. He was a holy man, and he cursed the town, and he cursed the men in it. From that day the Wase men eat without ever stilling their hunger, the sun dries up their seed, and the rain beats down their houses, and where will you ever see a well-fed horse or a beautiful woman in Wase town to-day?"

When the horsemen from Bauchi originally came down, they found living alongside of the Jikums the pagan tribe of the Yergums. These people now live in the mountains of the Murchison range just opposite Wase, and in the plain between the Wase river and the hills. The Yergums say that they did not take to the mountains till they were driven there, and that originally they also had come down from the north. As far as I can judge, after a stay with them of only a few months, I believe, from their features and their language, that they belong to the same stock as their neighbours the Montoil, the Ankwes, the Angoss, the Burmawa, and the Gatali, all found along the hills running parallel to the river. Most of these tribes are still cannibals, but nowhere did I find that this was connected with any religious ceremony. As an old Montoil chief informed me, man's flesh is eaten because "it is extremely tasty, far sweeter than goat or sheep." Fear of the various spirits and their propitiation seem to constitute their religion. Under "Nan," the Yergums understand what the Red Indians call the great spirit. The blazing of the sun, the downpouring of rain, are his manifestations; he speaks in the thunder and in the howling of the wind. The idea of transmigration of the soul is not unknown to them. Accidentally one day I overheard a Yergum boy who had joined my boys as a donkey driver, saying, while looking at his tired ass, "May Nan never turn me into a donkey. I would rather become a dog than a jackass." Any one who deals with these pagans, and sees them in a natural state and not frightened, will notice that as a rule they strictly adhere to the truth. This being very unusual amongst the natives which I had seen before, I asked a young Yergum, who told me that no men with any sense ever willingly told an untruth. Though this characteristic is not uncommon amongst primitive races, it shows how much these pagan tribes have kept to themselves, for no one who has visited the Benue will assert that the native there would easily forget himself so far as to give a straight answer to a straight question. As regards the dress, the Yergums have simple tastes. The men wear a skin round the loins; the women a few bunches of fresh leaves stuck into a narrow belt, carried in front by the married women, and behind by the girls.

Around and behind the Yergums on the various hilltops are scattered other tribes, such as the Talus, the Pés, and the Gazums. While visiting the latter, I found right up to the mountain crest regular terraces, skilfully built of large granite boulders, and in several places where the path led over the steep rocks, regular steps had been cut, similar to those an Alpine guide carves in the ice. It will require a good deal of careful study to find out who were the original inhabitants. There are a number of natural caves, but in none of these could I find any signs of previous occupation.

Leaving Wase I followed the route through Bashar, a prettily situated and well-kept place. The natives are good farmers, and form a close community, allowing no strangers to settle in the town. They claim to have come from Bornu.

The road then leads on to the north over the hill range to the high plateaus of Bauchi. The country is more wild and rugged, showing volcanic action; the plateaus of iron sandstone are intersected by deep cañons. The road leads through several of these, first at Duguri, where we have a regular valley with a little river and fertile fields on both sides.

Further on the road at Tongolong, the village lies in a regular chasm. The sheer precipices of rock which enclose the little settlement have formed a natural and effective defence against all intruders. The natives like informing one that they were never worried by the all-feared Fulanis, who, indeed, must have turned back for their horses' sake at the sight of these rocks. It was also the natural and safe position of their settlement which made them independent from their chief at Fali. They say that originally they had come down with the Fali people from Bornu, and their features, as well as their tribal marks, certainly seem to bear that out. I willingly consented to the wish of the venerable old headman, who asked me if his people could have their dance in the evening.

The high cliffs of the valley showed clearly in the bright moonlight, when the strains of a native band were heard coming from an adjacent village. Through the long guinea-corn stalks men and women came out like so many shadows from the various clusters of huts. The sound of the fiddles and the rattling of a calabash filled with pebbles came ever nearer, till the band with many followers emerged from the dark fields to the open space, where a broad sandy river-bed formed a natural playground. A merry crowd had now gathered, chattering and laughing and thoroughly enjoying itself after the way of the African. The musicians, three stout men and a woman, played in that typical way common to all primitive people, one fiddle leading with a slightly varying wailing tune, when the second fiddle took up the air, repeating it in lower notes, and the woman accompanied with a rhythmic swinging of her calabash. It is a weird, melancholy noise, naturally in a minor key, but full of ever-growing excitement. All the young people had now formed into two rings, the men inside, and round them an equal number of girls. They started walking round slowly in opposite directions. Then, as the music became faster, they quickened into a kind of two-step, the men dancing in and out around the girls, who kept moving the other way. Each time the boy faced the girl, he turned round, gave a little jump, and, smacking her outstretched hand, moved off to the next beauty, where the performance began again. All was done in time to the music, and the movements of the laughing youngsters could not have been better measured. Without reserve all abandoned themselves to the most thorough enjoyment, dancing and yelling as if west, and Turfan on the north, and stretches eastward 400 or 500 miles toward the desert of Gobi. It is a desolate region of naked mountains half buried in plains of gravel, and is well named the "Dry mountains" ("Kuruk Tagh") on the south, and the "Desert mountains" ("Chol Tagh") on the north. It is so little known that the best I can do is to quote what was said by my guide, a remarkably intelligent camel-hunter of Kuzzil Singer, the only inhabited place, who knows every spring and mountain for 100 miles in every direction. I asked him whether there was more or less water now than in the past, or just the same. In reply he told of the drought during the last four or five years which every one speaks of, and then went on, "And long, long ago, in the days of which neither my grandfathers nor their grandfathers ever heard, there must have been much more water. In the high mountains there are many places where little stone shepherd's houses, with the roofs all fallen in, stand in valleys where nobody has ever known of there being any water. The nearest water is sometimes 5 or 10 miles away. Surely no one would have built houses and kept flocks and herds in those places unless there had been water. How many such houses have I seen? Oh, many; I never counted, but the mountains are full of them. In other places, away from the higher mountains, one often finds salty deposits and a few reeds where once there must have been springs, and on every side there are old paths coming in where once the wild camels and antelopes used to come regularly to drink. Now, as there is no water and only a very few reeds, scarcely two or three animals come in a year. There were men here then, for near almost all of the dry springs there are old shelters of rocks and pieces of tamarisk, just such as we make now when we lie in wait for game. I never talked to any one about this before, and I do not know whether I am right, but I have seen these things when I have been hunting, and," as the Turki idiom puts it, "that is what I know in my stomach." My own limited observation agrees with that of the camel-hunter. Moreover, I found traces of ancient roads and of villages where there is now no water, and the basin of the Turfan, near by to the north, is full of evidences of an historic decrease in the water-supply.

The phenomena of rivers, large and small, of springs, lakes, ruins, and vegetation, all seem to point to a gradual desiccation of Chinese Turkestan for nearly 1500 miles east and west, and 500 north and south. The records of antiquity indicate that the Caspian and Aral seas were once more extensive than now, and presumably that the tributary rivers were much larger. Transcaspia, Eastern Persia, and the neighbouring regions appear to have been subject to a desiccation similar to that of Turkestan, and indicated by similar phenomena. Thus all the more arid part of Asia, from the Caspian sea eastward for over 2500 miles, appears to have been subject to a climatic change whereby it has been growing less and less habitable for the last two or three thousand years. Such a change, embracing Persia, Baluchistan, Afghanistan, Russian Turkestan, and Chinese Turkestan, and probably an even larger area, and converting thousands of square miles of habitable country into desert, can hardly fail to have had some effect upon human distribution and history. In Chinese Turkestan part, at least, of the ancient towns described above appear to have been abandoned deliberately, presumably because the water-supply became limited. Movements of the same sort are to-day taking place on a small scale all over the arid parts of Asia; as, for example, in the cases already cited of the inhabitants of Dumuka and other villages who moved in a body to a new location, or of the Dungans and people from Turfan, who wandered here and there along the lower Tarim. In 1904, 500 Kossack nomads, with their flocks and herds, came to Lob Nor, and would have settled among the reeds of the lower Cherchen river if Chinese soldiers had not driven them out with bloodshed. The nomads had come from the Altai mountains, where pasture had become too scanty either because of increasing drought or increasing population, or more probably both. Such movements only need to be magnified to cause invasions like those of the Dark Ages. That they were magnified in Turkestan when the Buddhist towns were abandoned appears highly probable. The abandonment took place in the early centuries of the Christian era, and for most of the time from that day to this the whole country from Keriya eastward for 600 miles, almost to China Proper, remained practically uninhabited, even more so than to-day. Not only the inhabitants of the towns disappeared, but also the shepherd tribes among the mountains, who, judging from names, traditions, and ancient roads and dwellings, were formerly numerous, and who would feel the pinch of aridity more quickly and keenly than the townspeople. Part of the population may have been killed in war, or have died in the epidemics which rage when a country is over-populated, but the rest must have migrated. If, though only in bands of a few thousands, they invaded regions already well populated, where the means of livelihood were growing less because of desiccation, distress and wars would ensue, and the only relief would lie in further and greater migrations. And thus, all Central Asia being under the same ever-increasing stress, a succession of dry years, or a change such as has taken place in Chinese Turkestan since 1900 from an increasing to a decreasing quantity of water in the rivers, might cause migrations equal to the greatest recorded in history.

Finally he was escorted home by all the elder men present. The great mass of villagers solemnly watched this performance.

To the west of this high plateau there are several small ranges of hills, which separate it from the Gongola valley. On entering these hills, I came to the picturesque heathen village of Doho. With its well-kept high walls, intersected by a number of tower-like structures, over which one catches a glimpse of the huts on the other side, the place looks like some mediæval town with wall and battlement. All is built of a light yellow clay, showing off prettily against the dark background of the wooded hills and the light blue contours of the mountain range to the south. The compounds inside the walls, remarkably clean and well kept, consist of a number of huts and high conical-shaped granaries, all connected by a wall enclosing a courtyard, in which the women of the house grind the corn. One of these granaries I measured 20 feet high. When the owner wants some of his grain, he sends up a boy, who climbs to the top with a wooden ladder, and, having removed the little grass cap from the aperture, lets himself down by a rope, and so brings out the required bundle of guinea-corn. A great deal of iron is found near Doho, and smelted by the natives in the place. I saw here, for the first time, some Tangali pagans, who, owing to a bad harvest, had been driven down from their mountains, which were showing in a faint outline on the southern horizon. What Vogel (*Zeitschrift für Erdkunde*, vol. 6, Heft 5) wrote from Bauchi is the most authentic information we possess of this wild tribe: "While at Bauchi I made the acquaintance of cannibals, with whom even the Mohammedan natives had scarcely any intercourse. They are all called by the country people Nyamnyams, a collective name, similar to our term of man-eater, as Nyam means in their language 'man.' The wisest and most important tribe amongst them are the Tangali, who inhabit the mountain range to the south, known by the wonderful peak towering high over the plain. These people have up to now kept themselves independent, and are only frightened from time to time by raids of the Gombe chief, who lives five days away from them. They rarely descend to the plain to buy iron implements for their farms, and it gave me some trouble to enter into communications with them, for at first they ran away at the sight of me, like the heathen on the Mandara hills. Some beads and other small presents at last quieted them, and I found the people good-natured, talkative, and extremely grateful for my presents. It is untrue that they eat their sick. By chance I saw two people sick in their village, and found that they were being nursed tenderly. When they died, their relations broke out in the usual wailing, which lasted all night. But they eat all their enemies fallen in fight. The breast was given to the chief, and the head, as the worst part, to the women, while the soft parts were dried in the sun and ground into powder, to be mixed with the cooked food." So far Vogel.

Richard Lander was informed that the mountains south of Kano, towards the sea, were all inhabited by the wild Nyamnyams, and again we meet that name in the descriptions of Schweinfurth's travels through the heart of Africa. The occurrence of this name of a like meaning in the different parts of Africa points to a language common to some primitive race, which must have been that of the original inhabitants of the country, or that in these hill pagans we have fairly sure descendants of the old Africans. The Tangalis that I saw were very black and ungainly built, with coarse negro features. They had no tribal marks, and wore absolutely no clothes.

Doho was the last heathen village that I saw before crossing the Gongola into Bornu. To the north of Doho the country is inhabited by the Gombe Fulanis. Passing through Dukul, Tongo, and over the ruins of Burmi, I came to Ashaka, and, bidding farewell to that country where such an interesting chapter of African history has been written, crossed over the Gongala river into the land of the merry Kanuri.

TWENTY-FIVE YEARS' GEOGRAPHICAL PROGRESS.*

By the Right Hon. Sir GEORGE TAUBMAN GOLDIE, K.C.M.G., President R.G.S.

It is just a quarter of a century since the British Association held its last meeting in this ancient city of York, and celebrated the jubilee of its foundation, so that from the moment of accepting the invitation to preside over this Section it was clear to my mind that the most appropriate subject for my address would be the progress of geography between that jubilee and what I believe would be called in other spheres our Diamond Jubilee. For although the immediate concern of geographers is with the Earth's surface, yet we cannot avoid sharing with the rest of our race the religious observance of astronomical periods and the tendency to regard certain numbers of such periods as having a peculiar value. Geographers, indeed, might be excused some tendency to this human weakness, as they are entirely dependent on astronomical methods and on an elaborate use of numbers for the primary necessity of ascertaining where they are on that surface which it is their business to examine and describe.

I do not propose in this address to deal only, or even chiefly, with the progress of exploration since our jubilee meeting in York, for although that progress has been remarkable, its effects are probably less far-reaching than the growth during the same period of the scientific treatment of geography; while both of these advances, taken together, are, to my mind, of less importance to our country—and we are, after all, a "British" Association—than the spread of the geographical spirit amongst our people, on the main cause of which I shall say a few words. Let me deal, then, with these matters in turn, bearing in mind, however, that the two latter subjects—the growth of scientific method and what I may term the democratization of geography —are so interwoven as to make it impossible to separate them altogether.

First, then, as to the advance of exploration since 1881. In that section of the

* Address to the Geological Section at the York meeting of the British Association for the Advancement of Science, by the Right Hon. Sir George Taubman Goldie, K.C.M.G., LL.D., F.R.S., President of the Section.

Arctic Regions in which the Nares and the Greely expeditions had done their work considerable progress has been made, mainly by Lieut. Peary, who carried the investigation of the coast of Greenland further north and east than had been the case before, while his contributions to our knowledge of the inland ice are of much value. The explorations of Captain Sverdrup among the lands lying north of America, and the not less important expeditions of Nordenskjöld and Nansen across the centre of Greenland, have added much to our knowledge, not only of the physical geography, but also of the geology, biology, and ice conditions of a land which, though lying to a large extent outside the Arctic circle, is essentially Arctic in character. Another expedition, under Captain Amundsen, is now completing its work, which has extended over about three years, around the north magnetic pole. Both English and Swedish expeditions have greatly improved our knowledge of the islands of Spitsbergen, while Jackson, Nansen, and others have enabled us to lay down with something approaching to accuracy the archipelago of Franz Josef Land. But perhaps the largest addition to our information about the north polar region during these twenty-five years has been through the ever-memorable expedition of Dr. Nansen, during which he reached within four degrees of the pole, obtained soundings down to 2000 fathoms, and collected a vast amount of meteorological, physical, and biological information, which has enabled him to work out, to a large extent, the probable conditions which prevail around the pole itself.

Let us pass now to the other end of the Earth—to the great continent which, as now appears beyond doubt, surrounds the southern pole. Here also very considerable progress has been made during the last twenty-five years. For a long period after the time of Ross, over sixty years ago, only spasmodic efforts had been made to continue the work of south polar exploration. But in recent years numerous national expeditions—Belgian, German, Swedish, and British—have pursued this work, producing a mass of data in geology, physics, meteorology, and biology which should throw a flood of light both on the present conditions and on the history of this dead continent. Perhaps, as the successor in the presidential chair of the Royal Geographical Society to that great geographer, Sir Clements Markham, a Yorkshireman, I may be allowed to dwell especially on the splendid and varied work of the National Antarctic Expedition under Captain Scott, which not only carried our knowledge of the Antarctic continent about 5° further south than the limits of exploration previously reached, but also collected a vast amount of scientific information.

And now, leaving the polar regions, let me try to recall the position of exploration of the African continent in 1881. Stanley had only recently completed that history-making journey across Africa, by which he traced on the map the last great line in the framework of the continent, the river Congo; and so accurate were his observations that, notwithstanding the vast number of later explorers, the course of the river laid down by him has practically remained unaltered. But a glance at a map of Africa of 1881 reminds us that enormous blanks existed, almost from the tropic of Capricorn to the upper bend of the Niger, in the centre and west of the continent; that the region between the equator and the Gulf of Aden was almost unknown; that our knowledge of the great lake region of Central Africa, as also of the eastern and western tributaries of the upper Nile, was most imperfect. Little had been done for the Central Sudan states since the days of Barth, and only very vague notions existed as to the real character of the Sahara. Since 1881, through the efforts of Stanley himself and of a host of Belgian, French, and British explorers, the map of the whole Congo basin has been crowded with rivers, defined with a fair approach to accuracy, while the hypothetical lakes of the past have evaporated. In the southern quarter of the continent, all the region from the northern limit of Cape Colony up to the Congo watershed and Lake Tanganyika has been to a large extent mapped in a provisional way and all the main features laid down. The work of exploration in the eastern regions of Africa has been no less complete. Stanley, on his expedition for the relief of Emin Pasha, discovered the important range of Ruwenzori, and laid down with some precision the outlines of Lake Albert Edward; while British and German explorers have made very fully known those remote feeders of the Nile which supply the Victoria Nyanza, and have contributed largely to our knowledge of the great Rift valleys and the lakes which occupy them. Joseph Thomson, the original pioneer from the east coast through Masailand towards Uganda, has been followed by many others, so that the map of all this region is thickly studded with new features; while the Anglo-German Boundary Surveys have been able to lay down a trigonometrical basis for a complete and trustworthy map of the whole region. Somaliland, the outlying parts of Abyssinia, Lake Rudolf, the rivers that run into it, and the rivers that run from the south-east into the Sobat and the Nile—all these have been explored and laid down with wonderful fulness since the Association last met in York; while, after the breaking down of the barrier of Mahdism, the advance in our knowledge of the Egyptian Sudan became almost too rapid to record. Nor has the progress of exploration in Western Africa been less remarkable. Through the energy of the officials of the Chartered Royal Niger Company, of Sir Frederick Lugard and his staff, of Binger, Monteil, and a host of other French as well as German explorers, great blanks have been filled in, and mapping of the most detailed character in many districts has been rendered possible. Our knowledge of Lake Chad and of its present and its probable past has been greatly extended, and many problems have been suggested which will provide ample work for the geographer and the geologist. The Sahara has been crossed and recrossed in many directions during recent years, especially by French explorers, with the result that we have been compelled to revise the prevailing impression of the great desert, which is by no means the featureless waste which it used to be considered. Taking the continent of Africa as a whole, its map has been thickly covered with a network of features, and, so far as cartography is concerned, all that remains to be done is to fill in the meshes of that network with local details and to give precision to our maps by careful triangulation.

I have dealt at some length with exploratory work in Africa, because it is the continent of which we knew least in 1881, and our knowledge of which has made the greatest strides since then; but the contemporaneous advance of our acquaintance with the topographical and physical conditions of other portions of the lithosphere has been very remarkable. A host of explorers, of whom I will only mention Younghusband, Littledale, Bower, Sven Hedin, and Huntington, have crossed the centre of Asia in various directions. During the same period the topographical survey of India has been brought to completion, while Indian officers and others have carried geographical investigations far beyond the limits of our great dependency, and have made much progress in the mapping of Baluchistan and Persia. The recent Tibet expedition practically settled the question of the sources of the Brahmaputra, and laid down its central and upper course. I do not know whether we should regret that they were not able to fill in the long gap in the lower course of that river, for we shall still enjoy the pleasures of hope of solving this interesting problem, which, with some equally unsolved problems in other parts of the globe, reminds us that explorers need not yet sigh, like Alexander, for other worlds to conquer. Numerous travellers have crossed China in all directions, and have done much for its accurate mapping, as have also the French in their Indo-Chinese possessions. Even in Turkey in Asia, where serious difficulties are encountered by explorers, such men as Ramsay and Maunsell have done much valuable work.

Turning to America, the surveys of Canada and of the United States have made great advance in the accurate mapping of their respective countries, while much has also been done in Mexico and in Central America. The Argentine Republic and Chile have made great progress in the exploration and mapping of their territories, and Peru and Bolivia have within recent years shown creditable diligence in this respect; but there remain in the southern continent areas covering from two to three million square miles still practically unexplored, so that to-day, as far as preliminary exploration is concerned, there is more to be done in South America than in Africa.

I have, perhaps, sufficiently indicated the marvellous progress of exploration of the lithosphere. I have naturally less to say of the advance of oceanography, for the *Challenger* expedition had completed its voyages before the jubilee meeting of the Association in 1881, although the results were not then worked out. It is, indeed, only within the last few years that Sir John Murray has been able to complete this immense work, which occupies no less than fifty volumes. Since the voyages of the *Challenger* there has been no equally extensive expedition for oceanographic work, but the study of the oceans has been carried on steadily, if slowly. The German expedition in the *Valdivia* added much to what the *Challenger* had achieved, especially in the Indian ocean; where also, only within the last year, Mr. Stanley Gardiner has carried out an enterprise which promises to yield results of the first importance. Further east, in the seas around the Malay archipelago, the Dutch *Siboga* expedition added something to our knowledge of the ocean bed; and not less important than any of these later expeditions was the enterprise carried out over a series of years in the Pacific and in the Gulf of Mexico by Mr. Alexander Agassiz, entirely at his own expense. The cable-laying companies have also done a good deal on behalf of oceanography, and some of the results of their investigations have been published by the Royal Geographical Society, under the superintendence of Sir John Murray. The immensely valuable work constantly carried on by His Majesty's surveying vessels, under the direction of the Hydrographic department of the Admiralty, is so generally known as to make it unnecessary for me to dwell upon it.

Long before the close of the nineteenth century, however, oceanic navigation had ceased to be of a pioneer or exploratory character, except in the polar regions, and had devoted itself to the no less important tasks of filling in details and of undertaking scientific research, while the comparatively new subject of limnology, which deals with those other portions of the hydrosphere known as lakes or inland seas, and which has had such immense and valuable labour devoted to it in this country by Sir John Murray, falls strictly within the limits of scientific research. To this end all geographical travel and all geographical study must come; and I am thus led to the second branch of my address, dealing with the growth of the scientific side of our subject and the concurrent spread of interest in its study. On these points I propose to deal mainly with our own country; but I shall be compelled to draw certain comparisons, however unwillingly, with the more advanced conditions, in this respect, of other countries, and notably of Germany. No one, indeed, could assert that the importance of problems relating to the geomorphology of the lithosphere, to the distribution of land and water, and to the influence of these (combined with climatic conditions) upon the distribution of life and on human interests were not recognized amongst us long before the last meeting of the British Association at York. The underlying principles of scientific geography have been perceived in all ages and in all countries by a few thinkers; but so late as twenty-five years ago a true conception of the functions and scope of geography was confined to a very limited circle of specialists. In confirmation of this, I may remind you of an inquiry which the Royal Geographical Society undertook about that time into the position of geography at home and abroad.

For many years previously the Society had been endeavouring to awaken the public mind as to the high capabilities of geography when dealt with on scientific lines, and to encourage the teaching of the subject on a higher plane by the award of medals on the results of examinations. The failure of these attempts induced the Society to make the investigation to which I refer, and its report (published only a few years after the York meeting) may be regarded as the starting-point of the revolution that has since occurred. It was found that Germany even then had professors of geography in nearly all its universities, and a number of thoroughly trained and earnest students who devoted themselves to investigation of the subject in all directions; and that in Austria, as well as in Germany, geography had attained a position, both in universities and in schools of all grades, practically on a level with other subjects of education; while in this country it was generally regarded with apathy, and even contempt. It had no place in our universities; it was barely tolerated in our secondary and higher schools; while in the simple geography of our elementary schools there was great room for improvement. Practical work in geographical research scarcely existed, except in so far as it was an outcome of geology. There was no encouragement for students, there was no high-class geographical literature, such as existed in Germany, and for standard works we had to resort either to that country or France. The great treasure-house for geographers was Elisée Reclus's 'Géographie Universelle,' which, fortunately, was translated into English. There existed, indeed, a few popular works in this country, but these were more or less of a purely descriptive and unscientific character, excluding altogether the fundamental data of the subject. In the Society's report to which I have referred were also given very interesting quotations from the opinions of head masters of English public schools as to the value of geography and the educational position which it ought to have. It was melancholy reading. Only a few of them took a favourable view of the subject, while the majority treated it with little respect. The remarks of those who favoured its study are to-day chiefly interesting as showing the entire inadequacy of the methods of geographical tuition in those days, and the little importance attached to it in educational circles. I must, however, quote with approbation the words of one master, who said, "I feel strongly the great importance of the subject, not only as a mental discipline, an essential part of a liberal education, but as more especially necessary for Englishmen, many of whom will be called upon in after-life to turn their geographical knowledge to practical and serious account;" and he added, "One of the difficulties in doing justice to the claims of the subject is the somewhat absurd prejudice in teaching geography, as if it were less worthy of first-rate men than Latin prose, or essay writing, or criticism." On the other hand, most of the head masters throw cold water on any attempt to give geography a substantial place in our great public schools. They considered it not sufficiently important as an educational instrument; it was hardly a discipline; it was little more than an effort of memory; it was quite worthless educationally till it became a branch of history; problems in it could not be set. These masters were supported by the opinion of a distinguished geologist that geography was not suitable as a university subject because it was a "graphy," and not a "logy." Nor, indeed, can it be contended that these depreciatory views of geography, as it was then generally taught, were unreasonable. The text-books of that time were, as a whole, worthy of the position which the subject held in the education of the country, and on a par with its reputation among the educated public. The use of maps in the daily newspapers was almost unknown; while as regards military geography, the late Lord Napier of Magdala, at the opening of the

Education Exhibition of the Society, forcibly contrasted the position at home with the importance attached to the subject in the German army, where at the manœuvres every third soldier has a map of the ground, and where in the Franco-German war maps formed part of the equipment of every company. If the position of geography in this country was so unsatisfactory a quarter of a century ago, it was not because its raw material was wanting in our language. On the contrary, few countries then possessed a literature of travel and exploration so wide and of so high a class as ours. The source of our weakness was the paucity of men qualified to apply scientific method to this raw material, and there was no institution where it was possible to obtain a thorough training in geography, such as could be obtained at a score of universities in Germany, Austria, and France. This was the position which had to be faced before placing the subject on a more satisfactory footing.

It is unnecessary for me to describe in detail the methods adopted by the Royal Geographical Society—so far as its resources and influence permitted—in carrying out the work of reformation. I need only bring before you the general results. No one will now doubt that the active minds in this great movement were right in believing that the surest means of influencing our schools of all grades, and also of obtaining in the country generally a recognition of the subject as a department of science, as a field for research, and as a subject of practical importance in various spheres of national activity, was to obtain, in the first place, proper recognition at our great universities. Attempts had, indeed, been made in the same direction as far back as 1871 and 1874, but without effect. I need hardly remind you that the later efforts of the Society had a very different result. For many years now there has been a school of geography at Oxford, while a readership established at Cambridge several years ago has also developed into a fairly well-equipped school. At Oxford there is a reader with a staff of three lecturers, and a diploma in geography is granted which practically amounts to honours in the subject. The field covered may be seen from the subjects of examination for this diploma. They are: (1) Regional Geography; (2) Climatology and Oceanography; (3) Geomorphology; (4) Ancient Historical Geography; (5) Modern Historical Geography; (6) History of Geography; and (7) Surveying. It may give a more complete idea of what English students regard as included in their subject if I mention the principal topics in the examination on regional geography—the cartographical analysis of the physical regions of the world—an elementary knowledge of the chief generalizations regarding the surface forms of the land; the movements of air and water, and the distribution of plant associations, animals, and man; the chief facts of modern political and economic geography, considered in relation to the influence of physical features. Candidates are also required to be familiar with the principles of map-making by plane-table, prismatic compass, and clinometer, with the representation of relief, and with the orientation, reading, and measurement of maps. Equally thorough and exhaustive are the various topics included under the other heads of examination. Both in ancient and modern historical geography the subject has to be considered in relation to the influence of physical features. The standard adopted at Oxford is as high as that which exists at any university in Germany. The establishment of a school at Cambridge being recent, one cannot yet speak as positively of its success as in the case of Oxford. But Cambridge has gone a step further than Oxford in placing geography as a subject in the examination for its B.A. degree; and while that may be regarded as a simple pass, the student may also enter for the examination for the diploma in geography, the standard of which is no less high than that at Oxford, while the ground covered is essentially the same. In both universities the training in cartography and surveying is thorough, and it is to be hoped that such students as propose to follow either a military or a colonial career will take advantage of the opportunity thus presented. The example of Oxford and Cambridge has been followed elsewhere, though to a lesser extent. In the University of London there is a board of geographical studies, and the subject holds a substantial place in the University examination, and is a compulsory subject for a degree in economics. There are chairs or lectureships of geography at Victoria University, Manchester, at the University of Liverpool, and at the University of Birmingham. Steps are being taken to establish a chair at the University of Edinburgh; while other institutions of a similar kind would be glad to follow the example of the great universities if only their funds permitted. In the elementary schools the programme is nearly all that can be desired, the one thing needed here, as elsewhere, being a sufficiency of teachers who have been thoroughly trained in the subject. In the secondary schools progress has been somewhat more slow; but there has been a steady advance in recent years, and a step recently taken by the Board of Education, in issuing a very satisfactory syllabus for the teaching of geography, is certain to give a strong impetus to the subject. In the London School of Economics, under the directorship of Mr. Mackinder, which is attended annually by over a thousand students, geographical teaching holds a place of the first rank. The publishers have kept pace with this great revolution in the schools, so that to-day there is no difficulty whatever for any one, from the elementary school up to the university, in obtaining a text-book, or an atlas, or special maps suitable for his requirements. The country has been, indeed, almost flooded with cheap atlases issued in parts, some of them of a highly creditable quality, while the slides of photographs taken by explorers are sold by the thousand for educational and lecture purposes.

The main cause of this remarkable growth of interest in geography amongst our educated classes dates back to about three years after the last meeting of the Association at York. In 1884, Germany, which in the middle of the century had been still said to rule the air (while France ruled the land, and Britain the sea), and which in later years had been absorbed in the process of unification by blood and iron, suddenly launched out as a world power, and gave the signal for the partition of Africa. England and France, in both of which countries a few men had been carefully preparing, during several years, for this inevitable partition, hastened to join in the international race, and the spirit of colonial expansion, long dormant, reawakened, and reached out to all parts of the Earth where settled government did not forbid advance. We, who have lived through the last quarter of a century, are apt to underestimate the revolution through which we have passed, for a true analogy to which we must go back to the Elizabethan age. The impulse given by this movement to the study of geography can hardly be overestimated. War has been called the best teacher of geography, and certainly Napoleon, the highest exponent of the art of war, was as ardent a student of geography as he was of mathematics; but now it appears that empire-building is an even greater factor than war in advancing and popularizing geographical knowledge. Amongst the educated classes of England, France, and Germany, and, in a lesser degree, of Italy and Belgium, there are few persons who have not had relatives or friends engaged as explorers, or missionaries, or officials, or soldiers, or traders in previously little-known parts of the world, while countless numbers have been concerned in the new movement through vast shipping and other interests that shared in it. The Press, which prior to 1884 had paid little attention to the outlying lands in question, gradually devoted more and more space to everything connected with them, and continually produced most useful maps, showing not only their physical features, but also their economical conditions. It is not my business here to attempt to forecast the judgment of the future historian on the more general results of this colonial expansion, but he will assuredly recognize its enormous effect on popular attention to geographical subjects, as well as, or even more than, on exploration.

It must not be inferred that the popularity of a subject is taken by me as a test of its place in the ranks of science; but, owing to the widening of the area from which students can be drawn and men of genius evolved, this democratization of geographical ideas is, to my mind, a very hopeful feature as regards the future of the scientific treatment of the subject.

I should have to extend my address to undue length if I attempted to demonstrate the recent growth of the scientific method at home by giving you even an imperfect catalogue of the geographical books and papers of a scientific nature published during the period under consideration, and especially in later years. I can only select for mention a few typical books, such as Dr. Mill's 'International Geography,' Mr. Mackinder's 'Britain and the British Seas,' Mr. Hogarth's 'Nearer East,' and Sir Thomas Holdich's work on 'India,' and other works in Mr. Mackinder's series entitled 'The Regions of the World.' As to papers dealing with this kind of work, I will mention those by Messrs. Buckman and Strahan, giving the results of their investigations on the river systems of the west of England; by Mr. Cooper Read on the river system of East Yorkshire; by Dr. Herbertson on the major natural regions of the world, and on the distribution of rainfall over the Earth's surface; by Mr. Chisholm on the distribution of towns and villages, and on the geographical conditions affecting British trade; by Messrs. Smith, Lewis, and Moss on the geographical distribution of vegetation in England and Scotland; by Mr. Marr on the waterways of English Lakeland; and last, but not least, by Dr. Mill on the Clyde Sea Area, on a fragment of the geography of England and Wales viewed geographically. It must, indeed, be confessed that in this respect we are still behind Germany, which has been pouring forth a mass of geographical literature of the highest scientific value. But this backwardness is the result of past neglect of the subject, and not of present apathy. There was a current saying a quarter of a century ago that the schoolmaster was abroad. I have shown you that, in a different sense, the geographer was then abroad; but I believe that we may now say that the geographer is at home and has come to stay. There is a whole school of young geographers—not yet very large, but zealous and active—full of the new ideas, the new methods, the new hopes of our rising science, and I do not think it too sanguine to expect that when the British Association holds its centenary meeting, twenty-five years hence, perhaps in this very city of York, our countrymen will be found to occupy the same position in the front rank of scientific geography that their forefathers held in pioneer exploration.

THE RECENT CALIFORNIAN EARTHQUAKE.

The Commission of Inquiry into the earthquake phenomena in all parts of the state of California, which was appointed immediately after the earthquake of April 18 last, has issued a preliminary report, the most interesting part of which is a description of the proximate cause of the earthquake. The coast ranges of California are crossed obliquely by a peculiar set of surface features, not due to atmospheric or stream erosion, but to a dislocation, or rather a series of dislocations, of the Earth's crust, with a differential movement on either side of the plane of rupture. In general this line follows a system of long narrow valleys, or, where it passes through wide valleys, it lies close to the base of the confining hills; but in some cases it passes over mountain ridges or crosses a spur or shoulder of a mountain. Along this line are abrupt changes in the normal slope of the ground, giving rise to scarps, to small basins or pools, and occasionally to trough-like depressions bounded on either side by scarps. In many cases these features have been so modified and softened down by weathering that only the expert eye can detect their abnormal character, but where the line traverses the more desert part of the coast range, as, for example, in the Carissa plains, they are known to the people of the country, and the aggregate of the features is commonly referred to as the "earthquake crack." This line has been traced from Point Arena to the vicinity of Mount Pinos, in Ventura county, and is either continued even further to the south-east, or a similar set of features comes in, in echelon, and can be traced to San Jacinto, on the south-east border of the Colorado desert. Leaving the southern extension out of the question, this very remarkable physiographic line has a length of 375 miles from Point Arena to Mount Pinos, and crosses obliquely the entire breadth of the coast ranges. Throughout its length it affords every evidence of recurrent differential movements extending far back into the Quaternary period.

The earthquake of April 18 was due to one of these movements, but the extent of the rift along which it took place is not yet fully known. Direct field observations have shown that it extends certainly from the vicinity of San Juan, in San Benito county, to Point Arena, a distance of 185 miles; but the destruction at Petrolia and Ferndale, in Humboldt county, indicates a northerly extension of the rift at least as far as Cape Mendocino, thus making the total length at least 300 miles. Along the 185 miles of this rift, where movement has actually been observed, the displacement has been chiefly horizontal, on a nearly vertical plane, and the county to the south-west of the rift has moved north-westerly, relative to the county on the north-east of the rift. The evidence of rupture and differential movement along the line of rift is clear and unequivocal; the surface soil presents a continuous furrow, generally several feet wide, with transverse cracks, showing very plainly the effect of torsion within the zone of the movement; and all roads, fences, pipe, and other lines which cross the rift have been dislocated. The amount of dislocation varies; in several instances it did not exceed 6 feet, a more common measurement is 8 to 10 feet, while in one case a roadway was found to have been moved no less than 20 feet. Probably the mean value is about 10 feet, and variations from this are due to local causes, such as drag of the mantle of soil upon the rock, or excessive movement of soft incoherent deposits. Besides this general horizontal movement, there is observable in Sonoma and Mendocino counties a differential vertical movement, not exceeding 4 feet, so far as is known, whereby the south-west side of the rift was raised relatively to the north-east side so as to present a low scarp facing the north-east. This vertical movement diminishes to the south-east along the rift-line, and is scarcely, if at all, recognizable in San Mateo county; still further south there are suggestions that this movement may have been in the reverse direction, but this needs further study. As a consequence of this movement, the latitudes and longitudes of the trigonometrical stations occupied by the Coast and Geodetic Survey must have altered to a measurable amount, and the commission expresses a hope that these stations may be re-occupied. From another source we learn that it has been decided to do so, and the re-triangulation is to be carried far enough eastward to connect the redetermined points with stations that may safely be regarded as quite beyond the effect of the recent movement.

The remainder of the preliminary report is devoted to an account of the organization of the investigation and a brief account of the principal facts known; of no great importance in itself, enough is said to show that the earthquake of April 18 is one of those which are likely to add materially to our knowledge of the principles of seismology, and it is gratifying that its investigation should have fallen into such capable hands, and be uncrippled by any lack of funds or workers.

R. D. O.

THE VALPARAISO EARTHQUAKE.

The earthquake which laid Valparaiso in ruins at about quarter-past seven on the evening of August 16, or shortly after midnight by Greenwich time, affected a region which has been made classic by Charles Darwin's researches into the changes of level produced by the earthquake of November 19, 1822. It is the third great earthquake which has occurred on the west coast of America during the present year, the other two being the Colombian, of January 31, and the Californian, of April 18. Like this last, it found a large city within the area of destructive violence, and, like it, the horrors of the earthquake were followed by fire. So far as can be gathered from the telegraphic reports, the shock was an even greater one than that which destroyed San Francisco; though it is difficult to disentangle the truth from the exaggerated accounts which have been telegraphed to the daily newspapers, it seems certain that the shock was of destructive violence, accompanied by widespread ruin and loss of life from Ilapel on the north to Talca on the south, a distance of over 250 miles, and was felt over a much larger area, whose limits it is not possible to define. It is to be feared that this earthquake will not receive the same thorough investigation which is being accorded to the Californian one, and this is to be regretted, as it seems to present problems of great interest. One of these is the explanation of the absence, so far as reports go, of any sea-wave on the American coast, though sea-waves were recorded on the tide-gauge at Honolulu, and observed on the coasts of the Sandwich islands. At Honolulu the oscillation is reported to have been only 3 or 4 inches, but at Mani and Hilo the waves were 5 feet high, and in the enclosed Bay of Maalea reached 12 feet. The time at which these waves were recorded shows that they were originated by the earthquake; they were, however, small in comparison with the sea-waves of the Peruvian earthquake of May 9, 1877, which had a height of 58 inches at Honolulu and 36 feet at Hilo. These sea-waves point to a submarine origin of the earthquake, while the distribution of the damage done shows that the line of fissure, along which the earthquake must have originated, passed inland somewhat to the north of Valparaiso, running in an approximately north-to-south line, with a slight easterly trend. We are still uncertain whether the disturbance of the sea-bottom, which gave rise to the sea-waves, was accompanied by any permanent change in the relative level of land and sea. Some of the earlier accounts made specific mention of alteration in the shore-line after the earthquake, but, according to a later account, soundings taken at sixty-four places in the Bay of Valparaiso showed that there had been no important change in the bottom of the bay. This does not, however, prove that no change has taken place, for it would not require an important change in the depth of water to account for the earthquake and its sea-wave, nor is it impossible that there may have been important changes further north, though not at Valparaiso.

Two statements regarding this earthquake, which were given prominence in the daily papers and have received the sanction of a scientific weekly, may be rejected as mythical. The first of these is that the destructiveness of the earthquake at Valparaiso was intensified by that city being built on granite, and the second is the reported destruction of the island of Juan Fernandez. It is a well-established principle that earthquake shocks are more destructive on soft ground than on hard, and the details of the destruction at Valparaiso show that here, as at San Francisco, the damage was greatest in the business quarters, situated on low-lying made ground, while the fact that the residential quarters on the surrounding hills suffered severely shows that Valparaiso lay nearer the focus of its earthquake than did San Francisco. The reported destruction of the island of Juan Fernandez called forth many articles of a sentimental nature, but the earthquake certainly did not destroy an island lying at a distance of 400 miles, larger than Jersey, and rising 3000 feet above the sea. Possibly the low-lying part of the settlement, not the island itself, was wiped out by the same sea-wave which visited the coasts of the Sandwich islands.

R. D. O.

REVIEWS.

AFRICA.

The Nile.

Survey Department, Egypt. 'The Physiography of the Nile and its Basin.' By Captain H. G. Lyons, F.R.S. Cairo, 1906. Pp. viii. + 412. *Maps and Diagrams.*

Year after year light is being poured into the dark parts of the Sudan, and piece by piece the mysteries of the ancient river, the Nile, are being unfolded to an inquisitive generation. Junker, Schweinfurth, Marchand, Emin, Donaldson-Smith, and others have all taken their share in the work, and although there is still abundant field for the explorer and the sportsman up the courses of unknown Nile tributaries and along undiscovered watersheds, it may be said that the geography of the Nile basin, so far as the main features are concerned, is pretty well known.

In 1904 appeared the exhaustive report of Sir W. Garstin, closely followed by that of Sir W. Willcocks. Now we have the very interesting volume of Captain H. G. Lyons. Garstin and Willcocks wrote first as engineers concerned in the water-supply of Egypt. Captain Lyons writes as an engineer, a geographer, a meteorologist, and a geologist. His volume now before us consists of 387 pages of very solid matter, bristling with figures, and containing forty-eight plates and diagrams. There is not a page of padding or spinning out in the book. In fact, it is to be regretted that Captain Lyons did not develop some of his arguments more fully. They are so condensed as sometimes to be not very easily followed. It is, therefore, difficult to review such a book within reasonable length for an article for this journal.

There is little to be gained from disputing what is the source of the Nile. Garstin pronounces emphatically that the great reservoir of the Victoria Nyanza, covering an area of 24,000 square miles, is the true source of the river. But if it be measured by the volume which it contributes to the common stream north of the junction of the Victoria with the Albert Niles, then the latter river must be taken as the true Nile, having its source about lat. 1° 30′ S., where "the Great Rift" is finally blocked by the mountain masses of volcanoes rising to a level of above 12,000 feet, which form the watershed of the basins of the Nile and the Congo. Moore points out that this great obstruction across the long valley of the Albert Edward and Albert lakes is the result of a "comparatively recent volcanic outburst," before the occurrence of which the waters of Lake Kivu, which now discharge into Lake Tanganyika, probably flowed north into the Nile. It seems possible, then, that at one time the long course of the Nile was still longer, and its source was to be found south of Tanganyika.

The volume of water coming from the Victoria lake and flowing past Fowera to join the Albert branch is nearly constant, and amounts to about 20,000 cubic feet per second. The volume contributed by the Albert branch, on the other hand, is a very variable amount, ranging from a minimum of 17,000 to a maximum of 35,000 cubic feet per second. The reason assigned for this difference is the evaporation and the moderating influence of the vast water-surface in the Victoria lake and of the marshes of Lake Choga to the north. The rainfall, too, in the Great Rift, especially at the southern end under the Ruwenzori mountains, probably much exceeds that of the basin of the Victoria lake. Observations are naturally very scanty, however, and we cannot quite be satisfied with the explanations given by Captain Lyons for this remarkable difference. We may be sure that the last word has not yet been said as to the variations in the discharge of the Nile and its many branches.

The water-surface of the Victoria lake stands at a level of about 3700 feet, and that of the Albert at about 2300 feet, above the sea. Down this slope of 1400 feet the Nile has to flow in a course of 250 miles. The Ripon falls are 16 feet high. Below this for 40 miles the river flows on a steep slope; then for 150 miles sluggishly through marsh and shallow lake. Willcocks estimates that the loss by evaporation in these great sheets of water must be as great as the gain by rainfall. On emerging from these swamps the river flows with a gentle velocity and a navigable stream for about 80 miles, when it again enters on a long series of cataracts and rapids, ending in a narrow cleft in the rock wall not 20 feet wide. Through this cleft the whole river rushes and thunders over the Murchison falls, a drop of 140 feet. A short distance below this the Victoria and Albert branches of the river unite.

Captain Lyons thus briefly sketches the geology of the southern part of the Nile: "A plateau lying some 1500 metres above sea-level, and composed of gneiss, quartzite, and schists. The central portion is occupied by Lake Victoria, while the deep fault valley in which Lakes Albert Edward and Albert lie forms the western portion. Much movement has taken place comparatively recently, and blocks of the plateau have been raised, lowered, or tilted, so that the drainage follows the depressions so formed. As yet the rivers have not had time to deposit or erode sufficiently to give a regular grade to their beds, so that marshes and water-logged depressions still alternate with reaches in which the fall is considerable, and the flow therefore rapid."

About 10 miles from the north end of the Albert lake the river flows in one channel about half a mile wide, between high and well-defined banks, and although there is no rock anywhere near the surface, Sir W. Garstin considers this the spot where a regulating weir ought to be thrown across the river, should it be determined to control the waters of the Albert lake, a measure which will certainly be undertaken some day. For about 140 miles from the end of the Albert lake the flow of the river is gentle, and navigation not difficult, though obstructed by papyrus marshes, and then begins a wild descent of 100 miles, in which the river falls 730 feet. In some of these cataracts the river is not 40 feet wide, and must be of great depth. The last of them is known as the Fola rapid. From this point, for a distance of 1150 miles the navigation would be uninterrupted, save for the very formidable obstructions known as *sadds*, to be alluded to later on, masses of vegetation that rapidly block the whole course of the river. The river, which is here known as the Bahr el Gebel, has now deserted the plateau of the lakes, formed of gneiss and other rocks, and henceforth to the Mediterranean, a distance of nearly 3000 miles, it flows through an alluvial plain, unbroken save by the dykes of rock which create the six cataracts north of Khartum. Hitherto it has passed through mountain country. Now it is in the plains. Away 50 miles to the east is visible the great hill mass of Agoro, rising to a height of nearly 10,000 feet above the sea. On the west the hills rise steeply to a height of about 4000 feet, attaining to what is believed to be a high plateau, but it is largely unexplored.

In this part of the Sudan the temperature does not vary 5° between the hottest and the coldest month, the average of the year being about 79° Fahr. The rainfall is about 40 inches, of which 33 fall in the months from May to October.

Captain Lyons remarks that "it has been known for years past that the rainfall on the more elevated parts of its basin supplies the Nile, but the statement that melting snows also play a considerable part still lingers, although, except for a few streams fed by the melting glaciers of the Ruwenzori, no snow-water reaches the Nile." We could have wished that Captain Lyons had told us where the melted glacier-water of the Ruwenzori all goes to, if a considerable proportion does not find its way into the Nile. Surely we have not sufficient data to go on to pronounce very positively on this question.

Captain Lyons objects to Willcocks' description of the Bahr Gebel, south of Lake No, as being deltaic, "since a delta is formed when a stream delivers its load of detritus into a body of still water, such as a sea or lake." But we think the term *deltaic* is capable of a wider signification. The course of a large river may generally be divided into three sections. At first it rises among mountains, or flows down very steep slopes, scouring its banks and bed, and carrying with it a quantity of detritus. During the next section the river flows through the foot-hills. The s'ope of the country and the consequent current is diminished, but is still sufficient not to continue scouring, but to float on the detritus brought from above. In the third section there is not force enough to carry on the detritus, which therefore deposits in the bed, and in the lake or sea into which the river discharges, and this we consider the deltaic stage. There is certainly no lake in this part of the Nile valley, but Captain Lyons calculates the slope of the Bahr Gebel as 1 in 24,000, a condition not very far removed from a lake. The explanation he gives, in page 144, of this part of the Nile's course is not very clear or convincing.

From Gondokoro to Lake No is a distance of about 414 miles, and for the northern 250 miles of this distance the river is liable to be blocked by *sadds*. These consist of tangled masses of three aquatic plants, the *papyrus*, the *Phragmites communis*, and the *Vossia procera* reed. On either side of this portion is a series of vast shallow swamps. These plants are bedded in the soil below the water. Their hold on the wet earth is lessened by the force of the wind, and if the water-surface rises the roots become detached from the soil, with earth adhering to them, and retaining them in a vertical position; the wind and current carry them into the sluggish stream of the river; a *snag* projecting in the stream checks their course; another floating island catches on to the first, and, as Sir W. Garstin says, "a strong gale may set hundreds of acres of these floating masses moving in one direction. When the surface of the water is blocked, the succeeding masses get sucked down, until at last the whole becomes wedged into one solid block, . . . not infrequently attaining a thickness of 5 metres." This blocking of the waterway naturally raises the up-stream surface, flooding the marshes right and left till the river manages to find a side channel, or until the obstruction in the main channel at last bursts, and the river clears itself. There is record of a *sadd* of this description forming afresh seventy days after being cleared.

Notwithstanding that there is an annual rainfall of at least 39 inches over the catchment basin of the Bahr el Gebel, and that it receives from the lake plateau from 17,000 to 35,000 cubic feet per second, and although this vast swamp is the natural outfall of the Bahr el Ghazal and of many tributaries as far as the distant plains of Darfur—in spite of all this, and incredible as it appears, the volume of the river up-stream of the junction of the Sobat does not exceed a constant supply of 16,600 cubic feet per second. Willcocks is positive "that the *sadd* region is unmistakably . . . an old lake which has silted up and become full of peat and sand deposits." Garstin is inclined to the same belief, but Captain Lyons pronounces this merely an hypothesis, and gives geological reasons for opposing it which seem sound.

For about 500 miles above Khartum, where it is joined by the Sobat, the Nile has no very considerable tributary. The Sobat is a very important factor in the hydrography of the Nile basin. For the first 125 miles its course is through the

Abyssinian mountains, whence it carries forward great deposits of silt to be dropped whenever it reaches a more moderate slope. For the remaining 340 miles of its course it meanders through almost level plains. The Sobat attains its maximum (at least 25,000 cubic feet per second) in September and October, but there is no room in the valley of the Nile at this season to allow the Sobat water to proceed northward in its course. A much greater river—the Blue Nile—is then in force, and this holds up the White Nile, the Sobat, the Bahr el Gebel, and all its tributaries.

From the junction of the Sobat to Khartum the slope of the White Nile is rarely more than 1 in 100,000. This extremely low slope renders the channel a vast reservoir, with (according to Captain Lyons) a storage capacity of about 53,000 million cubic feet.

So far, we have been considering the branch of the Nile that descends from the Lake plateau, and more or less serves to drain the great swamps that lie about 550 miles south of Khartum, while it receives the waters of the Bahr el Ghazal from the west. The basin of the White Nile and its tributaries vastly exceeds that of the Blue Nile and Atbara, but it is these last that create the wealth of Egypt.

The rainfall over this part of North-East Africa decreases from south to north, and so it happens that, while the Sobat is still in high flood up to December, the Blue Nile, which rises 6° further north, falls rapidly throughout October, and has a very modest discharge in January, by which date the Atbara has ceased to flow altogether and is merely a series of pools. Yet at its maximum in September the Blue Nile is discharging about 400,000 cubic feet and the Atbara 70,000 cubic feet per second. It is the water ponded up in the White Nile that keeps up the supply in Egypt until the end of December. For six months after that Egypt depends on the supply coming down from the lake plateau. The Blue Nile and the Atbara take their rise among the lofty mountains and elevated plateaus of Abyssinia, rising to a height of from 15,000 to 6000 feet. It is this high mountain region crossing the path of the monsoon current which causes the heavy rainfall which supplies the Sobat, the Blue Nile, and the Atbara. The slope to the west is gentle, and so most of the rivers flow in this direction in channels deeply eroded and devious in their courses. Of these the largest and most important is the Blue Nile, known in the upper part of its course as the Abai.

The geological formation here, as in general over the Eastern Sudan, consists of granite and gneiss, varied by tracts of lava and basalt. Embedded among these mountains, at an elevation of about 5800 feet above the sea, lies the beautiful Lake Tsana, covering an area of about 1200 square miles, from the south end of which flows the Abai or Blue Nile, the discharge of which Mr. Dupuis found to be, on January 31, 1903, about 1500 cubic feet per second. A marked feature of the Blue Nile and the other rivers of Abyssinia is the deeply eroded channel through which, by the most devious courses, they come out at last on to the plains of the Sudan. The gorge of the Titta, for instance, is 3400 feet high.

For some 500 miles of its course from Lake Tsana the Blue Nile flows through hilly country. From Roseires onward to Khartum, a distance of nearly 400 miles, it flows through wide-stretching plains covered with low scrub jungle until the approach to Wad Medani, the most important town on the Blue Nile, with a population of some 20,000, the capital of the Sennár province. Here we get into abundant *dhurra* or millet cultivation. When the population has been replaced which was exterminated in the Mahdi war, and when a reasonable sum has been spent on irrigation works, the country between the two branches of the Nile should be one rich field of fertility, not inferior to the Nile valley of Egypt. From Khartum northwards the Nile valley is now so well known that it may be only briefly noticed here.

One fact is dwelt on by Captain Lyons. In the great tourist season of Cairo, the opinion is often expressed that the climate is changing, and whereas rain was formerly unknown in Egypt, it is now a yearly occurrence; and this is put down by some to the Suez canal, by some to the extension of irrigation since the English occupation. Reference to the Memoirs of the learned staff brought to Egypt by Napoleon at the end of the eighteenth century, shows that as the climate was then so it is now. "But at least," says the tourist, "no rain falls in Upper Egypt." And when he looks out from the hotel verandah at Aswan and sees the clouds pouring forth their supply, he is convinced that this must be a very exceptional year. Captain Lyons, talking of the Nile valley from Aswan to Cairo, remarks, "A few rainstorms occur every winter, but they are usually very local in their effect. On the eastern side the much larger area and the steeper slopes, together with the greater frequency of rain near the Red sea hills, make the winter rainfall a more important factor. In about every second year one or other of the larger *wadis* comes down in flood, sometimes so suddenly as to carry away camels and sheep which may be grazing in the valleys, and pours a large volume of water into the Nile. . . . These *seils* [or rain floods] are less rare than is usually supposed, and the dry arid appearance of the desert, together with the rareness of rain, cause the effect of such storms as do occur to be underestimated."

Captain Lyons may be congratulated on having brought out a very important addition to Nile literature. In a country until lately so very little known as the Sudan, it is quite wonderful how many valuable observations and statistics he has managed to collect together. This book must, in every way, rank very highly as a scientific geographical treatise. Everywhere he employs the metric and decimal system of notation, and in Appendix I. he gives, for the sake of the unlearned, conversion tables, so they cannot complain. But why does he not give us a table for converting square kilometres into square miles? and why will he not leave us our familiar Fahrenheit thermometer. Wherein is the Centigrade to be preferred?

The National Printing Department of Cairo deserves credit for turning out so good a work, probably the best they have ever done; but they might have given us a thicker cover than this wretched sheet of paper, and they should remember that the English synonym for a weir has not got the letter *n* in it (see p. 133).

C. C. S. M.

Liberia.

'Liberia.' By Sir Harry Johnston, G.C.M.G., etc. With an Appendix on the Flora of Liberia, by Dr. Otto Stapf. 2 vols. London: Hutchinson & Co. 1906. *Price* 42*s. net.*

Liberia, says Sir Harry Johnston, by reason of its fauna and flora, is a peculiar country almost rising to the dignity of a distinct sub-district of the West African sub-region. Nevertheless, Liberia is of interest chiefly by reason of the racial, social, and political problems there on trial. This fact the author recognizes by placing the history of the republic in the forefront of his narrative. The story of the endeavour to evolve a self-governing civilized negro state is clearly set forth. Into the controversy as to what lines of development the Liberians ought to pursue if they are to maintain a permanent place among the nations of the world we do not propose to enter, beyond stating our general agreement with Sir Harry Johnston that the ideal which they now cherish, namely, that of an Anglo-Saxon culture of the early nineteenth-century type, is not that suited for an African people. But the author, in his zeal and the plenitude of his knowledge, has done more than give the history of Liberia; he has devoted five or six chapters to the oft-told tale of Hanno's Periplus; to accounts of the voyages and traffickings of the Normans, Portuguese, English, and Dutch along the Grain Coast; and to a *résumé* of the slave trade and piracy practised in that and neighbouring regions. Much of this has no special connection with Liberia, but the author justifies himself by identifying the references made in the old chronicles to places now within the limits of the republic, thereby contributing a valuable page to the elucidation of historical geography.

Apart from its historical matter, the scope of the book will be best exhibited by indicating in the author's order the contents of the two handsome volumes. In the preface Sir Harry acknowledges his indebtedness for much of his information to a number of scientists and others, especially to Dr. Otto Stapf, of the Botanical Gardens, Kew, who has contributed the appendix on the flora of the country (Sir Harry has, however, considerable and recent personal knowledge of Liberia, and appears to have made a special study of its native races and economic condition). After the preface comes an analytical bibliography, which the student will find very useful. A generous tribute is paid to the valuable work of Dr. Büttikofer, especially in the subject of biology. Next we have an introductory chapter in which the topography of Liberia is broadly outlined, and this is followed by another, called "Ancient History," largely devoted to speculative ethnography. Thus early the author discloses his admiration for the Mandingoes, a virile race professing Islam, and among the aristocrats of West Africa. From this point we are taken through the history of the country, the first volume concluding with chapters on commerce, geography, climate and rainfall, geology and minerals. One of the facts demonstrated is that the transplanted American negroes and mullattoes are almost as much aliens in the land of their ancestors as are the white intruders, and are subject to the same climatic disabilities.

With regard to the geography of Liberia, Sir Harry Johnston has little to add to existing knowledge as the result of his own journeys, but he ably summarizes all that is known of the country. We get a vivid picture of a land of primeval forest —the densest forest region in Africa—hilly generally, and mountainous in parts; short, rapid, and usually unnavigable rivers; pestilential lagoons; a harbourless coast, with one bold cliff rising over 1000 feet sheer from the water; magnificently coloured flowers, birds, and beasts; a land of heavy rain and humid heat. In its outlines at least it does not differ greatly from other West African countries.

The first prices quoted in the chapter on commerce are these: "The value of wives varies in different districts, but an average may be struck—viz. 6 brass kettles, 15 kegs of powder, and 5 pieces of cloth. The value of a slave-boy is 15 kegs of powder, and of a slave-girl 10 kegs of powder or 100 sticks of salt." However, all the commerce of Liberia is not of this type. The staple exports are coffee, rubber, palm oil, palm kernels, and piassava. The extraordinary wealth of rubber-producing trees, lianas, and shrubs indicates that with proper management, and the provision of better means of communication, the rubber industry might become an important source of wealth to the community. There are only slight indications of the existence of minerals of commercial value, though the sand of some of the rivers is auriferous.

The second volume opens with an account of the Liberian flora, followed by Dr. Stapf's appendix already mentioned. Then come four chapters devoted to fauna; three chapters on anthropology—historical (there is here some repetition of information given in vol. 1), physical, and social. The nearest approach to an indigenous race are the Kru and Kpwesi people, and concerning these tribes much illuminating information is forthcoming. Chapters on folklore, languages, and vocabularies end the volume, save for the index, which, so far as we have tested it, is satisfactory.

Much of the value of this book, a monument of industry and insight, lies in its illustrations and maps. Sir Harry Johnston has a reputation as an amateur artist, and twenty-eight of his paintings are reproduced in colour; those of birds and beasts are specially good. There are twenty-four botanical drawings by Miss Matilda Smith, and over four hundred other illustrations. These help materially to the understanding of the text. Of the maps two are reproduced from the *Journal*; others are useful sketch-maps, showing rainfall, forest region, political boundaries, etc. There are, besides, two contoured maps, drawn by Mr. J. W. Addison, on the scale of 1 : 1,000,000—one of Western Liberia, the other of Eastern Liberia.

F. R. C.

AMERICA.

The Volcanoes of Colombia.

'Die Vulkanberge von Colombia.' By Alphons Stübel. (Edited and completed by Theodor Wolf.) Dresden: 1906.

By the death of Stübel in November, 1904, the science of vulcanology lost one of its greatest masters. After spending a great part of his life in the active investigation of the volcanoes of Central and South America in the field, he had returned to Germany, and it was expected that a series of monographs giving the results of his work would ultimately appear. The present volume is a companion to his well-known book on the volcanoes of Ecuador, and is written in the same clear and graphic language, but, unlike the previous work, is accompanied by an excellent series of panoramic views of the principal mountains described. The book is concluded by a sketch of the operation of the volcanic forces, an elaboration of the author's theoretical views on this subject which have already received much attention from geologists.

J. S. F.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Geomorphology.

'The Face of the Earth.' By Prof. E. Suess. Authorized English Translation by Hertha B. C. Sollas, under the direction of Prof. W. J. Sollas. Vol. 2. Oxford: Clarendon Press. 1906.

The second volume of Miss Sollas's translation of Prof. Suess's great work fully bears out the promise of the first. It is in every sense an excellent version, presenting in clear and most readable English the intricate and often difficult matter of the original. The German edition is followed very closely, even though in some respects it would not be hard to introduce improvements. Thus, for example, no one would complain if an index, however brief, had been added to the work; and again, while some of the illustrations have been adapted to the use of English readers (*e.g.* Fig. 29), there are others in which the German nomenclature still stands. It seems unusual to find, in a book for the use of English students, a map of Scotland with such terms as Hebriden Inseln, and Nord Canal (Fig. 10).

This volume is devoted to the history of the oceans, and contains much of the most brilliant speculation associated with its author's name. It has excited great controversy, and has evoked much criticism, not entirely favourable. As a masterpiece of the literature of physical geography and geology it has long since taken its place among the classics of science. The simplicity of the main conceptions in this part of the work makes it on the whole most suitable for the general reader, though it is by no means easy reading. The enormous mass of detail on the geological structure and history of the Earth's crust which its pages contain are apt to fatigue the mind and to overpower our sense of proportion; but the author never flags. He brings each chapter to a close with a masterly generalization, summing up in a few brief paragraphs the results of our geological knowledge of half a continent.

In order to establish the differences which exist between the Atlantic and the Pacific ocean, the geological history of much of the adjacent continents has to be unfolded. A comparison is drawn between the structure of Northern Europe and of

North America, in which it is shown how many features these ancient lands have in common, and the very perfect balance between the two sides of the Atlantic is gradually demonstrated. Incidentally the history of the older mountain chains of the world is sketched, as a sort of appendix to the story of the Alps and other mountains already described in the first volume. It is shown how the Atlantic is an ocean bounded mostly by broken fragments of continental masses. The long and intricate story of the Mediterranean must also be told in order to explain many exceptional features of the Atlantic shores. The Pacific, on the other hand, is surrounded everywhere by folded ranges which on the whole run parallel to the strand, and are accompanied in a more or less regular fashion by the volcanoes which constitute the great Pacific zone of fire.

We then pass to consider another question of the highest importance, with which the name of Suess will always be associated. The ridging up of the Earth's crust by the formation of mountain chains has hitherto been one of his principal themes. The question he now asks is this: Can we recognize another type of earth-movement by which the land is slowly upheaved or submerged over great areas without marked folding? The raised beaches, so well known to all geographers, have long been held to prove that such changes have gone on extensively in comparatively recent times. But after a review of all the evidence, which amazes the reader by the intimate knowledge shown of the geological literature of all countries, the conclusion is arrived at that there is no good proof that the land has experienced elevation and depression of this nature. The explanation hinted at is that the changes have been in the level of the sea. But the argument is destructive rather than constructive.

Whatever verdict posterity may bring in on this question, the surpassing interest of this volume cannot be gainsaid. Every chapter is full of geographical speculations which fire the student's imagination. The importance of the book must be measured rather by the influence it has exerted on geological thought than by the rigidity of its demonstrations and the ultimate triumph of its teaching. Those who know it well in its German and French editions will welcome the appearance of so good an English translation, while those who never read it before may be congratulated on having it prepared for their use in so acceptable a form.

J. S. F.

GENERAL.

Surveying Instruments.

'Instrumentenkunde für Forschungs-Reisende.' Unter Mitwirkung von Ingenieur C. Seidel bearbeitet von W. Miller. Hanover: Jänecke. 1906.

Among the numerous works that have been published during the last few years on scientific observations for travellers and the necessary outfit, that entitled 'Instrumentenkunde für Forschungs-Reisende,' by Profs. C. Seidel and W. Miller, ought certainly to be classed with the most useful and practical. At the first glance it has somewhat the appearance of an ordinary catalogue of instruments by different makers, but it is in reality far more than this, for although it gives lists and illustrations of theodolites, sextants, barometers, photographic apparatus, instruments for marine surveying, for magnetic observations, and indeed the necessary outfit for almost every conceivable branch of scientific investigation that an explorer can undertake, with particulars as to price and weight, yet it is in no wise confined to a bare list, but contains valuable information as to principles of construction, variety of form, and many other subjects that cannot fail to make the work of considerable value and practical importance. One important subject dealt with is the customs tariffs for scientific instruments in different countries, a list of which is given, followed by useful information concerning frequency and dates of departure of steamships by which instruments may be sent from Hamburg to all parts of the world.

As might perhaps be expected, this is essentially a German work, and by far the greater number of the firms of instrument makers are German. Still, this is not entirely the case, and since makers in other countries are included, it is surprising that the list is not more complete in this respect. For instance, nearly all the more important makers in this country are omitted from the general list, although the names of some incidentally appear in the list of scientific outfit of the Japanese government surveying ships. Again, as to instruments, there are some important omissions, such as the Lloyd-Creak magnetic instrument, from the list of instruments for magnetic observations. No reference is made to the plane-table, of which many forms exist, and which instrument is admitted by the best authorities to be specially suitable for rapidly filling in topographical features between fixed points on a survey. Amongst the apparatus for photographic surveying, it is surprising that the Bridges-Lee photo-theodolite, certainly one of the best, is omitted.

Hints to Travellers.

'Anleitung zu wissenschaftlichen Beobachtungen auf Reisen.' Herausgegeben von Prof. Dr. G. von Neumayer. 2 vols. Third edition. Hanover: Jänecke. 1906. *Price (vol. 1), 25m., (vol. 2), 24m.*

If the geographical explorer of the present day fails to bring back valuable scientific results of his travels, or is at a loss to know how to preserve his health in the region he may visit, or what instruments he should take with him, it can hardly be due to the fact that no instructions have been published for his guidance; for apart from works dealing with special subjects, of which several have lately appeared, almost simultaneously with the new edition of this Society's 'Hints to Travellers,' a third edition of Dr. G. von Neumayer's 'Anleitung zu wissenschaftlichen Beobachtungen auf Reisen' has been published. Although both of these works are intended to furnish guidance for the intending travellers on scientific matters, the latter, since it now consists of two octavo volumes, each containing over eight hundred pages, is perhaps more fitted for previous careful perusal than to furnish practical hints in the field. Still, to many the bulk may not be a serious difficulty, and on important expeditions, the traveller acquainted with German would doubtless consider that the valuable information the 'Anleitung' contains far more than compensates for its weight and size.

The work is certainly most exhaustive and complete, and no less than thirty-two professors and experts have contributed articles on the particular branch of scientific inquiry which they have specially made their own. To give merely a brief notice of each of these would be impossible in these pages, and if any fault can be found it is that too much has been attempted for the purpose in view, and that the average traveller would have profited more if less had been given and the matter had been more condensed.

That the latest discoveries and results of the most recent investigations have been taken advantage of may be seen from a glance of such articles as that by Prof. S. Finsterwalder on "Photography as an Aid to Land Surveying;" Dr. G. von Neumayer and Dr. J. Edler's on "Magnetic Observations on Land;" the important notes on "Magnetic Observations on Board Ship," by Dr. Friedrich Bidlingmaier; the article by Dr. W. Köppen on the "Use of Kites in Meteorological Observations;" and many others. A special interest attaches itself to the article on geology, inasmuch as it was the last work of the kind undertaken by its illustrious author, the late Baron F. von Richthofen.

Very properly, the opening section of the work, written by Herr P. Vogel, is devoted to fixing positions by astronomical observations; but considering the importance of this subject, and the amount of detailed information contained in many of the others, this section is hardly so complete as might have been expected. In addition to bare statements of formulæ, it would have been an advantage to the ordinary explorer if more fully worked out examples of the computations had been given, and if matters such as telegraphic determination of longitude, and longitude by occultations of stars, had received more adequate attention. The astronomical section is followed by one on route-surveying and triangulation by Herr P. Vogel; and here again some important matters, such as plane-table surveying, and the more exact methods of computation of geodetic distances, have hardly received the attention they deserve. Still, both of these articles are good so far as they go, and those on nautical surveying and photographic surveying give valuable additional information on these matters.

In conclusion, Dr. von Neumayer may be congratulated on the publication of the third edition of this most useful work, and the amount of labour and painstaking care which its venerable editor must have devoted to its supervision is decidedly remarkable, when it is remembered that he has now reached his eightieth year.

THE MONTHLY RECORD.

EUROPE.

The Peopling of Switzerland.—An article by M. Pierre Clerget in the *Bulletin* of the Belgian Geographical Society (1906, No. 2) on the peopling of Switzerland, gives a clear and detailed account of the relation between the geography of that land and its population. To its mountainous and therefore retired character, Switzerland owes its preservation of the Romansh language; to its central position, the fact of its having been peopled from prehistoric times. All the epochs between the ages of stone and of iron have been brought to light, and that not only in the lake dwellings of Geneva, Bienne, Zürich, and Constance, but also in the region of the sources of the Aar, Kander, Lutschine, Sarine, and Simme. Switzerland falls naturally into the regions of the Alps, occupying 59·1 per cent. of the total surface, the Jura 11·4 per cent., and the intermediate plateau 29·5 per cent. These three regions have each a distinctive density and character of population determined by its special geography. Its general elevation, however, assigns to Switzerland the rearing of cattle as its principal occupation. The vine is cultivated in Valais. In the Alpine valleys fruit trees, cereals, etc., grow, while industries, such as the working of marble, granite, and slate, exist. There is, moreover, abundant reserve of water-power, a factor of vast capacity, but its exploitation lies in the future. The characteristic employment, however, of Switzerland is cattle-rearing. That fact carries with it a wide dispersion of the population. The great longitudinal valleys are more populated than the much more narrow and abrupt lateral ones. The highest inhabited villages are in the Grisons. More than half the people of that canton live well above 3000 feet, two-fifths of them above 3800 feet. The great valleys bear on their slopes terraces due to glacier action. Where the terraces are well marked we find great administrative communes, often composed of many different centres. The physical factor seems to create political solidarity. Where, on the other hand, the terrace is absent, quite small groups constitute independent bodies. Everywhere alike, too, the sunny side is much more populated than the shady, and the dwellers in the former look down on those in the latter. Included in the interesting article is an account of nomadism, communism, "consertages," etc., all of geographical significance. A plate shows the migrations to and fro of the dwellers of Chandolin, between the Rhone valley and the Alps from January to December.

Population of German Towns in the Middle Ages.—The population of the leading German towns in the Middle Ages is a question which has long been the subject of inquiry. Thanks to some lucky finds made in ancient town archives, it is now possible to state, according to official enumerations of the fifteenth century, the figures of population of a number of such communities, in part with complete authenticity (as in the case of Nürnberg), in part with a high degree of probability. The following is a list of such towns:—

Town.	Year of enumeration.	Population.
Strassburg	1473–77	26,198 *
Nürnberg	1449	25,982 †
Lübeck	end of 14th century	22,300
"	end of 15th century	23,672
Ulm	1427	20,000
Augsburg	1475	18,300
Rostock	1410	14,000
Zürich	1410	10,570
Frankfurt-on-Main	1440	9000
Basel	1471–75	9000
Eger	1446	7340
Freiburg in Uechtland (Switzerland)	1447–48	5800
" " "	1444	5200 ‡
Mainz	end of 15th century	5767
Nördlingen	1459	5295
Heidelberg	1439	5200
Freiberg in Saxony	1474	5000
Ueberlingen	1444	4800
Dresden	1477	4228
Butzbach	1421	2235
Meissen	1481	2000

On the above data the distinguished Austrian statistician, His Excellence von Inama-Sternegg, makes the following remarks in the *Statistical Monthly* (May, 1906): "This goodly roll of twenty towns suffices to reduce to their proper measure the representations, mostly extravagant, of an earlier time respecting the wealth of population of German towns in the Middle Ages. On this list are included towns, such as Lübeck and Augsburg, belonging beyond dispute, politically and economically, to the most important and influential of their time. It can only be regretted that precisely for the two most important communities of the old German Empire, Cologne and Vienna, no available sources have been discovered for the determination of their population. Were the figures of population for these cities ascertained, they would furnish the high-water mark of city population for Middle Europe in that period. They would, however, further supply evidence that a population which nowadays seems hardly adequate for a modern second-rate town, was yet in those times a factor of great power, not only on account of the generally low standard of population in the empire and its territories, but also by reason of the exceedingly strong tide of rich civic life pulsating in these autonomous communities."

ASIA.

Earth-movements and River Profiles in Peninsular India.—In the *Records of the Geological Survey of India*, vol. 33, part 1, Mr. E. Vredenburg calls attention to the marked deviation from the normal displayed by the profiles of several of the rivers of the Indian peninsula, notably the Narbada, and

* Excluding people in transit, 20,722. † Excluding people in transit, 20,165.
‡ Not counting people in transit.

the conclusions to be drawn respecting movements of the surface in recent geological times. The subject is of interest from the fact that the phenomenon seems to be not merely a local one, but to belong to a series of simultaneous movements which have been of considerable importance in determining the existing configuration of large parts of the Earth's surface. The upper part of the Narbada basin is occupied by an immense deposit of Pleistocene alluvium, rich in mammalian fossils, which boring has shown to fill a rock-basin of great depth. On emerging from the alluvial plain, near Handia, the profile of the river becomes suddenly steeper, and from this point to the sea is almost a straight line instead of presenting the curve characteristic of most river-courses with their gradually decreasing fall. The general straightness of course also points to the agency of recent surface changes. Somewhat similar features are observable in the case of other rivers, such as the Tapti, with its tributary the Purna, and the upper Godaveri, all of which traverse planes of old alluvium, on leaving which their gradient becomes markedly steeper. It has been sought to account for this by supposing an uplift of the western side of the peninsula relatively to the eastern, but Mr. Vredenburg points out that the result in the case of the Godaveri would necessarily be the reverse of that in the case of the westward-flowing streams. A more satisfactory explanation would be forthcoming on the supposition of an extensive though shallow warping of the surface along certain definite lines. A single anticlinal ridge, running west of the western end of the Narbada and Purna plains, with a strike slightly east of north, would also cut the upper Godaveri at the lower end of its plain of ancient alluvium, and so account for the accumulation of all three deposits, while a parallel ridge would account for the plain of Khandesh. Similar exceptional features in the profile of the Rhine are also largely due to Pleistocene crust-movements, while many features of northern topography, *e.g.* the Swiss and North American lakes, have been ascribed to similar and contemporaneous agencies. In the latter cases glacial conditions played their part, but the simultaneous occurrence of Earth-movements in a country where glaciation, at the time, is out of the question, strengthens the idea that the ice had little more influence than to preserve the effects of such deformation. Such a widespread warping of the surface in Pleistocene times would be a remarkable fact, but further data from regions intervening between India and Europe are needed. Mr. Vredenburg suggests the possibility that the present isolation of most of the drainage of Persia and neighbouring countries may be in part the result of similar movements.

Dr. Tafel's Journey in North-West China.—A further letter from this traveller (*Journal*, **27**, 302), printed in the *Zeitschrift* of the Berlin Geographical Society (1906, No. 5), continues the account of his interesting researches down to February 25 last, at which date he was at Hsi-ning, in the Kuku-nor region. The previous letter had left the traveller at Kwei-hwa-cheng, near the north-eastern angle of the course of the Hwang-ho. Great scarcity was prevailing in this district, and the traveller comments on the absence of enterprise on the part of the mandarins, who, by inaugurating a system of irrigation, might make of the neighbouring Hwang-ho valley a veritable granary. Kwei-hwa-cheng is well known as a centre of the wool trade between China, Mongolia, and Northern Tibet, and the traveller gives some interesting details as to the method of transport, and so forth. From this place he travelled to Bautu, on the Hwang-ho, making a circuit through the mountain range to the north, the In-shan of the maps, though the only name current in the country is Da-tsing-shan, as it is correctly given by Rockhill. It consists mainly of steeply inclined Archæan formations, and forms a very rugged wall-like escarpment with an undulating steppe beyond. In this region the Chinese are pressing back (or assimilating) the Mongols, but their agricultural operations are limited by want of rain, which falls regularly only in the hills. From Bautu (which has nearly the same importance as Kwei-hwa-cheng) the traveller crossed the Hwang-ho valley, the southern part of which is a useless steppe, and ascended to the moderately elevated Ordos country. Here too the Mongols are being rapidly displaced by Chinese, who now form more than half the population. The first part of the Ordos country consisted of horizontal strata rich in silicates, sand being hardly anywhere seen. The grassy plain was covered with vast herds of sheep and camels belonging to the Mongols under the Ordos chief Wang. Further south sand became more and more plentiful, forming great barchanes and blocking many of the original valleys. At length hills appeared to the south, and the towers and battlements of the Great Wall appeared. It is here composed entirely of blocks of loess, which here makes its appearance. The wall is threatened by the advancing sands from the north, as well as by the loess itself, and the city of Yu-lin is likewise half buried in sand. No traveller had previously made his way to this place in foreign dress, and Dr. Tafel was subjected to much annoyance. South of this he crossed a low range formed by a gigantic wall of loess over 1500 feet thick, and seeming to represent the Lu-kwa-ling of the maps. Beyond Anbien he left the main road to Ning-hia, in order to touch the northern spurs of the Liu-pan-shan. The formations here showed traces of much dislocation and pressure, and the structure was difficult to make out. Dr. Tafel endeavoured to follow the Hwang-ho from Chung-wei to Lan-chau, but found that it passed through a wild gorge, impassable by foot-passengers, having here to break through the extreme easterly spurs of the Nan-shan. The population was exceedingly scanty, and from what he saw, Dr. Tafel is inclined to put the whole population of Kansu at far less than has been supposed—some two or three millions only. From Lan-chau he made his way to the country north of Kuku-nor, but his caravan was attacked by Tibetans and forced to beat a retreat. He hoped, however, after renewing his equipment, to carry out his intended journey through north-eastern Tibet.

Ascent of Cherimai Volcano.—The *Tijdschrift* of the Royal Netherlands Geographical Society for March last gives a provisional notice of an ascent, made on December 24 and 25, 1905, of the gigantic volcano of Cherimai, in Java. Previous ascents were those of van Blume (1825), Junghuhn (1837), and van Hoëvell (1844). This last ascent was made by Heer J. A. Deknatel and five other mountaineers from Linger Jati, east by north of the summit. Starting at 7.30 a.m., the expedition climbed on horseback till 9. Beyond the top of Gedeh, their path ran without a break through dense primæval forest. Then, rising into the zone of European vegetation, they experienced great difficulty in breathing, the heart's beating being felt up to the throat on making a ten minutes' climb. At 3 p.m. they were within 1000 feet of the pinnacle. After a further climb of three-quarters of an hour, four of them reached the rim of the crater at 5.45. The cavity, with its continuous rumble and sulphurous steam, made an unspeakable impression. All around, however, was dense fog. Descending to their hut within 1000 feet from the top, where they passed a cold night with the thermometer at 47°, they started again next morning at 4, and reached the top at 5. At 5.30, under the rising sun and a cloudless sky, they had a view extending from far beyond Pekalong to Krawang, with the sea in front, and in the distance the peaks of all the volcanoes of mid-Java. Starting at 7.30, four of them made the circuit of the crater in two hours.

The Name Halemahera (Jilolo).—The derivation and meaning of the word "Halemahera" is discussed in the *Tijdschrift* of the Royal Netherlands Geographical Society, vol. 23, No. 2. In an earlier number of the same journal, the word was represented as Tidorese, and as signifying "Mother of the land," relatively to which Tidore was island, "child of the land." A letter from P. A. Oudemans in the above journal quotes a passage from F. S. A. de Clercq, stating that the name means support or foundation of the land, and should properly run Halémahéra. Halé, however, is Tidorese, corresponding to the Ternatan "Kaha," though nobody thinks of saying "Kaha-ma-hera." In Tidorese pure and simple, the name would be "Haléjorah," and nobody can explain the barbarous combination of the two languages. Following a peculiarity of the whole of the Indian archipelago, the natives constantly speak of "Halmahera"—"great land"; but the people of Ternate apply the half Ternatan and half Tidorese "Halemahera," and the people of Tidore the word "Halejorah," to the largest of the Moluccas proper. Herr Oudemans further cites an authoritative passage, showing that, according to Oviedo, the name Halmaheira properly applies only to a province. The island of Jilolo was by the inland people called "Aliora." There is a reply to this letter by J. A. F. Schut in the same journal.

AFRICA.

The Ascent of the Ruwenzori Peaks.—Full details as to the recent ascent of the Ruwenzori peaks by the Duke of the Abruzzi and his companions are not yet forthcoming, but a letter from one of the latter, Signor V. Sella, communicated to the *Times* by Mr. Douglas Freshfield, makes some addition to the vague information previously available. Signor Sella says that the duke, accompanied by two Courmayeur guides, climbed all the five highest peaks of the range, and took from them observations with a mercurial barometer as well as a number of compass bearings. Captain Cagni carefully measured a base-line near Bujongolo, in order to ascertain the exact distance of the summit of Kiyanja from the rock shelter Kichuchu, so that the resulting map of the snowy portion of the chain will have a firm basis. Signor Sella also made several ascents and obtained a number of photographs and panoramas, including views in the forests and valleys of the Mubuku and Bujogo. The latter is said by him to be the largest tributary of the Mubuku, so that, as Mr. Freshfield points out, it seems to be of more importance than has been suspected. As regards the height of the highest peaks, all the information given is that they are several hundred feet higher than Kiyanja and to the north-west of it. It will be remembered that the height obtained for Kiyanja by the British Museum party (*Journal*, July, 1906, p. 50) was 16,379 feet, but this was by aneroid and boiling-point thermometer only, and may be in excess of the truth. In any case there is no reason to suppose that the height of the culminating point will greatly differ from that given by Lieut. Behrens, in the July number, to the higher of the two peaks identified by him with Stuhlmann's Kanyangungwe. A sketch-map sent by Signor Sella to Mr. Freshfield places the various summits in positions closely approximating to those of Lieut. Behrens, the highest summit of the Italian traveller corresponding to Kanyangungwe of Lieut. Behrens. The position of Kiyanja, however, according to Sella, corresponds to that of the peak estimated by Behrens to have a height of 15,692 feet, and identified by him with the Ngomwimbi of Stuhlmann. If this was really Kiyanja (of which Lieut. Behrens obtained, otherwise, no observations), it would help to explain the fact that Mr. Wollaston placed the higher peaks seen by him at some miles from Kiyanja, though in this case the direction given by him (due north) would not be quite intelligible.

New Route to Lake Chad.—Considerable activity is being displayed in the attempt to open up a new route to Lake Chad through the French Congo colonies, by way of the upper Sangha and Logone rivers. In the July number of *La Géographie* particulars are given of an expedition which was carried out in the latter half of 1905 by Lieut. Lancrenon, of the French Colonial Artillery, while on his way to take up a post in the Chad territory. Acting under special instructions from M. Gentil, the Commissary-General of the French Congo, Lieut. Lancrenon organized a caravan at Carnot, on the Mambéré branch of the Sangha, with the object of exploring the little-known country between that station and Lai, on the Logone. No similar expedition had been undertaken since Captain Loefler's journey in 1901 (see *Journal*, vol. 20, p. 540). Though he covered a great deal of new ground, Captain Loefler was unable to establish the desired connection between Carnot and Lai, his route on the northward journey trending eastwards to the Shari, while on the return journey, after traversing the Tuburi marsh, he reached Carnot by a route which ran for the most part a considerable distance west of the Logone. The very heavy mortality among the porters who engaged in this earlier expedition made it extremely difficult for Lieut. Lancrenon to secure natives to act as carriers. A start was finally made from Carnot early in July, 1905. The expedition first made its way to Kundé, and then turned to the north-east in the direction of the Logone. The region traversed presented features of great orographical and hydrographical interest. Several rivers, confined within narrow and precipitous valleys, descend from the Adamawa highlands towards the Logone and the Shari; and of one stream, the N'gu, the course was found to be broken by a cataract between 300 and 400 feet in height. The Logone was struck not far from a mountain mass named Bumbabal, which dominates a wide expanse of country. Some of the tribes encountered had not even heard of a white man, and the early stages of the expedition were peaceful in character, but in the Laka country the attitude of the natives became decidedly hostile. Lai was reached on September 4, after a journey from Kundé of nearly 400 miles through unknown country. Circumstances made it necessary for Lieut. Lancrenon to accompany the expedition on its return journey. On this occasion the country between Bumbabal and Carnot was traversed by a new route which did not touch at Kundé; and when Lieut. Lancrenon again turned north to reach his post in the Chad territory, he sought out a third route between Carnot and Bumbabal, following in part the course pursued by Captain Loefler. What promises to be a still more important expedition has been despatched to the French Congo by the Paris Geographical Society, under the leadership of Commandant Lenfant, with the object of developing communications between the Sangha and the Logone basins. Efforts will also be made to secure reliable data about the economic resources of the country, and to extend French authority among the tribes. The upper Sangha Concession Company has contributed largely to the funds, which, according to the *Dépêche Coloniale*, amount to £7400. Including the leader, the European staff of the expedition will number no fewer than nine members. As might be expected, Commandant Lenfant, who left France for Brazzaville on August 25, will devote special attention to the navigability of the waterways he is to explore. On the way to Carnot some time is to be spent in exploring the forest region around Nola, where the Mambéré and the Kadéï flow together to form the Sangha. Beyond Carnot the plans of the expedition will largely be determined by circumstances. Somewhat different in character is another expedition, which has been organized by the Paris Geographical Society with the assistance of the Pasteur Institute, for the study mainly of the distribution and characteristics of the sleeping sickness in the French Congo, particularly in the upper Ubangi region. A sum of £8000 has been subscribed for the purposes of the mission, at the head of which will be Surgeon-Major Martin, who has had experience of tropical diseases both in Indo-China and in West Africa. The mission is due to start from France this month (October), and will, it is expected, be absent about a year and a half.

São Thomé Island.—A paper by M. Aug. Chevalier, in *La Géographie* (vol. 13, No. 4), gives a fresh and graphic picture of the Island of São Thomé, in its physical, historical, and more especially economic aspects, as a result of a sojourn of some weeks in 1905. Its population, 38,000, is distributed between the city, 7 villages, and over 200 plantations. There are 2500 Europeans; over 11,000 negroes converted to Catholicism; 2000 Angolan fisherfolk, the descendants of 200 slaves stranded on the coast in 1540; and 20,000 imported labourers, mostly from Angola. By nature a wild chaos of mountains, intersected by ravines opposing the most stubborn resistance to cultivation, the island has, practically since 1870, thanks to prodigious and ingenious industry, been converted into a vast tropical garden of exuberant fertility. Its superabundant watercourses, too, are now being utilized as water-power and for irrigation. Half the island is now under cultivation; a quarter in the centre, occupied with forest, is still capable of plantation; whilst the other quarter—marsh, dunes, and barren almost inaccessible peaks—is economically useless. The climate is mild and humid, with wet and dry seasons, but the temperature hardly varies all the year round. Yet three climatic regions are distinguishable: (1) the north and north-east, comparatively dry; (2) the south and south-west, much more humid; (3) the region of high altitudes. The cultures, again, are divisible into altitudinal zones: that of the oil palm extends from sea-level up to 800 feet; cacao is grown chiefly between 520 and 1300 feet; sugar-cane at low altitudes; *coffea arabica* from 2300 to 4000 feet. The two great products are cacao and coffee. In 1905 the cacao production of São Thomé and Principe (23,187 tons) much exceeded that of Ecuador (18,268 tons), and still more that of Trinidad (18,968 tons); and in a few years the two islands should double their present production. Other cultures are quinquina, introduced in 1864; bananas; and European vegetables, which thrive from 3300 to 4500 feet. In an ascent of the peak, the height of which M. Chevalier places at 6640 feet, he gathered ten species of plants nowhere existing save on the flanks of the mountain.

AMERICA.

Tide-levels and Datum-planes on the Pacific Coast of Canada.—The Canadian survey of tides and currents has lately been extended, under the able direction of Dr. W. Bell Dawson, to the coasts of British Columbia, and an account of the work so far accomplished has been given in a supplement to the annual report of the Department of Marine and Fisheries (Ottawa, 1906). An important piece of work, which had to be undertaken in an early stage of the survey, was the determination of a plane of reference for the height of the tide in the various harbours, and its correlation with previously employed datum-planes. The value of reliable levels is obvious from the point of view of harbour and other public works, as well as for marine purposes, while from a geographical standpoint they are of unusual interest in this particular region on account of the rapid alteration in the relative height of land and sea which seems to be taking place at the present time. The fixing of a satisfactory basis for the tide-levels was the more important on account of the uncertainty prevailing in regard to the datum-planes of important surveys, or the absence of means of correlation, owing to loss of records. The obvious plane of reference to be adopted in connection with tidal observations is mean sea-level, and the unusual character of the tides on the Pacific coast renders it important to adopt the best method of obtaining its value. The leading feature in the Pacific tide is a pronounced diurnal inequality in time and height, according with the declination of the moon, but subject also to an annual variation with the change in the declination of the sun. In the enclosed waters the tide curve has quite an anomalous appearance, the sea often standing for a long time near high-water level, with a sharp and short drop once in the day. The spring and neap tides are thus reduced to a secondary feature. Under these circumstances there is a notable difference between the half-tide level and the true value of mean sea-level, and the determination of the latter requires the hourly ordinates to be taken throughout the year by a registering gauge. By carrying out this work it is hoped that a basis has been secured by which some approximation to the rate of rise of the land now in progress can be attained. Much pains has also been taken to correlate the various datum-planes which have been employed at Victoria and Esquimault, one most fortunate result being the establishment of the lost Public Works datum (and others depending on it), with the help of a record of which the present engineering staff were unaware.

POLAR REGIONS.

The Polar Conference at Brussels.—Representatives of some of the principal countries and bodies interested in polar research met at Brussels early in September, under the presidency of M. Beernaert, Minister of State, to discuss the proposal for an "International Commission for the Study of the Polar Regions," put forward last year by Belgian representatives at the Economic Congress at Mons. After considerable discussion, a scheme put forward by Dr. Charcot was adopted on September 10, with some modifications, by a committee mainly composed of explorers, and on the following day was accepted by the Congress in plenary session. The commission will be constituted by the inclusion of two effective and two extra members of each country that has taken part in polar exploration, with arrangements for the addition of representatives of countries that may at any time be organizing new expeditions. Corresponding members may also be nominated from the ranks of explorers or others who have carried out scientific research in regard to the Polar regions. The members are to hold office for six years, half of the number retiring at the end of three years, but being eligible for re-election. They are to elect a president, a vice-president, and two secretaries. This scheme is the result of a compromise between the views of those who desired the commission to be composed entirely of polar explorers, and those who wished to give it a more comprehensive character, both as regards its composition and methods of action. It was understood, however, that its scope might be widened in future. At present, at least, it will not organize expeditions on its own account, its main objects being defined as the establishment of closer relations between polar explorers, and the co-ordination of methods of observation. Especial stress was laid on the second of these objects, and it was urged that all oceanographical work should conform to the methods adopted by the International Association for the Study of the Sea.

The Wellman Airship Expedition.—News received at Hammerfest from Mr. Wellman at the end of August was to the effect that, owing to faults in the mechanical equipment of his airship, the voyage northward had been postponed until next year, a possibility which he had kept in view from the first. The preparations in Spitsbergen had progressed satisfactorily, but the car would be entirely rebuilt in Paris during the coming winter.

The Voyage of the "Gjöa."—Captain Amundsen has telegraphed to King Haakon announcing the safe arrival of the *Gjöa* at Cape Nome in Alaska, the north-west passage having thus been completely accomplished by him. King Haakon has signified his assent to the naming of the coast charted by the expedition after himself and Queen Maud.

Mr. Mikkelsen's Expedition.—We have received news from Mr. Mikkelsen bringing the account of his doings down to August 18. He appears to have encountered unusual difficulties at the outset of his undertaking, and was apprehensive of being unable to keep to his programme as regards this year's winter quarters. On the way to Bering strait he had touched, among other places, at St. Lawrence island, where half the required number of dogs—fine, big animals—were obtained. A gale, accompanied by fog, made it impossible, however, to reach the Siberian coast, and a course was shaped for Port Clarence, but adverse wind and current kept the ship drifting to and fro for three days amid considerable danger. The port was reached at last, but the leader's plans were thrown out of gear by the serious illness of Mr. Detlevsen, necessitating his being sent back, and by the desertion of two of his men. A start was again made on July 22, but the season proved quite an abnormal one—wind and current coming persistently from the north, and making it impossible to make any good progress, owing to the closeness of the ice to the coast. Down to August 18 none of the whalers frozen in last year had made their appearance, and Mr. Mikkelsen's was only the second vessel, and the first sailing vessel, that had made its way as far as Point Barrow, gales and fog continually hindering an advance. At the time of writing there were indications of a southerly wind, and Mr. Mikkelsen hoped that this would make it possible to proceed eastward past the point. He intended to push as far as possible during the month of navigation remaining, and to do as good work as possible wherever it might be necessary to go into winter quarters. Next summer he hopes to carry out the original plan, spending two more years in the Arctic, should the additional funds (some £220) thus made necessary be forthcoming. A further communication may be expected from the explorer after the winter quarters have been reached.

Ice and its Movements in Baffin Bay.—A very thorough study of the movements of the ice in the region of Baffin bay, as a result of currents and weather influences, forms part 7 of the *Veröffentlichungen* of the 'Institut für Meereskunde' and the Geographical Institute of Berlin University. Its author is Dr. Ludwig Mecking, who, after a general discussion of the relative influence of currents and wind on drift-ice, deals in full detail with the effects of both agencies in the area in question. From theoretic considerations, supported also by actual instances, he concludes that while pack-ice is influenced in its movements by any wind that is blowing at the time, and while icebergs are of course moved by the wind when currents are practically absent, the wind has but a minor effect in the case of bergs where definite currents exist. In tracing in detail the effects of currents in the Baffin bay area, the writer has naturally to examine minutely the whole *régime* of the circulation, and this section is perhaps the most important part of the memoir, as some of the conclusions arrived at differ from those of previous writers like Pettersson. In particular, he holds that the so-called "North water," south of the entrance to Smith sound, which is remarkable from its comparative freedom from ice, even in winter, is really Atlantic water, which enters Davis strait as an under-current, and comes to the surface in the far north. Others have considered it to be derived from the relatively warm, northward-flowing, West Greenland current; but besides adducing evidence to show that the Davis under-current is maintained for a long distance through Baffin bay, Dr. Hecking contends that, as there seems little doubt that a movement of cold water takes place southward in the vicinity of Cape York, it would be impossible for the warmer water of the West Greenland current to make its way across this to the position of the North water. Another important point is that of the existence and source of the "middle-ice current," running southwards from Melville bay, which Dr. Hecking considers to receive an impulse from three, more primary, currents (including the Davis under-current), besides that which results from the melting of ice in the bay. In summarizing the general system of circulation, he shows that all the various components combine to feed the great Labrador current, which maintains its unity until outside the limits of the area dealt with. The question of the effects of weather conditions is more complicated, and must be referred to briefly only. Besides causing minor variations in the conditions of ice-drift, weather plays an important part in determining the amount of ice present from year to year in the sea off Newfoundland. Dr. Hecking points out that it is necessary to deal separately with the sea-ice and glacier-ice. He finds that the amount of the former varies directly with the steepness of the pressure-gradient, during the months November to January, between South Greenland and the mouth of the St. Lawrence. The amount of glacier-ice depends on more complex causes, the weather of the preceding *summer* exercising, however, a predominant influence. In conclusion, the writer points out the need of research to elucidate (1) the question of periodic variations in the amount of ice; (2) the relation between years of abundant ice in the Iceland and Newfoundland waters respectively.

MATHEMATICAL GEOGRAPHY.

Determination of Areas.—The methods by which the superficial areas of continents, countries, islands, and seas were obtained by geographers in early times, and the history of their subsequent development, form a subject that must always be of interest and importance, and it is striking that comparatively little has been written on the subject. True, brief accounts are to be found in the writings of Humboldt, Vivien de St. Martin, Gelcich, and others, but these are far from complete, or deal with the subject from special points of view. This want has now to a great extent been supplied by two important papers by Dr. W. Schmiedeberg, of Leer, which have appeared in Nos. 3 and 4 of the *Zeitschrift der Gesellschaft für Erdkunde zu Berlin* for the present year, under the title "Zur Geschichte der Geographischen Flächenmessung bis zur Erfindung des Planimeters." The subject is dealt with under the three following sections: (i.) From the time of the ancients to the middle of the seventeenth century; (ii.) From the middle of the seventeenth to the middle of the eighteenth century; (iii.) From the middle of the eighteenth to the middle of the nineteenth century. Although the first section contains useful information as to the earliest approximate methods of obtaining superficial areas, it is with the last two that Dr. Schmiedeberg principally deals, and concerning which he has evidently made a special study. In the forty-two pages which he devotes to these latter he gives a most useful account of the various methods by which estimations and measurements of areas were made, with some of the results obtained, making reference to many authorities from whom he quotes. The third section is exceptionally complete considering the comparatively few pages at the author's disposal, and commences with the date of the publication of Büsching's 'Neue Erdbeschreibung,' in 1754, traces the history of the subject down to the year 1850, giving also a short account of the invention of the planimeter, and finishing with a theoretical discussion of the more exact methods and computations for obtaining measurements of large areas and zones, taking compression and the figure of the Earth into consideration. The history and development of the various methods and devices for obtaining superficial areas corresponds pretty much with the history of geographical discovery, and in the earliest times the results were naturally extremely rough and approximate, not only on account of the methods themselves being at fault, but owing to the erroneous conceptions of the land forms and dimensions of the Earth. As geographical knowledge increased, the demand arose for more exact measurements, and with these demands the methods of obtaining them were forthcoming.

GENERAL.

Vacation Course at the Oxford School of Geography.—The third biennial Vacation Course in Geography was held this year from Tuesday, August 7, to Friday, August 24. There were sixty-five students, more than double the number of 1904. Eleven students came with grants from the West Riding County Council, and one with a grant from the Glamorgan County Council. Each morning lectures were given at nine and at ten in the lecture-room of the University Museum, which was kindly lent by the Museum Delegates. This permitted the preparation of the lecture-room and map-room at the School of Geography for the practical work which occupied the rest of the morning. To avoid overcrowding, the students were divided into three sections, two of which took practical work indoors, while the third carried out exercises in map-making in the field. The work at the School of Geography was carried out by the Reader in Geography and Mr. J. F. Unstead, of Goldsmiths' College, with the assistance of Misses N. E. MacMunn and L. Jowitt, Prof. G. W. Hoke, of Miami University, Ohio, and Messrs. E. F. Elton and H. O. Beckit. The field mapping was under the direction of Messrs. R. Sivewright and B. V. Darbishire. The course was opened by Mr. H. J. Mackinder, who discussed the matter and method of geography, and in illustration analyzed the geographical conditions, physical and political, of the eastern end of the Wealdan area. The other lectures were as follows: four lectures on the Growth of Geographical Ideas, by Mr. C. R. Beazley; four on Greece and Asia Minor, by Mr. J. L. Myres; two on Palestine, by Mr. J. F. Unstead. Eleven lectures were devoted to different aspects of the geography of the British Isles: three by the Rev. E. C. Spicer on its physical features; three on the climate, vegetation and economic natural regions, by Mr. Herbertson; two by Mr. A. M. Bell on the character and origin of the British flora; two on Mediæval Historical Geography, by Mr. P. M. Roxby; and one by Miss MacMunn on the Historical Geography of a County, illustrated by Essex and Cumberland. Five lectures dealt with World Geography: four by Mr. Herbertson, and one, on the distribution of wheat, by Mr. Unstead. One of the most interesting features of the course was due to the presence of three distinguished American professors, who were good enough to lecture on different aspects of the geography of the United States. Prof. Emory R. Johnson, of the University of Pennsylvania, gave two lectures on the Geography of American Transportation. In his last lecture he discussed the probable effects on trade routes of the opening of the Panama canal. Prof. Spencer Trotter, of Swarthmore College, Philadelphia, lectured twice on the Biological Regions of North America. Prof. G. W. Hoke, Miami University, Ohio, gave three lectures on the Social Geography of the Southern Appalachians and their Border. On three evenings there were animated discussions on (*a*) methods of teaching geography in secondary schools (introduced by Miss Cooper, Tutor to Women Students of Education at Oxford); (*b*) appliances (introduced by Mr. M. W. Keatinge, Reader in Education); and (*c*) on syllabuses. Several excursions were arranged to places of geographical interest. Mr. Spicer conducted the students to Shotover; to the Chiltern escarpment; and to Sinodun hills. Mr. Herbertson was leader in expeditions to the Evenlode valley and to the Cotswold escarpment. Mr. Myres showed the students Oxford itself, and the more important exhibits in the Ashmolean and Pitt Rivers Museum.

OBITUARY.

The Rev. George Grenfell.

We regret to record the death, which occurred on July 1 at Bassoko, West Africa, as the result of blackwater fever, of the Rev. G. Grenfell, the well-known pioneer missionary on the Congo, to whom, perhaps, more than to any one man besides, we owed our knowledge of the ramifications of the great interior fluvial system in the years following its first revelation to the world by Stanley.

Mr. Grenfell was born at Mount bay near Penzance in 1849, and educated at King Edward's School, Birmingham. Intended for a business career, he soon decided to give up his prospects in this direction and devote himself to missionary work, being sent out to the Kamerun in 1878, under the auspices of the Baptist Missionary Society. This region was then more of a *terra incognita* than any other part of the African coasts, and during his four years' residence in it, he was able to collect much information on the country and its people which was new to those at home, and which he made generally available in a paper published in the R.G.S. *Proceedings* in October, 1882. Four years before this he had been transferred to the Congo, then attracting universal attention from the efforts of the International Association to open up the unknown interior. He soon proved himself fully capable of making the most of the opportunities for pioneer work thus presented. In August, 1882, he, in company with his colleague, Mr. Bentley, founded the station at Manyanga on the lower river, and soon pushed on towards the interior, where his society, with commendable foresight and enterprise, had decided to place a steamer on the vast navigable system of the upper Congo. The work of transporting this steamer, the well-known *Peace*, through the region of the cataracts, was successfully accomplished by July, 1884, when, in company with his colleague, Mr. J. T. Comber (who had also shared his labours at the Kamerun), Grenfell started on a preliminary trip up the great river. During a five weeks' voyage, the first great tributary above the falls (now known to be identical with the Kasai) was ascended to a point above the junction of the Kwango. Soon afterwards a more extended voyage was made, the most important result of which was the discovery (accidental in the first instance) of the great northern tributary, the Ubangi. This was ascended during the return voyage as far as 4° 30′ N., the great probability of the identity of this river with the Welle of Schweinfurth being thus demonstrated. The important southern tributary, the Lomami, had also been ascended for a considerable distance, as far as 1° 50′ S., and the mouths of other tributaries examined.

These geographical labours were not allowed to interfere with Grenfell's primary work as a missionary, to which he devoted himself with unflagging zeal to the last. But he realized the importance, for his own work no less than that of other Europeans on the great river, of obtaining as clear a knowledge as possible of his field of operations. He therefore continued to take every possible opportunity of adding to our knowledge of the great river system, and during further voyages in the *Peace* and the companion vessel, the *Goodwill*, he was able to throw additional light on the courses of other important tributaries, especially the Kasai, which he ascended as far as its junction with the Lulua. The preliminary results of these surveys were given to our Society in 1886. In 1887 he ascended the Kwango to the Kikunji falls and made a large scale survey. His survey of the perplexing course of the main river, with its infinity of interlacing channels, was continued as opportunity offered, the result being a large-scale chart based on something like 200,000 cross-bearings, 1500 sextant and theodolite observations for latitude, and 1200 for time and longitude. A reduction in ten sections was eventually published in the *Journal* in November, 1902.

Mr. Grenfell had from his boyhood taken a keen interest in geography, and this natural bent no doubt had a good deal to do with the precise direction taken by his life-work. He joined the Society in 1882, and watched with appreciation its efforts to improve the status of the subject in the schools of this country. In 1887 he was the recipient of the Patron's Medal, given in recognition of his important services to geography during his long residence in West Africa.

CORRESPONDENCE.

The Phœnician Periplus of Africa.

As Mr. E. J. Webb groups me with those who appeal to the "Phœnician legend" of the circumnavigation of Africa in support of their view regarding the great antiquity of the Rhodesian monuments, I should like to say that I do not rely at all on the statement of Herodotus, which I none the less hold to be no "legend," but the truthful record of an historical event. In this I am supported by such weighty names as H. Wagner ("Phœnicische Schiffer umfuhren . . . den ganzen Erdtheil, begünstigt durch die Meeres-Strömungen an der Küste von Afrika," 'Lehrbuch,' Book 6, p. 190), E. Reclus ("the first voyage of circumnavigation, mentioned by Herodotus" (vol. 10, p. 27 of my English edition)), Dr. J. S. Keltie ("there is no difficulty in crediting the story" ('Partition of Africa,' p. 8)), and many others, to whom Mr. Webb will scarcely venture to apply his caustic remark about "ignorance of elementary astronomy." I, no doubt, refer to the subject (*Geographical Journal*, vol. 27, p. 338), but that is only to refute Mr. MacIver's paradoxical statement that the ancients had no knowledge of the Austral regions. The story is also mentioned in my 'Gold of Ophir,' p. 94, but only in a casual way, and no argument is built upon it.

Mr. Webb asks, if Herodotus is to be believed about the Phœnician circumnavigation, "why does no one believe him when he goes on to speak of a Carthaginian one?" The reply is that this is just what Herodotus does not do. He nowhere mentions a Carthaginian "Periplus," not even that of Hanno, which may have got as far as the Bay of Bissagos. What he does mention, immediately after the Phœnician story, is that of the ill-starred Sataspes (Book 4, par. 43), which was sent, not by the Carthaginians, but by Xerxes, who impaled or crucified (*ἀνεσκολόπισε*) the unsuccessful prince on his return to court. Why Posidonius is introduced I fail to see. No doubt he tried to discredit Herodotus; but so he did Eratosthenes too, and, in his attempt to correct that great mathematician's calculation of the circumference of the Earth, made a lamentable blunder which retarded the progress of geographical studies for many generations.

A. H. KEANE.

Mr. Webb seems somewhat to miss the point of those who regard the statement that the sun was on the right hand during the supposed circumnavigation as tending to confirm its truth. Surely the natural conclusion to be drawn from it is not so much that the sun was north at noon, as that it was, during the greater part of the day, on the right of the general course sailed. This could only be the case if the navigators reached a part of the coast with a decided trend to the west, which, of course, would not be possible unless they at least approached the southern extremity of the continent. The statement would also seem to point (for all that Mr. Webb says to the contrary) to a position well within the southern hemisphere, for nowhere north of the equator at least would the sun's general position (*i.e.* for any considerable part of the day or year) to the right of an east-to-west course be so marked as to call for special comment. There is no need to suppose that the statement "startled the world." It merely proved unacceptable to Herodotus, who was hardly remarkable for acuteness of perception, and whose whole attitude in the matter was obviously influenced by preconceived ideas.

EDWARD HEAWOOD.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *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.
Col. = Colonies.
Com. = Commerce.
C. R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Is. = Isvestiya.
J. = Journal.
Jb. = Jahrbuch.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological, etc.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
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—Geology. *C. Rd.* 142 (1906): 666–668. **Argand.**
Sur la tectonique de la zone d'Ivrée et de la zone du Strona. Note de Emile Argand.

Alps—Simplon. **Brunhes.**
Les Relations actuelles entre la France et la Suisse et la Question des voies d'accès au Simplon. Par Jean Brunhes. (Extrait de la *Revue Économique Internationale*, Février 1906.) Bruxelles: Office de la Revue. Size 9½ × 6½, pp. 56. *Maps, Plan, and Diagrams. Presented by the Revue Economique Internationale.*
Noticed in the April number (vol. 27, p. 403).

Andorra. *C. Rd.* 142 (1906): 662–663. **Chevalier.**
Sur les glaciers pleistocènes dans les vallées d'Andorre. Note de Marcel Chevalier.

Denmark—Tides. **Paulsen.**
Die dänischen Wasserstandsmessungen und einige Resultate derselben mit Bezug auf den Einfluss des Windes auf die Höhe des Wasserstandes. Von A. Paulsen. (*Meteorologische Zeitschrift*, Hann-Band, pp. 97–110.) Braunschweig: F. Vieweg und Sohn, 1906. Size 12 × 8. *Map and Illustrations.*

France. *C. Rd.* 142 (1906): 600–603. **Glangeaud.**
Une chaîne volcanique miocène sur le bord occidental de la Limagne. Note de P. Glangeaud. *With Sketch-map.*

France—Basses Alpes. *C. Rd.* 142 (1906): 605–608. **Martel.**
Sur le grand cañon du Verdon (Basses-Alpes), son âge et sa formation. Note de E. A. Martel.

France—Coasts. **Joubin.**
Cours d'Oceanographie fondé à Paris par S.A.S. le Prince Albert de Monaco. (Deuxième Année.) Considérations sur la Faune des côtes de France. La répartition des animaux dans ses rapports avec la nature des rivages. Les côtes rocheuses. Par L. Joubin. (*Bull. Musée Océanographique de Monaco*, No. 71 (1906), pp. 26.) *With Maps and Illustrations.*

France—Corsica. *Riv. G. Italiana* 13 (1906): 126–132. **Marinelli.**
Notizia di una grande carta manoscritta della Corsica. Olinto Marinelli.

The map, of whose author only the initials "F. M." are known, seems to date from the first half of the eighteenth century.

France—Geology. *Ann. G.* 15 (1906): 168-172. **Margerie.**
La nouvelle édition de la Carte géologique de la France à l'échelle du millionième. Par E. de Margerie.

France—Jura. *B.S.G. Lille* 45 (1906): 140–152. **Perron.**
Le Jura Central. Par Abbé Perron. *With Illustrations.*

France—Puy-de-Dôme. *C. Rd.* 142 (1906): 663–665. **Glangeaud.**
Les volcans du Livradois et de la Comté (Puy-de-Dôme). Note de P. Glangeaud.

France—Pyrénées-Orientales. **Buffault.**
B.S.G. Com. Bordeaux 29 (1906): 101–107, 128–135, 145–154.
La Forêt de Laroque-des-Albères. Notes et souvenirs d'un forestier. Par Pierre Buffault. *With Illustrations.*

France and Germany. *Contemporary Rev.* 89 (1906): 505–517 **Boulger.**
The Franco-German Frontier. By D. C. Boulger.

Germany. *Petermanns M.* 52 (1906): 49–59. **Rauers.**
Zur Geschichte der alten Handelsstrassen in Deutschland. Versuch einer quellenmässigen Übersichtskarte. Von F. Rauers. *With Map.*

Germany—Bavaria. *Sitz. K.B.A.W. München* 1905 (1906): 447–476. **Endrös.**
Die Seiches des Waginger-Tachingersees. Von A. Endrös. *With Map.*

Germany—Meteorology. **Hellmann.**
Die Niederschläge in den Norddeutschen Stromgebieten. In amtlichem Auftrage bearbeitet von Prof. Dr. G. Hellmann. 3 vols. Berlin: Dietrich Reimer (Ernst Vohsen), 1906. Size 11 × 7½, pp. (vol. 1) vi., 386, and 140; (vol. 2) viii. and 722; (vol. 3) viii. and 872. *Map and Diagrams. Presented by the Author.* [To be reviewed.]

Germany—Meteorology. **Kremser.**
Ergebnisse der Beobachtungen an den Stationen II. und III. Ordnung im Jahre 1900 zugleich Deutsches Meteorologisches Jahrbuch für 1900. . . . Von V. Kremser. (*Veröffentlichungen K. Preuss. Meteorolog. Institute*, 1900, Heft iii.) Berlin: A. Asher & Co., 1906. Size 13 × 10, pp. xxiv. and 123-272. *Map and Frontispiece. Presented by the K.P. Meteorologischen Institute.*

Holland. *Ts. K. Ned. Aard. Genoots. Amsterdam* 23 (1906): 561–568. **Baren.**
De seculaire daling van den grondwaterspiegel op de Veluwe. Door J. van Baren.

Hungary—Winds. **Hegyfoky.**
Ueber Berg- und Talwinde in Ungarn. Von J. Hegyfoky. (*Meteorologische Zeitschrift*, Hann-Band, pp. 59–67.) Braunschweig: F. Vieweg und Sohn, 1906. Size 12 × 8.

Italy.—Piedmont. *C. Rd.* 142 (1906): 809–811. **Argand.**
Contribution à l'histoire du géosynclinal piémontais. Note de Émile Argand.

Italy—Rome—Historical. *J. and P. Asiatic S. Bengal* 2 (1906): 1–7. **Vidyābhūṣaṇa.**
Romaka, or the City of Rome, as mentioned in the Ancient Pali and Sanskrit works. By Mahāmahopādhyāya Satis Chandra Vidyābhūṣaṇa.

Italy—Sicily—Mud-volcanoes. *B.S.G. Italiana* 7 (1906): 198–224. **Crinò.**
Le Macalube di Girgenti in rapporto alla distribuzione geografica degli altri vulcani di fango. Del prof. dott. S. Crinò. *With Illustrations.*

Italy—Vesuvius. *Nature* 74 (1906): 7. **Sjögren.**
The Eruption of Vesuvius. By Dr. H. Sjögren.

North Sea—Fisheries. *J.S. Arts* 54 (1906): 401–409. **Garstang.**
The Fisheries of the North Sea, and the bearings of recent investigations upon the problems of supply. By Walter Garstang.

Russia—Northern Coasts. *Deutsche G. Blätter* 29 (1906): 25–32. **Sibiriakoff.**
Von Archangelsk zu Schiff zur Mündung der Petschora. Von A. Sibiriakoff.

South-East Europe. **Cora.**
Contribuzione all' etnografia della Croazia e della Serbia. Relazione del Prof.

Guido Cora. (Estratto dagli Atti del V. Congresso Geografico Italiano, tenuto in Napoli dal 3 a 11 Aprile, Volume 2°.) Naples, 1905. Size 10½ × 7, pp. 16. *Presented by the Author.*

Spain. *B.R.S.G. Madrid* 48 (1906): 81–104. **Abulfeda.**
Descripcion de España, por Ibrahim Abulfeda, traducida por D. Francisco Molla, con prólogo de D. Antonio Blázquez.

Spain. *La G., B.S.G. Paris* 13 (1906): 325–327. **Briet.**
Les Défilés du Haut-Aragon. Par Lucien Briet.

Spain. *B.R.S.G. Madrid* 48 (1906): 105–132. **Vergara.**
Refranes y cantares geográficos de España. Conferencia de D. Gabriel Maria Vergara.

On popular sayings and rhymes relating to geographical features.

Spain—Asturias. *B.R.S.G. Madrid* 46 (1904): 316–324. **Sela.**
La Cuenca del Nalón en Asturias. Por B. Aniceto Sela.

Spain—Cantabrian Mts. **Labrouche.**
Paul Labrouche. Les Pics d'Europe. Notes vieilles et neuves. Pau, 1906. Size 8½ × 5½, pp. 16. *Presented by the Author.*

Spain—Geology. *C. Rd.* 142 (1906): 752–755. **Depéret and Vidal.**
Sur le basin oligocène de l'Ebre et l'histoire tertiaire de l'Espagne. Note de C. Depéret et L. Vidal.

Sweden—Norrbotten—Shore-lines. **Sjögren.**
Marina Gränsen i Kalix- och Tornedalarna. Af Otto Sjögren. (Meddelanden från Upsala Universitets Mineralogisk-Geologiska Institution, 29.) Stockholm, 1906. Size 8½ × 5½, pp. 14. *Map and Illustrations.*

Switzerland. *Quarterly J. Geol. S.* 62 (1906): 165–194. **Garwood.**
The Tarns of the Canton Ticino (Switzerland). By Prof. E. J. Garwood. *With Maps and Plates.*

Noticed in the Monthly Record (August, p. 177).

Switzerland—Railways. *Questions Dipl.* 21 (1906): 522–535. **Girardin.**
Les projets Suisses. Voies nouvelles et raccourcis. Par P. Girardin. *With Maps.*

Turkey. *Petermanns M.* 52 (1906): 37–38. **Ischirkoff and Kassner.**
Der Devna-See. Morphometrische Bemerkungen von Prof. Dr. A. Ischirkoff, Deutsch bearbeitet von Prof. Dr. C. Kassner. *With Map.*

United Kingdom. *C. Rd.* 142 (1906): 555–559. **Baillaud and Mathias.**
Sur la Carte magnétique des Iles Britanniques. Par B. Baillaud et E. Mathias.

ASIA.

Central Asia. *Petermanns M.* 52 (1906): 41–43. **Friederichsen.**
Nachrichten von einer Reise W. A. Obrutschews im Gebiet des Tarbagatai (Sommer 1905). Von Dr. M. Friederichsen. [See August number, p. 180.]

Central Asia—Tarim. *B. American G.S.* 38 (1906): 91–96. **Huntington.**
The Border Belts of the Tarim Basin. By Ellsworth Huntingdon.

China—Geology. *J. Tōkyō G.S.* 17 (1905): 303–315, 475–492. **Ogawa.**
The Cambrian Formation of North China. By Takudzi Ogawa. *With Illustrations.* [In Japanese.]

China—Sechuan. **Kingsmill.**
The Shanghai Society of Engineers and Architects. 1905–1906. Eastern Szechwan: its Structure and Communications. By Thos. W. Kingsmill. Shanghai, 1906. Size 8½ × 5½, pp. 24.

China—Sechuan. **Legendre.**
Le Far-West Chinois. Deux Années au Setchouen. Récit de Voyage, Étude géographique, sociale et économique par le Dr. A. F. Legendre. Paris: Plon-Nourrit et Cie., 1905. Size 7½ × 5, pp. xvi. and 546. *Map and Illustrations. Price 5 fr. Presented by the Publishers.*

Dr. Legendre's travels were referred to in vol. 25, p. 211.

Chinese Empire—Tibet. *P. Zoolog. S.* 1905, ii. (1906): 302–308. **Bonhote.**
On a Collection of Mammals brought home by the Tibet Frontier Commission. By J. Lewis Bonhote.

Chinese Empire—Tibet. **Duncan.**
A Summer Ride through Western Tibet. By Jane E. Duncan. London: Smith, Elder & Co., 1906. Size 9 × 6, pp. xviii. and 342. *Map and Illustrations. Price 14s. net. Presented by the Publishers.* [To be reviewed.]

French Indo-China. *La G., B.S.G. Paris* 13 (1906): 322–323. **Madrolle.**
La population de l'Indo-Chine. Par Cl. Madrolle.

India—Burma. ——
The Burma Route Book. Part iii. Routes in Western Burma. Compiled in the Intelligence Branch, Quarter-Master General's Department in India, 1905. Size 13¼ × 8¼, pp. 200. *Map. Presented by the Intelligence Branch, Quarter-Master General's Dept., Simla.*

India—Languages. *J.S. Arts* 54 (1906): 581-600. **Grierson.**
The Languages of India and the Linguistic Survey. By Dr. G. A. Grierson.

Japan—Formosa. **[Crowe.]**
Japan. Report on the Gold Mines of Formosa. (Diplomatic and Consular Reports, Miscellaneous Series, No. 649.) London, 1906. Size 9¼ × 6, pp. 10. *Price 4d.*

Korea. *J. Tōkyō G.S.* 17 (1905): 451–457, 550–563. **Sugiyama.**
Agriculture and Forestry in Korea. By Kiyotoshi Sugiyama. [In Japanese.]

Malay Archipelago—Ceram. **Sachse.**
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Phytogeographic Influences in the Arts and Industries of American Aborigines. By Dr. J. W. Harshberger. *With Map.*

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Post-Pleistocene drainage modifications in the Black Hills and Bighorn Mountains. By G. R. Mansfield. *With Maps and Illustrations.*

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United States—Arizona. **Barringer.**
P.A. Nat. Sc. Philadelphia 57, 1905 (1906): 861–886.
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Erläuterung zur Routenkarte der Expedition Steinmann, Hoek, v. Bistram in den Anden von Bolivien 1903–04. Von Dr. Henry Hoek und Prof. Dr. Gustav Steinmann. *With Maps.*

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British New Guinea. **Hunt.**
British New Guinea. Report by Mr. Atlee Hunt. [Melbourne], 1905. Size 13¼ × 8¼, pp. 28. *Map.*
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Magnetic Survey of the Pacific Ocean. Second Cruise. By L. A. Bauer. *Plate.*
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Some Meteorological Results of the Scottish National Antarctic Expedition. By R. C. Mossman. *With Diagrams.*

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Sur de nouvelles mappemondes paléogéographiques. Par A. de Lapparent. *With Maps.*

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Neue Beiträge zur Theorie der Erosionsfiguren. Von S. Günther. *With Illustrations.*

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Di un nuovo ordinamento sistematico delle forme elementari della superficie terrestre. A. Martelli.

Discusses a scheme of classification suggested by A. Issel.

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Beiträge zur Kenntnis der morphologischen Wirksamkeit der Meeresströmungen. Von Dr. Alfred Rühl. (Veröffentlichungen des Instituts für Meereskunde und des Geographischen Instituts an der Universität Berlin, herausgegeben von . . . Ferdinand Frhr. von Richthofen, Heft 8, Februar 1906.) Berlin: E. S. Mittler und Sohn. Size 10½ × 7½, pp. 44.

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Winterwasser der Gletscherbäche. Von Prof. Dr. H. Hess.

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On the Formation of certain Lakes in the Highlands. By Dr. Léon W. Collet and Dr. T. N. Johnston. With a Note on Two Rock Basins in the Alps, by Dr. Léon W. Collet. *With Maps and Illustrations.*

Limnology. *Petermanns M.* 52 (1906): 40–41. **Halbfass.**
Zu der Mitteilung von Dr. Otto Frhr. v.u.z. Aufsess "Untersuchungen über die Erhöhung der Temperatur am Grunde der Seen." Von Prof. Dr. W. Halbfass.

Throws doubt on the conclusions of the writer in question (cf. *Journal*, vol. 27, 408).

Limnology—Seiches. *P.R.S. Edinburgh* 26, 1905–6 (1906): 142–156. **White and Watson.**
Some Experimental Results in connection with the Hydrodynamical Theory of Seiches. By P. White and W. Watson. *With Illustrations.*

Meteorology. *Quarterly J.R. Met. S.* 32 (1906): 141–150. **Dallas.**
Brief Discussion of the General Features of the Pressure and Wind Conditions over the Trades-Monsoon Area. By W. L. Dallas. *With Diagrams.*

Meteorology. **Rotch and Bort.**
The Meteorological Conditions above the Tropical North Atlantic. By A. L. Rotch and L. Teisserenc de Bort. (*Meteorologische Zeitschrift*, Hann-Band, pp. 270–275.) Braunschweig: F. Vieweg und Sohn, 1906. Size 12 × 8. *Diagrams.*

Meteorology—Instrument. *Quarterly J.R. Met. S.* 32 (1906): 11–14. **Newton.**
The Aquameter. By Dr. W. B. Newton. *With Illustration.*

On a new instrument for measuring the amount of moisture contained in air.

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A Rapid Method of finding the Elastic Force of Aqueous Vapour and the Relative Humidity from Dry-bulb and Wet-bulb Thermometer Readings. By Dr. John Ball. *With Diagrams.*

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An attempt to fly Kites for Meteorological Purposes from the Mission Ship attached to a Deep-sea Fishing Fleet in the North Sea. By G. C. Simpson. *With Diagram and Illustration.*

Meteorology—Snow. **Jansson.**
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Discusses the conductivity of snow.

Meteorology—Temperature. *Petermanns M.* 52 (1906): 32–36. **Hopfner.**
Die thermischen Anomalien auf der Erdoberfläche. Von Dr. F. Hopfner. *With Maps.*

See August number, p. 184.

Meteorology—Temperature. *Petermanns M.* 52 (1906): 37. **Supan.**
Der jährliche Gang der Temperatur auf der Erdoberfläche. Von Prof. A. Supan. *With Diagram.*

Meteorology—Temperature. **Woeikof.**
Die Verteilung und Akkumulation der Wärme in den Festländern und Gewässern der Erde. Von A. Woeikof. (*Meteorologische Zeitschrift*, Hann-Band, pp. 186–208.) Braunschweig: F. Vieweg und Sohn, 1906. Size 12 × 8.

Meteorology—Winds. **Abbe.**
The Trade Winds and the Doldrums. By Prof. Cleveland Abbe. (*Meteorologische Zeitschrift*, Hann-Band, pp. 254–260.) Braunschweig: F. Vieweg und Sohn, 1906. Size 12 × 8. *Illustrations.*

Meteorology—Winds. **Hepworth.**
The Relation between Pressure, Temperature, and Air Circulation over the South Atlantic Ocean. Notes with reference to the Monthly Wind-Charts of the South Atlantic Ocean, prepared in the Meteorological Office and published by the Hydrographic Office, January, 1904. By M. W. Campbell Hepworth. London, 1905. Size 10 × 6, pp. 12. *Charts.*

Meteorology—Winds. **Rotch.**
Proof of the existence of the upper anti-trade and the meteorological conditions at lesser heights in the Northern Tropics. By A. Lawrence Rotch. Size 9½ × 6, pp. 4. *Presented by the Author.*

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Historical—Charts. *B.S.G. Italiana* 7 (1906): 263–264. ——
Portolani esistenti nella Biblioteca dell' Accademia Etrusca di Cortona.

Four of these portolani had not previously been described. The dates seem to vary from the fifteenth to the eighteenth centuries.

Historical—Quiros' Voyage. *B.S.R.G. Madrid* 46 (1904): 390–394. **[Collingridge.]**
El Puerto de la Vera Cruz: Sobre la Identificación de los Descubrimentos de Queiroz en las Regiones de su Tierra Austrialia del Espíritu Santo.

Historical—Waldseemüller. *G.Z.* 12 (1906): 165. **Ravenstein.**
Die Waldseemüllerschen Karten. Von E. G. Ravenstein.
Criticism suggested by the Waldseemüller facsimiles.

BIOGRAPHY.

Borgonio. *Riv. G. Italiana* 13 (1906): 142–150. **Mori.**
Tomaso Borgonio e la sua opera cartografica. A. Mori.

Borgonio, a draughtsman and military engineer, born about 1630 or earlier, is best known for his map of Piedmont.

Carletti. *Riv. G. Italiana* 13 (1906): 65–84. **Mondaini.**
Francesco Carletti, mercante e viaggiatore fiorentino (1573?–1636). Appunti del Prof. G. Mondaini. *With Map.*

Richthofen. *Ts. K. Ned. Aard. Genoots. Amsterdam* 23 (1906): 542–559. **Kan.**
Ferdinand von Richthofen als Geograaf. Door Prof. Dr. C. M. Kan.

GENERAL.

Medical Geography. *B.S.G. Italiana* 7 (1906): 90–100. **Maranelli.**
Ancora a proposito della "Carta della Malaria." Nota dell dott. Prof. Carlo Maranelli.

Medical Geography. *B.G.S. Philadelphia* 4 (1906): 29–55. **Ward.**
The Hygiene of the Zones. By Robert De C. Ward.

Year-Book. **Klein.**
Jahrbuch der Astronomie und Geophysik. Herausgegeben von Prof. Dr. Hermann J. Klein. XVI. Jahrg, 1905. Leipzig: E. H. Mayer, 1906. Size 9 × 5½, pp. viii. and 368. *Illustrations.*

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

British Isles. **Johnston.**
The British Isles. Scale 1 : 633,600 or 1 inch to 10 stat. miles. Edinburgh: W. & A. K. Johnston, 1906. *Price, mounted on rollers and varnished,* £1 1*s.* *Presented by the Publisher.*

Forms one of the publishers' Imperial Series of maps. It is bold in style, and intended for the walls of class-rooms. An attempt has been made to indicate hills by shading, but this is to a great extent obliterated by the unnecessarily deep colouring of the counties. The map measures 72 by 63 inches.

England and Wales. **Ordnance Survey.**
ORDNANCE SURVEY OF ENGLAND AND WALES:—Sheets published by the Director-General of the Ordnance Survey, Southampton, from August 1 to 31, 1906.

2 miles to 1 inch:—

Large Series, printed in colours, folded in cover or flat in sheets, 39. *Price, on paper,* 1*s.* 6*d.*; *mounted on linen,* 2*s.*; *mounted in sections,* 2*s.* 6*d.*
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(*E. Stanford, London Agent.*)

Germany. **K. Preussische Landesaufnahme.**

Karte des Deutschen Reiches. Herausgegeben von der Kartographischen Abteilung der Königlichen Preussische Landesaufnahme. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Sheets (plain): 341, Jüterbog; 344, Guben; 369, Spremberg; (coloured) 320, Fürstenberg a. d. O.; 321, Crossen, a. d. O.; 370, Sorau; 371, Sprottau; 458, Altenkirchen. Berlin: K. Preussische Landesaufnahme, 1905–6. *Price* 1.50 *mark each sheet.*

Servia. **Adamovic.**

Pflanzengeographische Karte Serbiens. Von Prof. Dr. Lujo Adamovic. Scale 1 : 750,000 or 1 inch to 11·8 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1906, Tafel 13. Gotha: Justus Perthes, 1906. *Presented by the Publisher.*

An outline map of Servia, showing, by various tints of green, six different vegetation regions, which are designated as follows: Tiefland, Hügel, Submontane, Montane, Voralpine, Subalpine, and Alpine. In addition to the green tinting, red lines divide the vegetation into zones, and the character of the vegetation and the different kinds of trees and plants are shown by symbols. The map itself is a bare outline with few names. If a general idea of the altitude of the various regions could have been given by figures or some other means, it would have been an advantage. The map, accompanied by a short article by the author, appears in the August number of *Petermanns Mitteilungen.*

Sweden. **Sveriges Geologiska Undersökning.**

Sveriges Geologiska Undersökning. Ser. Aa. Scale 1 : 50,000 or 1·3 inch to a stat. mile. Sheets: 120, Falköping; 125, Tidaholm; 126, Ankarsrum; 130, Vadstena; 131, Gällö; 132, Hjo; 133, Vimmerby.—Ser. A1,a. Scale 1 : 200,000 or 1 inch to 3·1 stat. miles. Sheet 5, Karlskrona-Kalmar. Stockholm: Sveriges Geologiska Undersökning. *Presented by the Institut Royal Géologique de Suède.*

ASIA.

Hong Kong. **Topographical Section, General Staff.**

Map of Hong Kong and of the territory leased to Great Britain under the convention between Great Britain and China, signed at Pekin on June 9, 1898. Scale

1 : 84,480 or 1 inch to 1·3 stat. mile. London: Topographical Section, General Staff, War Office, 1905. *Price 2s. 6d. Presented by the Director of Military Operations.*

A good general map based upon the best material, including Mr. Tate's surveys of the Kunlun territory and the Admiralty charts. Hill work is shown by brown contours at 100-feet intervals. The boundary along the shores of Mirs bay and Deep bay is the high-water mark; it has not been surveyed, and, as laid down, can only be taken as provisional.

Turkey in Asia. **Auler.**

Die Hedschas-Bahn. Scale 1 : 3,000,000 or 1 inch to 47·3 stat. miles. *Petermanns Mitteilungen*, Ergänzungsheft No. 154, Tafel 1. Gotha: Justus Perthes, 1906. *Presented by the Publisher.*

AFRICA.

Cape of Good Hope. **Geological Commission, Cape Town.**

Geological map of the Colony of the Cape of Good Hope. Sheet 1. Scale 1 : 237,600 or 1 inch to 3·7 stat. miles. Cape Town: Geological Commission, 1906. *Presented by the Director of the Geological Survey of the Cape of Good Hope.*

This sheet includes the neighbourhood of Cape Town, Stellinbosch, Lady Grey, Robertson, and Napier. The map of which it forms part will give the results of the first attempt at a general geological survey of Cape Colony, and will be of considerable importance. It is clearly drawn and printed, the colours being carefully selected.

Egypt. **Survey Department, Cairo.**

Map of a portion of the Eastern Desert of Egypt. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Sheets: 13 G, 13 H, 14 H, 15 H, 15 J, 16 J. Cairo: Survey Department, 1906. *Presented by the Director-General of the Survey Department, Cairo.*

The region of the eastern desert of Egypt represented by these sheets lies between the parallels of 23° 40′ N. and 25° 10′ N., and between the meridian of 34° E. long. and the Red sea coast. The whole of the area included within these latitudes and longitudes is not yet published, but the above are the more important sheets. Although a considerable amount of survey work has been completed by the Egyptian Survey Department, it is evident, from the many gaps on the sheets, that much still remains to be done; and it will be a great assistance to those whose duty it will be to fill in these blanks to have the triangulation points shown on this map, to which their work can be adjusted. These sheets are preliminary issues, and a note states that the final adjustment to the fixed trigonometrical points has not been made.

Egypt. **Survey Department, Cairo.**

Topographical map of the Giza Province. Scale 1 : 10,000 or 6·3 inches to a stat. mile. Sheets: N.E., 1-3, 1-4, 2-2, 2-3, 2-4, 3-1, 3-2, 3-3, 3-4, 3-5, 4-1, 4-2, 4-3, 4-4, 5-1, 5-2; N.W., 5-1, 6-2, 7-2, 7-3, 8-3, 8-4; S.E., 1-3, 1-4. Cairo: Survey Department, 1905–1906. *Presented by the Director-General of the Survey Department, Cairo.*

Kamerun. **Adams.**

Aufnahmen an der Batanga-Küste und im Lobe-Flussgebiet (Süd-Kamerun), 1905. Von Pater Gust. Alf. Adams. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. *Mitteilungen aus den deutschen Schutzgebieten*, Band xix. 1906. Berlin: E. S. Mittler & Son, 1906.

Togo. **Sprigade.**

Karte von Togo. Bearbeitet von P. Sprigade. Scale 1 : 200,000 or 1 inch to 3·1 stat. miles. Sheet D1, Kète-Krátschi. *Mitteilungen aus den deutschen Schutzgebeiten*, Band xix., 1906, Karte 5. Berlin: E. S. Mittler & Son, 1906.

AMERICA.

Panama. **Topographical Section, General Staff.**

Panama. Scale 1 : 1,000,000 or 1 inch to 15·8 stat. miles. London: Topographical Section, General Staff, War Office, 1906. *Price 2s. Presented by the Director of Military Operations.*

This map has been compiled from the best available material, but most of this is very approximate. The only part that has been properly surveyed is the Canal zone, which has been leased to the United States in perpetuity.

AUSTRALIA.

Queensland. **Fox and Dunstan.**

Geological sketch-map of Queensland, showing mineral localities. Prepared under the supervision of B. Dunstan, F.G.S., Acting Government Geologist, and compiled by H. W. Fox. Scale 1:2,534,400 or 1 inch to 40 stat. miles. Brisbane: Geological Survey Office, 1905. *Presented by the Geological Survey of Queensland.*

A new edition of a useful general geological map which, in addition to the usual colouring for the various formations, indicates by bold red circles and letters the distribution of minerals.

ATLANTIC OCEAN.

Canary Islands. **Sapper.**

Kartenskizze von Lanzarote (Canarische Inseln). Nach der Seekarte von Arlett, nach O. Simony und eigenen Aufnahmen, entworfen von Karl Sapper, 1906. Scale 1:150,000 or 1 inch to 2·3 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1906, Tafel 12. Gotha: Justus Perthes, 1906. *Presented by the Publisher.*

GENERAL.

World. **Bartholomew.**

Atlas of the World's Commerce. A new series of maps, with descriptive text and diagrams, showing products, imports, commercial conditions, and economic statistics of the countries of the world. Compiled from the latest official returns at the Edinburgh Geographical Institute, and edited by J. G. Bartholomew, F.R.G.S., F.R.S.E. Part vii. London: George Newnes, Limited, [1906]. *Price 6d. net. each part. Presented by the Publisher.*

This part contains the following plates: Nos.: 49, Dominion of Canada, industrial, chief imports and exports; 50, 51, North America, commercial routes and vegetation; 52, United States, industrial; 53, United States, industrial, chief imports and exports; 54, 55, South America, commercial routes and vegetation; 56, West Indies. In addition to these maps and diagrams there is the usual continuation of the alphabetical List of Commodities of Commerce, extending from "Palma Christi" to "Rags."

World. **Stieler.**

Neunten, von Grund aus neubearbeiteten und neugestochenen Auflage von Stieler's Hand Atlas. 100 Karten auf 200 Seiten mit 162 Nebenkarten in Kupferstich und einem alphabetischen Verzeichnis aller im Atlas vorkommenden Namen (ungefähr 240,000 Namen enthaltend) herausgegeben von Justus Perthes'. Geographischer Anstalt in Gotha. Lieferungen 13-18. Gotha: Justus Perthes, 1906. *Price 60 pf. each part.*

CHARTS.

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

Charts and Plans published by the Hydrographic Department, Admiralty, during July, 1906. *Presented by the Hydrographer, Admiralty.*

No.	Inches.	
3580 m	= 6·8	Wales, west coast:—Fishguard bay. 2*s*.
3494 m	= 1·42	Norway, west coast:—Giaeslingerne light to Dolm sund, including Folden fiord. 3*s*.
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3579 m	= {0·8, 0·89, 10·00, 1·78, 1·00}	South Atlantic ocean:—South Georgia. Plans:—Royal bay, King Edward cove, Moltke harbour, sketch of Cumberland bay.
3573 m	= 7·34	Plans on the coast of Chile:—Antofagasta, Hornos cove, Coloso cove. 2*s*.
591 m	= 1·46	United States, west coast:—San Francisco harbour (*preliminary*). 3*s*.
27 m	= 3·1	Persian gulf:—Abu shahr (Bushire). 3*s*.
3574 m	= {1·8, 3·6}	Malacca strait. Plans on the east coast of Sumatra:—Langsar bay, Langsar river entrance, Birim river entrance. 2*s*.
3283 m	= 3·63	Plans in the Philippine islands:—Salomague harbour and Lapog bay, Port Kurrimao, and Gan bay. 2*s*.

1288 m = $\begin{Bmatrix}5\cdot9\\2\cdot1\end{Bmatrix}$	China:—Plans in the Yang tse Kiang, Chin Kiang fu, and Silver island, Se Yun Kau creek to Silver island. 3*s*.
3565 m = 0·48	New Zealand, north island:—Bream head to Tepaki point (Mercury bay), including Hauraki gulf. 3*s*.
2527 m = 0·25	New Zealand, sheet iii.:—Mayor island to Poverty bay. 3*s*.
3576 m = $\begin{Bmatrix}7\cdot5\\6\cdot0\end{Bmatrix}$	Fiji islands:—Namuka harbour, Nai Toni Toni and Veivatuloa anchorages. 3*s*.

New Plans and Plans added.

2114 m = 5·0	Baltic entrance:—the Kattegat. Plan added:—Anholt harbour. 3*s*.
1596 m = 5·99	Harbours and anchorages on the coast of Italy. Plan added:—Port Sorrento. 3*s*.
1221 m = 2·50	Labrador:—Harbours and anchorages in Hudson bay and strait. Plan added:—Hebron bay. 2*s*. 6*d*.
1282 m = 3·65	Chile, sheet vii.:—Lora point to Maitencillo. Plan added:—Port Lapallar. 2*s*.
1300 m = 2·43	Plans on the coast of Chile. New Plan:—Port Papudo. 2*s*.
2732 m = $\begin{Bmatrix}0\cdot91\\1\cdot45\end{Bmatrix}$	Plans of anchorages in Bali, Lombok, etc. Plans added:—Grajagan bay, Pangpang bay. 1*s*.
2873 m = 5·7	Anchorages in the Solomon Islands. Plan added:—Ngora fu harbour. 2*s*.

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

Charts Cancelled.

No.	Cancelled by	No.
1410 Wales, west coast. St. Goven's head to New Quay. Plan of Fishguard bay on this sheet.	New chart. Fishguard bay	3580
2842*a* Baltic sea. Plans of Faero and Aarö sounds on this sheet.	New chart. Trælle nes to Aarö sund	3465
2202*b* South Atlantic ocean, western portion. Plans of South Georgia and Moltke harbours on this sheet.	New chart. South Georgia. Plans. Royal bay, King Edward cove, Moltke harbour, sketch of Cumberland bay	3579
1277 Chile. Point Grande to Point San Francisco. Plan of Antofagasta on this sheet. 2346 Plans on the coast of Chile. Plan of Coloso cove on this sheet.	New chart. Plans on the coast of Chile, Antofagasta, Hornos cove, Coloso cove	3573
591 United States, west coast. San Francisco harbour.	New chart (preliminary). San Francisco harbour	591
27 Persian gulf. Abú shahr, or Bushire.	New chart. Abu shahr (Bushire)	27
3283 Plans in the Philippine islands. Port Salomague and approach.	New chart. Plans in the Philippine islands, Salomague harbour and Lapog bay, Port Kurrimao and Gan bay	3283
2376 Harbours in Formosa. Plan of Port Kok Si on this sheet.	— — —	—
1288 China. Yang tse Kiang, Chin Kiang fu, and Silver island.	New chart. Chin Kiang fu and Silver island, Se Yun Kau creek to Silver island	1288
2527 New Zealand, sheet iii. Mayor island to Poverty bay.	New chart. Mayor island to Poverty bay	2527

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

Charts that have received Important Corrections.

No. 871, England, south coast:—Tamar river. 2364, Germany, north coast:—Lübeck bay and Fehmarn belt. 2789*h*, River St. Lawrence (Sheet 21):—Cole shoal

The Geographical Journal.

No. 5. NOVEMBER, 1906. Vol. XXVIII.

A FIFTH JOURNEY IN PERSIA.*

By Major P. MOLESWORTH SYKES, C.M.G.

I.

In the autumn of 1902, after an absence of about two years, during which I had been able to compare the plateau of the Karroo with that of Irán, I reached Bandar Abbás, which port had already served as a starting point for previous journeys. There was a feeling of progress in the Persian gulf, mainly due to the impending inauguration of a quick service, which would bring Bushire to within about five, instead of eight, days of Karachi. Bandar Abbás was, however, not to enjoy the direct benefits of this boon; but three years later its isolation was terminated by the construction to it of a branch cable from the island of Henjám. "Better late than never" is a proverb particularly applicable to this step, and one can now hope that, in spite of its bad climate, the importance of this port will gradually be recognized by the various British firms who trade with Southern Persia.

We steamed slowly to the anchorage before dawn, and I was much struck by the imposing, if forbidding, nature of the scenery, and indeed Bandar Abbás is singularly favoured in this respect. In the foreground, some 3 miles distant, the Arab-like town stretched parallel to the sea-shore, backed by a wide expanse of "painted" desert, if we may apply the epithet used in America, behind which Kuh-i-Ginao and Kuh-i-Nián rise sheer to a height of some 7000 feet, and constitute gigantic portals to the caravan routes which ascend to the Irán plateau. Indeed, compared with Bushire, it may be said that Bandar Abbás is situated close to natural gates leading to Persia, whereas Bushire is

* Read at the Royal Geographical Society, June 18, 1906. Map, p. 429.

set down at the foot of a wall which has to be climbed by means of ladders. In due course of time geographical will overcome artificial advantages, and, unless I am mistaken, Bandar Abbás will ultimately become the chief port of Southern Persia.

Owing to the continuance of plague in India, we were quarantined near Naiband, a hamlet some 3 miles to the east of the port; but, thanks to the kindness of H.M.'s Consul, Major Grey, our discomfort was considerably alleviated. When released, we visited the governor in what was formerly the Dutch factory, but is now the custom house. It is interesting to know that Bandar Abbás occupies a site on or near the mediæval Suru or Shaheru, which, at the epoch when Hormuz was in the hands of the Portuguese, became celebrated as Gombrun, this word being a corruption of the word *gumruk*,* or custom house. In fact, the mediæval history of the Persian gulf reveals a constant change of ports. Under the Abbaside caliphs Siráf (now Táhiri), due south of Shiráz, was the chief emporium. In time it yielded its supremacy to the island of Keis, which, in its turn, was beaten in the struggle for commercial supremacy by Hormuz and Bandar Abbás.

For some years I had been anxious to travel over the section of country between Rudbár and the Persian gulf, which had, I believed, been traversed by the illustrious Venetian, Ser Marco Polo. Consequently there was no uncertainty as to the route to be pursued, and, after overcoming the usual transport difficulties, our party, which included my cousin, Mr. H. R. Sykes, whose photographs illustrate much of this paper, started off on the 300-mile journey to Kermán.

Four marches across the level plain and along the slopes of the Kuh-i-Nián brought us to what is now termed the Navargun pass, which, like all the low ranges near the Persian gulf—its altitude is but 1400 feet—proved somewhat difficult to negotiate, both from the badness of the track and the absence of water. There was also a fair chance of an attack from Bashákirdi raiders, who are now armed with Martinis, and are thus an unpleasant race to meet when lying in ambush in a narrow defile. That there is a fine historical continuity in their proceedings is proved by referring to Ser Marco, who wrote, "And then you come to another descent some 20 miles in length, where the road is very bad and full of peril, for there are many robbers and bad characters about." † On the eastern side of the Navargun pass, Rudán, which is a remote district of Fárs, had to be crossed. Its name has remained unchanged since the epoch of Ibn Haukal, who wrote in the fourth (tenth) century. Down its

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* *Gumruk* is itself a corruption of the Greek κουμερκί. *Vide* 'The Lands of the Eastern Caliphate,' by Guy le Strange, p. 319. This is a work to which I am much indebted, and I have at the same time, by my travels, been able to contribute something to it.

† *Vide* Yule's 'Marco Polo' (3rd edit.), vol. 1, p. 107.

centre flows the Rudkhána-i-Duzdi, or "River of Theft," which is the principal tributary, if not the main stream, of the Mináb river; it is the Nahr-i-Zankan of Mukaddasi, who was a contemporary of Ibn Haukal. In 1898, on my journey across Bashákird, I had camped at Birinti, the village at which the junction of the two bodies of water is effected.*

After crossing the brackish river and the stony valley of Rudán, we reached the district of Rudbár, which forms a part of the Kermán province. Its Governor welcomed me at Gulashkird, the Lashkird of Ibn Haukal, and we rode up a charming gorge lined with date palms, down which ran one of the rare streams which are so highly prized in dried-up naked Irán. Indeed, for the last two years, dread drought, with its attendant, gaunt famine, had held sway in South-east Persia, so much so that the purchase of supplies of forage and food for our caravan was effected with the greatest difficulty. Moreover, owing to the drought, there was no game in Jiruft, and, one way or another, we were glad to hasten across the Jabal Báríz range, the passes of which might be blocked by snow at any moment. In short, as we were travelling at the coldest season of the year, and had much sickness and one death in the party, our arrival at Kermán in the middle of January, without being caught in a blizzard, was a matter of congratulation.

When I had left Kermán in 1900, the Church Missionary Society had but one representative in the shape of a clergyman; but when I returned, I found Dr. J. O. Summerhayes established in a small hospital, and engaged in performing a series of operations which formed the universal theme of conversation. Opinions differ as to missionary enterprise; but there cannot surely be two opinions as to the value of medical work which creates beneficent centres throughout the dark places of the world, and, incidentally, saves the lives of hundreds of Europeans. Apart from that, the hard-working, self-sacrificing life led by missionaries in Persia appeals to whatever is noble in the people with whom they are brought into contact, and, in the East at any rate, it is character which raises or lowers the prestige of the European, who is, and will ever remain, a numerically insignificant unit. Kermán had been suffering a good deal from the two years' drought, but this had fortunately coincided with a boom in carpets, which had materially assisted the prosperity of all classes. As a natural consequence, every one set up a loom, the weaving deteriorated, and a heavy slump ultimately set in, which was, perhaps, just as well from every point of view.

During the summer of 1903, I made a short tour southwards to the summer quarters of the Buchákchi† tribe, which consist of elevated

* *Vide Geo. Journal*, February, 1902.

† The Buchákchi tribe, with its three divisions of (*a*) Sarsaidali, (*b*) Kara Saidali, and (*c*) Khursali, is of Turkish origin, and is numerically weak, only aggregating 150 to 200 families.

rolling downs and charming valleys on both sides of the main range of Southern Persia, known in this section as Kuh-i-Bidkhán. Quitting their breezy uplands, we traversed the Afshár* country, where I was visited by its chief, Hasan Khan, who, in many ways, was a typical patriarch and one who loved the old order of things, when might was right. The old gentleman was full of complaints against the powers that be; but, as members of his tribe were generally the culprits in cases of raiding, one felt that, in this question as in many others, there was more than one point of view. The Afshár tribe is famous as having supplied a sovereign to Persia in the person of Nádir Sháh, who is referred to later on in this paper. Curiously enough, Khorasán, which was their headquarters, has been entirely deserted by the tribe which, while possessing important offshoots in the south of Persia, chiefly occupies the district between Kazvín and Zanján.

My meeting with the Afshár chief had taken place at the hamlet of Hushun, situated near the range of very low hills which divides the basin of the Halíl Rud from that of the great *Kavir*, or salt swamp of Persia, a term to which reference will again be made in this paper. From this point we swung due east to Báft and Bezinján, the latter district being the headquarters of the Lak tribe. The Lak claim our interest in that they are undoubtedly among the most ancient of Persian tribes. One of their divisions is termed "Zand," and they claim that the tribe was constituted the legal guardians of the Zoroastrian scriptures, which are commonly, but erroneously, known as the Zend-Avesta. A member of the Zand tribe ruled Persia after the death of Nádir Sháh, before the rise of the present dynasty. Indeed, but for the folly of his successors, the Zand dynasty, which Kerim Khan founded, might have continued paramount in Persia for many years. To-day the Lak are held, and not without reason, to be inferior to the average Persian. They are also said to be born thieves, whereas the Persian villager is extremely honest. So much so was this the case that, when the Persian guard of the Kermán Consulate was composed of men furnished by the Lak, they were invariably changed. It seems hard to give such a bad character to a tribe which can boast of such an ancient lineage; but, after all, the fact that they have been conquered by alien races tends to show that they furnish but yet another example of that decay which affects peoples as well as individuals. The whole country was in the throes of an invasion of locusts; but, owing to the abundant spring rains which had fallen, the crops were mercifully spared, and

* The Afshár tribe is also of Turkish extraction, and in the Kermán province alone there are 8000 to 10,000 families, the tribe being subdivided into seven subdivisions, viz. (1) Ali Ghazalu, (2) Kásimlu, (3) Jalálu, (4) Amui, (5) Pir Morádlu, (6) Ján Kuli Oshági, and (7) Fársi Madán. The headquarters of the tribe is the Kuh-i-Khabr. In summer they feed their flocks and till the land on its northern slopes, and in winter they move to its southern slopes.

Scale 1:7,000,000 or 1 inch = 110·46 Stat. miles 50 0 50 100

the countless marauders contented themselves with stripping the bushes bare, and thus did but little harm to anything but the grazing. From Bezinján we skirted the Lalazár range as far as Rahbur, whence we turned due north and returned to Kermán before the hot weather finally settled in.

In the autumn Kermán was reached by the Central Persia telegraph line, about which I propose to give a few details. The main Indo-European line runs across Germany, Russia, and North-west Persia to Tehrán. Its onward course from the capital lay due south, and at Bushire cables had been laid down the Persian gulf to Jask. Thence one cable ran to Karachi *viâ* Gwádur; but there was also a land line which, more or less, followed the coast throughout the entire length of Makrán. So far as Persia is concerned, this alignment followed two sides of a triangle, and as cable transmission is slower and more expensive than a land line, it was decided to construct a new line, branching off at Kashán, and thence running *viâ* Yezd and Kermán to Bam. From Bam the Lut, the great desert of Persia, had to be crossed to India. Work was commenced at Kashán in December, 1902, and as far as Yezd, a distance of 237 miles, the rate of progress was 15 miles per week, which, in the Yezd-Kermán section of 220 miles, was increased to 20 miles per week. Kermán was reached in October, and by January, 1904, the line was completed as far as Bam. Here the three-wire section terminated, and, as there was much difficulty in selecting the most suitable alignment across the Lut, a single line was experimentally run between Bam and Kuh-i-Malik-Siá, the extreme north-west frontier of the Indian Empire. Two points, apart from the credit due to Mr. King Wood and his staff, are worth notice. The first is that the carriage of the material slightly exceeded its value; and, secondly, that Bandar Abbás handled more than one-half of the material, whereas the transport on the Bushire-Shiráz route broke down utterly under the strain. To conclude this necessarily brief sketch of a very difficult undertaking successfully carried through, the benefits of this line, from the point of view of the European communities in Yezd and Kermán, are great; but farther east, too, its advent will, I anticipate, prove of value in stimulating and protecting trade, as, owing to the fact that acts of brigandage or illegal seizure can be immediately reported, a telegraph line plays a considerable part in the pacification and development of any wild country which it may traverse, and this is particularly the case as regards Persia and Baluchistán. Indeed, it is not too much to expect that, thanks to its beneficial influence, the long-disused caravan routes between Southern Persia and India may be brought back to life. Baluchistán will also be a great gainer by the new state of affairs, and its inhabitants may possibly develop some commercial aptitude.

II.

In the spring of 1904 a short tour was made to the north-west and west of Kermán, the idea being to visit various parts of my district, which had hitherto escaped me. We first followed the Zarand road to the village of Zangiábád, which lies some 15 miles to the north-west of Kermán city. The whole district is termed *Kavir*, and certainly, as Marco Polo, who also followed this route, wrote, everything is very salt. Where the "Father of Geography" met with no water for three days, there are now villages fed by the underground irrigation channels, known as *kanáts;* but even so the water is brackish and unpleasant

BANDAR ABBÁS FROM THE SEA.

to drink. Indeed, the more one travels in Persia, the more one admires the patient industry which successfully overcomes the grudging hand of Dame Nature, who is here revealed in square miles of level salt-covered soil, on which nothing whatever grows of itself, but where man, nevertheless, manages to produce good crops of wheat, barley, and lucerne.

From Zangiábád we kept more to the west, and, the third day after quitting Kermán, rode into Kakh, the capital of Khinámán, which I had explored in 1900, and where the interesting bronzes referred to in the last paper which I had the honour to read before this Society were found. I had at that time been told of a bronze axehead identical with the one then given me, but surmounted by a lion and a grotesque animal. My host, in the meanwhile, had recovered it from a servant who had stolen it, and I have much pleasure in exhibiting it to-night.

Leaving our camp at Kakh, we rode some 8 miles east to a secluded hill village known as Argus, which is said to be a corruption of Arjásp, king of Turán, who was the great enemy of the founder of Zoroastrianism. Its altitude was considerable, and from the top of the valley the eye scanned terrace after terrace of emerald-green crops. Below, in the dim distance, lay the yellow *Dakk*, as the level area between Bághín and Kabutar Khán is called. This range is said to contain several deposits of coal; but although fuel costs fabulous prices at Kermán, I failed to induce any one to take the question up.

After saying good-bye to our hospitable host, the Khan of Khinámán, we travelled west along the edge of the hills to Dávarán, which lies some 20 miles due north of Bahramábád, on the Zarand route, and, the following morning, we examined one of the wonders of Kermán which I had heard of for many years, but had hitherto not been able to visit. This consists of a circular hole in the desert some 90 feet in diameter, closing to an oval-shaped fissure some 20 feet by 10 feet, which was unapproachable. Stones thrown in by us struck water, which must be of considerable volume, as camels are frequently carried away by it. Water is the first need of Persia, and it is to be hoped that this underground river, known as the Chah-i-Daria, or the "Well of the World," may some day be tapped to the great advantage of the district.

From this interesting phenomenon we rode down to the plain of Rafsinján, a district which I had previously traversed more than once. In mediæval times the whole of this valley as far west as Anár was termed Ar-Rudhán, the chief town of the district bearing the same name being at or near the modern Kushkuh, where there are extensive ruins. Bahrámábad, the capital of the modern district of Rafsinján, was the mediæval Unas, which was visited by Mukaddasi, and was famous for its fullers. To return to modern times, during the last decade there has been an extraordinary increase in the production of pistachios, which form the chief export of Rafsinján. Ten years ago these delicious nuts, which thrive best in salty land, and are grown on small and gnarled trees with a sage-green leaf, were produced to the extent of 120,000 lbs. only, but to-day the output is tenfold. The Rafsinján pistachios are possibly the best in the world, and it is well that there are some compensating advantages in the salt lands of Persia.

We spent three days with the Governor of Rafsinján, who was an old friend, and then travelled south to Páriz, up a valley thick with tamarisks, where, in the late autumn of the same year, we enjoyed excellent hare-shooting. Páriz is the centre of a small hill district bearing the same name, and dividing Rafsinján from Sirján, which latter district is as famous for its almonds as the former is for its pistachio nuts. The district occupies the rolling hills of the great mountain barrier, and in spring and summer it forms a charming retreat from the heat of the plains, the former season revealing a wealth of blossom on a species of bush known as Badám-i-kuh, or "hill almond," which for once justifies the glowing panegyrics of Persian poets. Páriz has, however, the misfortune to be situated on the borders of Fars, and is thus much harried by robbers. One band of these gentry attacked my advance camp, but, receiving a warm welcome, speedily retired, and I espied them in the distance the next day, observing our party from the crest of a hill.

The speciality of Páriz is *gaz*, which merits a description if only for the fact that it is popularly identified with the manna of the Book of Exodus. *Gaz* is the usual name for the tamarisk, which is common in the stony watercourses of Persia. During the summer months a white sticky substance exudes from it, which is collected and cleaned, and, after mixing with flour, and sometimes with honey, is boiled with almonds or pistachios. The result is a delicious sweetmeat, resembling but excelling the best *nougat*. Chardin was, as far as I know, the first traveller to identify the above with the manna of Holy Writ. He describes the *gaz* near Isfahan, which is famous throughout Persia, as follows: "The leaves of this tree about Isfahan do in summer drop this liquid manna, which they pretend is not dew, but the sweat of the tree congealed upon the leaf." * Chardin refers to three sorts of manna, but subsequent travellers have apparently accepted the view that it is the exudation from the tamarisk. However, when I was studying the Koran, my teacher insisted on translating the word *mann*, or manna, by a word referring to a similar exudation from the camel thorn, which is still collected, more especially in the Turbat-i-Heideri district of Khorasán, and forms an object of export. *Turanjabin*, as it is termed, is a yellowish exudation, and is used by the Persian faculty for various diseases. If one reads the passages referring to manna in the Book of Exodus, and takes into consideration the nature of the country, which was then, as to-day, covered with scrub, it seems more reasonable to suppose that the substance was gathered from the bushes surrounding the camp than in the comparatively rare watercourses. Persians insist that *turanjabin* was the manna of Holy Writ, and, as far as I can judge, they are right.

The little town of Páriz must occupy one of the most elevated sites in Persia, situated as it is at an altitude of 7500 feet. Above it lies a carefully tilled valley, which is beautifully wooded with fine old walnuts, mulberries, and willows, and behind is the lofty range of Kuh-i-Mamsar. Quitting this charming little town, perched above the yellow plain of

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* *Vide* 'The Travels of Sir John Chardin in Persia,' vol. 2, p. 35. Chardin mentions that "the best is of a yellowish colour, a large coarse grain, and comes from Nichapour, a country of Bactriana." This is undoubtedly a reference to the manna of the Turbat-i-Heideri district, which touches that of Nishapur.

Sirján, we skirted the Mamsar range in an easterly direction and joined the Sirján-Kermán route at Bid-i-Khab, where we were detained by heavy rain. When progress was again possible, we crossed the Khan-i-Surkh pass at an elevation of 8500 feet. Close by to the north is a remarkable jagged peak, which is visible for about 100 miles from the west. This pass was crossed by Gill, many years ago, in his journey across Persia, and, although thus not new ground, it was particularly interesting to me personally, as it was the only pass in the ranges to the south and west of Kermán which I had not examined. Like the Gudár-i-Kafanu to the south of Kermán, I found it extremely easy as regards gradients, although it is frequently blocked by snow in winter. Heavy hailstorms and bitter weather at the end of April made us glad to reach lower altitudes, and, after passing through Mashiz, which I have previously described, we returned to our headquarters almost simultaneously with the arrival of M. Alexander Miller, the distinguished Russian official who was commissioned to found an Imperial Russian Consulate at Kermán.

III.*

The summer of 1904 was mainly spent at Máhun, and I took advantage of the opportunity to examine in detail its famous shrine, which I have not previously described, but which deserves mention, from its historic interest, and still more on account of its architectural beauty. Indeed, outside the chief cities of Irán there is no shrine comparable to this artistic village tomb, which affords a striking example of the decorative value of ceramics in certain styles of architecture. Tiles are slowly but surely gaining favour at home too, and will, it is to be hoped, aid in dispelling somewhat of the unnecessarily dreary appearance of even the main streets of London, as every shower of rain helps to cleanse them from the grime which is so terrible an eyesore.

To return to our subject, *Seiid* Nur-u-Din, better known by his title of *Shah* Namat Ulla, was the son of Mir Abdulla of Aleppo, in which city he was born in A.H. 730 (1330). He was a descendant of the Imam Bákir, and in his extreme youth began a series of travels, visiting Kerbela, Mecca, and then Samarcand, where Tamerlane treated the saint with high distinction. Ahmad Shah, of the Bahmanid dynasty in the Deccan, also became one of the devoted followers of the spiritual *Shah*, who, after years of wandering, chose Máhun as a retreat for his old age. Many of the saint's prophecies are still current in Asia. One of these, to the effect that Christianity would rule for a century in India, and be succeeded by Islam, undoubtedly had something to do with the Indian mutiny; and a second prophecy, foreshadowing a great battle for the

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* This part of the paper was read before the Geographical section of the British Association in 1906.

supremacy of Asia, which is to be fought on the Dasht-i-Bakwa, about halfway between Kandahár and Herát, is seriously believed throughout the Middle East, and is indeed remarkable if only for the site selected.

We were readily shown over the shrine, which is approached down the stony watercourse bisecting Mahun. This highway is arched over at a particular point, where the building on the left bank forms the residence of the *mutawali*, or "custodian," who is comfortably housed in the quarters erected for the use of pilgrims. On the right bank is the shrine, in front of which two gigantic plane-trees give that particular touch which, in conjunction with bright sunlight, shows tiles at their best. The main gateway is supported by two *minars* with a pre-

A TYPICAL MOUNTAIN TRACK.

dominating blue-green colour, which has a finer general effect than when inspected in detail. The oblong courtyard, which is first entered, together with the gateway, was erected by order of Mohamed Shah of Persia. His cypher appears in imitation Kufic lettering, and runs *Shah-in-Shah Anbiá Mohamed*, or "the King of Kings of the Prophets (was) Mohamed." The date is A.H. 1287 (1871).* A second courtyard, the gift of *Seiid* Nisa, an Indian disciple of the sage, is then traversed, and from it the actual shrine is entered. The blue dome is particularly fine when seen from this second court; indeed, the whole building, consisting of a central chamber supported by galleries, strikes one as

* Mohamed Shah himself died in A.H. 1250 (1834), but the work was carried out in his memory.

being remarkably well proportioned, and is eminently pleasing. The western gallery was constructed by Shah Abbás, and must have been gorgeous at the date of its completion, which, as an inscription over the entrance shows, was in A.H. 999 (1601). Even to-day the frescoes of flowers which survive are beautiful specimens of Persian art. The tomb of the saint is situated beneath the dome, and here we are in the original structure, which was erected by Ahmad Shah, of the Bahmanid dynasty. Again a date was forthcoming, A.H. 840 (1437) being clearly decipherable over the beautiful doors of sandal wood, which now, alas! are falling into hopeless decay.*

The actual tomb is of yellow marble very roughly fitted together, and the floor was, when I first visited the shrine, covered by a superb carpet with a pattern of fine dark brown medallions. The date woven in it was A.H. 1067 (1656), and this unique product of the Kermán looms was purchased for a few pounds by an enterprising Hungarian in 1895. The tomb of *Shah* Khalil Ulla, grandson of the saint, is to the south of the main tomb, and is surrounded by a yellow lattice. The eastern gallery opens on to a lovely courtyard, with a cruciform tank of limpid water containing an interior octagonal tank. As the date shows, both the gallery and two smaller minarets were completed, or more probably restored, in A.H. 1287 (1871) by the Vakil-ul-Mulk, at that time governor-general of the province, who forced the then *Mutawali* to provide the funds. So much for the shrine itself, but its interest does not cease at this point, as in it was deposited the single relic of Achæmenian times which existed in South-east Persia. This was a small pyramid some 6 inches in height, with a tetragonal base, black in colour, and probably carved from a block of limestone. One side was blank, but on the other three was a finely cut inscription in Persian, Assyrian, and the language of Susa, which ran as follows: "I Darius, the Great King, King of Kings, the King of the Countries, King of this land, son of Hystaspes, the Achæmenian." I had heard of the existence of this little pyramid from reading Gobineau's work, but no one seemed to know anything about it at Mahun, and so the matter dropped. My Russian colleague was, however, more successful, and was able to obtain photographs of this interesting stone. But, alas! his success was fatal in one respect, as news of its existence reached Tehrán, whence peremptory orders were telegraphed for it to be sent to H.I.M. the Shah. My latest information on the subject of this Achæmenian relic is that it never reached Tehrán, but disappeared between Kermán and the capital. It is, consequently, most fortunate that it has been both photographed and deciphered before perhaps being lost for good. I understand that magical healing powers were attributed to this little block of stone, and that it was applied to the

* Ahmad Shah ascended the throne in A.H. 825 (1422), and died in A.H. 838 (1435).

bodies of sick persons suffering from any and all diseases with wonderful effect. To conclude this brief description, after repeated visits to the shrine, it possesses a charm for me which is perhaps due to the combination of tiles, greenery, and running water, glorified by the turquoise blue of the Persian sky, which I have never seen equalled elsewhere, and whenever I reflect on an ideal scene in Persia, my thoughts invariably revert to Máhun.

The event of the winter of 1904–5 was the arrival in South-eastern Persia of a commercial mission under Mr. A. Gleadowe Newcomen, which landed at Bandar Abbás in October, 1904. I met their camp at Sirján, and conducted the party *viâ* Páríz and Bahramábád to Kermán, where inquiries were made which kept us fully occupied until the end

THE LALAZÁR RANGE FROM THE SOUTH.

of 1904. At the same time preparations were being made for a mid-winter journey, much of the success of which depends on the adequacy of arrangements to meet all likely contingencies.

It was January, 1905, when the mission started off on the second section of its journey, the immediate objective of which was Khabís, and as I had never visited the Kermán "Riviera," I looked forward to the journey with much interest. The first stage lay almost due east, the stony track running up to the watershed which divides the Kermán basin from that of Khabís. From the top of this pass we looked down a steep and stony valley to the maze of ranges ahead, and as we were at an elevation of over 7000 feet, we rejoiced to find that rooms in a dilapidated house had been secured for us at the stage of Darakht-i-Anjirá. The following morning we were up some hours before daylight, as the march was both long and trying, and, starting in intense cold, we entered a grim and gloomy defile shut in by beetling cliffs which towered thousands of feet above. When dawn, that wizard of the East, lightly touched the peaks while we pursued our way in gloom below, it was almost impossible to exaggerate the beauty of the delicate shading laid on these old-time cliffs, which were more especially impressive after our late experience of rolling hills and wide open valleys. This phase of our stage abruptly ended as the track turned up a side valley, crossed a rough neck, and again descended to a second valley, which was full of the ever green oleander, the bane of all four-footed beasts, not excepting the indomitable ass. We lunched at the junction of two streams, under gnarled plane trees, at Dar-i-Sakhti, or the "Gate of Hardness," a most appropriate name, and tasted water which is generally held to be the finest and lightest in the province. But the pass was still ahead of us, and after a short rest we resumed the march, turning up another valley which grew narrower as we proceeded. Suddenly we heard a confused noise to our right, and to our surprise saw the almost perpendicular hillside thronged with donkeys, albeit so distant were they that we thought at first that we were looking up at a flock of sheep. Riding being almost out of the question, we slowly walked up the tortuous track, and were met by caravans of donkeys laden with golden oranges, all painfully stumbling down the precipitous mountain pass on their way to Kermán. At last the summit was reached, when, from an altitude of 7000 feet, we enjoyed a superb view across a succession of rugged spurs down to the illimitable Lut, which, in appearance, resembled rolling ocean waves, but which, instead of uniting, ever divides. Before sunset we were clear of the hills, and encamped near the first palm grove of the plain. But it was long into the night before our mules with the indispensable bedding arrived, and their advent filled us all with joy, as, after a march of fourteen hours, one of the hardest stages in Persia had been successfully accomplished.

Khabís, the following day, lay but a few miles distant, and recalled the epithets bestowed on Damascus, although, perhaps, the blighting Lut should make the traveller approaching its date groves from the east even more appreciative than the Arab who gazes with rapture on the "Eye of the Desert." The day was exceptionally clear, so much so that I was able to recognize a sharp-cut peak, known as Shah Kuh, which I had observed when skirting the eastern margin of the desert some five years previously, and which must have been nearly 200 miles distant from Khabís. We were met by the governor and principal residents a few miles out of the town, and were warmly welcomed, as Khabís is so close to Kermán that I knew practically every one of importance. In blinding dust we rode through narrow lanes between high walls, and finally found our camp pitched in a lovely grove of oranges and palms.

Khabís, situated at an elevation of 1800 feet, derives its name from an Arabic word signifying a sweetmeat composed of dates, flour, and clarified butter, and possesses a population of perhaps five thousand inhabitants during the winter months, and less than two thousand during the summer. As is so often the case, little is known of its past history, but its antiquity is attested by Ibn Haukal, who described it as "a town on the borders of the desert, with running water and date trees;" other writers refer to it as being populous and an important

RUINS OF SUPPOSED NESTORIAN CONVENT AT KHABÍS.

silk centre, its gardens being celebrated for their mulberry trees. There are also references to the district in Seljuk times, and, until the Kájár dynasty was firmly established, it was held by Afghans, whose descendants still own much of the land. Dates are, of course, its staple product, the output averaging 3,000,000 lbs. annually, 70 per cent. of which is carried across the Lut to Khorasán and distant Herat. But the famous oranges of Khabís, the golden fruit of the Hesperides, delight the English traveller still more than the dates. The parent stock is the *bakrai*, which produced a yellow, somewhat insipid orange. On this is budded the *naringi*, or loose-skinned orange, the lime, and the Seville orange, and also the "Portugale," * or orange generally sold in

* This is, as far as I know, the only trace the Portuguese have left in the language of their long connection with Persia. Cf. modern Greek, πορτοκαλί.

Europe; this latter is, however, somewhat scarce. In any case, Kermán owes much to the oranges of Khabís, which are, indeed, transported to Tehrán, specially packed in cotton for the use of the royal table.

The morning after our arrival, we rode out to the east of the oasis to examine the site of an ancient Khabís. Until eighty to one hundred years ago, the entire population was crowded into an enclosure covering some 50 to 70 acres, and surrounded by a bank and strong towered wall, which could doubtless tell many a tale of Afghan and Baluch foray. Outside are the ruins of various buildings, one of which is known as *nakus*, or *akus*, signifying a rattle, which implement was employed by Christians instead of a bell in Mohammedan countries to summon the faithful to prayers. The chief portion now extant is an octagonal brick tower some 30 feet in height. Inside it are tombs,* the stones of which have been carried off and used as facings to water-channels, and the *mihráb*, or place of prayer, is set towards Jerusalem, and not towards Mecca. The kiln-burnt bricks are not of the size or colour now employed, nor have I seen an octagonal tower anywhere else in Persia except at Burj-i-Aga-Mohamed, in Narmashir. Indeed, it is difficult to dismiss the tradition that this was a Christian convent, when we take into consideration both the name of the place and the orientation of the *mihráb*; and, finally, the tower bears a vague family likeness to illustrations of churches in Armenia, which I have seen. I prefer, however, to leave the decision on this knotty point to a more competent archæologist than myself, noting, however, that the Nestorians firmly established themselves in Persia, and that, in the fifth century A.D., there was a Nestorian bishop of Kermán. But it is for the superb view that I shall ever remember Khabís—set on the brink of the tawny Lut, and displaying the rich colourings of its orange and date groves under a cloudless blue sky, the whole picture being backed by the dazzling snows of the mighty range which rises almost sheer to a height exceeding 13,000 feet, and perhaps once set the limits to an inland sea.

From Khabís we had intended to march due south to Bam *viá* Kashít, the Kashíd of Mukaddasi, and thus keep in the *Garmsir*, or Hot Country; but the question of supplies was paramount, and, in consequence, we were compelled to make for the large village of Gok, situated in an elevated valley parallel to that of Máhun. It is a district where we might expect intense cold, which is so dangerous for natives of India, of whom we had many in our party. Upon clearing the oasis, we marched east-south-east across an utterly arid plain, passing ruins which are said to be all that is left of a Khabís more ancient than the one described. We then swung south and made for the low hills, among which the hamlet of Godiz lay concealed. Behind it we sighted the

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* One of these tombs bore the date A.H. 173 (789).

ruined watch-towers and fort of Andujírd, which is a charming oasis set in a framework of naked sterility, with a gleaming background of salt. Andujírd is an ancient site, and we discovered a tombstone bearing the date A.H. 800 (1397); it is famous for its oranges, which excel those of Khabís. The following morning we entered a maze of deep ravines, some of which, from their sullen gloom, reminded me of Doré's illustrations to Dante's 'Inferno.' In time, however, we rose to the uplands once again, and after a trying march, which included a rise of some 4000 feet, reached the little town of Gok, the Kuk of Mukaddasi. Although it was January and we were in tents at an elevation of about 7000 feet, the weather was comparatively mild, and the musk willow, the earliest of trees in Persia, was out in premature bloom.

We halted a day at Gok, which is famous for its grapes, to allow our advance camp a long start on the route to Tahrud, which was 40 miles distant, the intervening country being absolutely waterless. Fortunately, our loads were light, as otherwise the whole expedition might have broken down, mules being unable to march such a long distance without water when it is hot. We left Gok in the dark, and stumbled down a stony watercourse for some time, until, 7 miles out, the going became good, and we pressed on hour after hour. About 2 p.m. we arrived at the crest of the pass overlooking the Tahrud valley, and by sunset reached our camp, which was only just in, and, as may be imagined, we found man and beast worn out after a march of over thirty hours. The chief anxiety was, however, the fate of the few mules which had been left to follow us with specially light loads; and when they arrived safely late at night one felt most thankful, as a storm in such an elevated district would have been fatal to any weak members of the party.

Bam was reached a few days later *viá* Darzín, and then the winter set in with extraordinary severity—so much so that, as we afterwards heard, the orange groves of Khabís, of Tabas, and of Mazanderán were all ruined. I have already described Bam as being the most easterly town in South-east Persia and some 700 miles from Quetta, the first town on the British side of the frontier, the entire intervening space being desert. It is situated at an altitude of 3600 feet, and the prosperity of its 13,000 inhabitants mainly depends on the henna of Narmashír. In a *Bam Náma*, or 'Chronicle of Bam,' written about three centuries ago, the *Arba* or "four" cities of Bam are referred to as Darzín, Nisá, Chugukabád, and Jezán Khás. Darzín of to-day is surrounded by ruins and choked *kanáts*, but in the twelfth century of our era formed the theme of a glowing eulogy.* It is situated a stage to the north-west of Bam, as mentioned above. The other three

* Cf. 'Ten Thousand Miles in Persia,' p. 215 *et seq.*, for a description of Darzín and Bam.

cities were in the district of Narmashír, which I had previously traversed in two directions. I had, however, been unable to quit the beaten track, and consequently I was delighted to have the opportunity of exploring these interesting sites at leisure.

The oasis of Narmashír—the Arabs termed it Narmasir—lies to the south-east of Bam, and is especially important from the fact that the main route from Bandar Abbás to Seistán and Khorasán runs across it. When South-east Persia was subdued by the Arabs in the seventh century A.D., its hot climate evidently attracted them, and, so far as can be ascertained, Nisá was their headquarters. Our first stage from Bam lay to the south-east, and soon after entering the Narmashír district, we found the ruins of this Arab city, which are even now most imposing. Its fort, occupying the south-west corner, possessed walls 70 feet in height, which is most unusual in Persia; along the top a gallery ran round the wall inside. We camped at Kuruk, 3 miles to the south-east of the once famous Nisa, and thence rode into the hills to examine the *band*, or dam, which was also equally famous. After a ride of 12 miles we struck a wide valley, down which flowed a river, and at a point where a few rows of pebbles diverted part of the water towards Kuruk was the dam, which thus proved to be no dam at all in the usual sense of the word; and yet there was once a dam here, built, it is said, by Tádud *Khatun*, the wife of the founder of the Sasanian dynasty. In any case, it is in response to this river that parts of Narmashír are as green as Sind, and one could only wish that an engineer might be called in to husband the priceless water, which, in flood-time, not only runs to waste, but causes infinite damage.

One feature of Narmashír is certainly the number of its deserted towns. Kuruk, for instance, which Mukaddasi described as a populous city, was only deserted in the nineteenth century, when Afghan and Baluch raids had become less serious, and the peasantry were able to live on the land. Many travellers point sadly to these ruins as a proof that Persia was once more thickly populated than to-day. They are, I think, mistaken, as it is, on the contrary, a proof that more peaceful, and consequently more prosperous, times have set in, as a result of which it is no longer necessary for the entire population of a district to be gathered into a few strongly fortified towns, such as those I am now describing.

From Kuruk we marched due north not far from the right bank of a sluggish reedy stream, which, taking its rise near Nisa, flows past Fahraj and disappears in the Lut. Villages abounded, but the jungle was thick, and nothing prepared us for the importance of the ruins of Chugukabád, or "Sparrow Town," which we traversed a few miles before striking the main Bam-Rigán route at Azizabád. This was the former city of Narmashír, and Mukaddasi, after referring to its dense population and fine palaces, mentions that Khorasán merchants trading with Omán made their headquarters in this city. The area enclosed by its walls must, to judge by its extent, have been sufficient to shelter perhaps eighty thousand people. In the centre was a mound, on which were the crumbling walls which constituted all that is left of the great Kush-va-Ran * fort, but of the celebrated *minar* which once dominated the entire district we saw nothing. From its appearance, Narmashír city has been deserted for centuries, the latest reference to it being by Hamd Allah, who in the eighth (fourteenth) century mentions it as populous. To-day the jungle has gained the upper hand, and not even a hamlet exists on the site of this erstwhile proud city. After clearing these very interesting ruins, which are situated about a mile from the

PALMS AND POPLARS AT BAM.

right bank of the nameless river, we rode through thick jungle to our camp at Azizabád, pleased to have had the opportunity of examining what was, without doubt, the ancient city of Narmashír, which we found, as indicated by the Arab geographers, occupying a site half-way between Bam and Fahraj.

The next day we enjoyed some good francolin shooting, and camped at Burj-i-Aga-Mohamed, which was built by an Afghán chief. Indeed, until the Kájár dynasty was firmly established, Narmashír, like Khabís, was held by Afghan adventurers, Fahráj being the last

* This word apparently embodies the Kuch, who are often referred to in conjunction with the Baluch, and the Ran are the Rinds. Probably the fort was named after the raiders who were to be guarded against.

stronghold from which they were ejected, as late as three generations ago. One of my numerous Persian friends owned much of the property around the *burj*, or tower, and informed us that we were in the centre of the henna land. This valuable dye is sown in April, and most carefully watered for a year. It is then planted out, and still most carefully watered and manured for a second year. The plants, which somewhat resemble tea bushes, bear for an average of fifteen years, and the output of Narmashír is 1,800,000 lbs. per annum in a normal season. Owing to lack of enterprise, the crop is exported to Yezd, where it is ground by primitive stone mills. Thence it is sent all over Persia, and even penetrates to the distant Caucasus. Henna is used more especially for dyeing the nails of good Mohammedans, and, mixed with indigo, makes a grey beard glossy black. The Shah's horses have their tails dyed with the pure article, producing a curious effect, which will long be remembered by Londoners of the last generation.

Rigán is to-day the most important centre in the district of Narmashír, but it is little more than a fortified caravanserai, and possesses no commercial importance, which fact is somewhat remarkable, and is perhaps attributable to the very low type of the inhabitants of the districts, whose wants appear to be as limited as those of the Baluchis. To the south, some 3 miles distant, are the ruins of Jezán Khás, the fourth city of the district in Safavi times, but unknown, so far as I can ascertain, to the Arab geographers. Its plan closely resembled that of Chugukabád, there being a strong city wall with an interior keep, but the scale was smaller. This concluded the exploration of the ancient sites of Narmashír, and, as everywhere we enjoyed good shooting, and there was thick jungle in places, the members of the mission, who were painfully affected by the treelessness of Persia, voted the district the best and most fertile that they had struck since leaving Bandar Abbás.

We were, as mentioned before, on the main eastern artery of commerce, which, from Rigán, runs due north across the Lut to Neh.* We were naturally anxious to examine the pass by which the main range is crossed, and Rudbár, which lies to the south of this great mountain barrier, was consequently the next district to be examined. Supplies were again a difficulty, but by engaging thirty camels to carry forage and flour, we hoped to tide over that difficulty, and, as heavy snow had fallen, the water question was for once not acute. Leaving Rigán, we skirted Jezán Khas and modern Sangabád, a few miles beyond which the jungle ceased, and we made for a gap in the range up one of the huge gravel slopes which are such a feature of Persia. The stage was, however, 34 miles in length, and as our mules lost the

* *Vide* Trade Report for Khorasán, 1904-5, where this question is fully dealt with by me.

way, we were lucky to be able to settle down by midnight. The following day a gale was blowing, but we had to move on, and, after a comparatively easy rise, reached the summit of the Godár-i-Gíshu, or "Pass of the Oleander," at an elevation of 4100 feet. A few miles further west is the Godár-i-Sabzu, which is said to be equally easy. The importance of these two passes lies mainly in the fact that, owing to their comparatively low elevation, they are never closed by snow, and if South-east Persia be ever developed, they will become better known than to-day. It is of considerable interest to know that these rocky passes were crossed, more than 2000 years ago, by Krateros who, quitting the main army of the Greeks in the delta of the Indus, marched from Sind *viâ* Quetta to the Helmand, which he followed down to Seistán.

THE MIL-I-FARHÁD TO THE SOUTH OF THE GODÁR-I-GÍSHU.

He thence crossed the Lut *viâ* Nasratabád (Ispi), and joined Alexander the Great in the valley of the Halil Rud, "bringing the rest of the army and the elephants." * We camped on the south side of the pass, underneath an extraordinary rock, which is one of the wonders of the province. It is composed of grey, deeply indented limestone, and rises in the shape of a natural cone to an altitude of about 1000 feet. At its base is a shrine, which pilgrims occasionally visit, but it is for its shape that the Mil-i-Farhád is famous. The name contains a reference to Farhád, the legendary engineer of Khusru, and the lover of the renowned Shirin. From this stage, two long marches west across the level valley brought us to Bijenábád, in Rudbár. Throughout, supplies

* Arrian, vi. 27, 3. *Vide* 'Ten Thousand Miles in Persia,' xiv. 171.

were a cause for anxiety, as the district is inhabited by nomads, who do not store *kah*, or chopped straw. To add to our troubles, one of our horses died from the effects of oleander poisoning. *

Rudbár, which I have already described, was in the throes of revenue collecting. But we scraped together some forage and flour, and, after being detained by heavy rain, marched slowly up the valley of the Halíl Rud to the district of Jiruft, where our difficulties ceased. We crossed the river to the right bank, and enjoyed the best francolin shooting in which I have ever participated, as one day with three guns we bagged over eighty head of game in two and a half hours. After exhausting our supply of cartridges, we recrossed the river in flood, when it justified its ancient name of Div Rud, or "Demon Flood," and made a flying visit to the upper reaches, where the hills would favour a modern dam, but where we found no traces of an ancient one. This concluded our work in this fertile valley, and, bound once again for Kermán, we crossed the Rudkhána Shur, which flows down from Dilfárd, and was also in flood. One baggage animal was drowned; but we finally reached the camping-ground at Saghdár with our kit intact, although a part of it was soaked.

The next day we started to march through the finest scenery of its kind in South-east Persia. East of us towered snow-clad peaks, and westwards we looked across a delightful valley covered with brilliant flowering scrub, to other giant ranges, and to the north Kuh-i-Hazár rose up in all its stately majesty. Thrice have I travelled along this route, and on each occasion the sense of pure pleasure which comes from perfect scenery has filled my mind with the desire to retrace my steps and loiter in such surroundings. Maskun, situated in the heart of the range, is connected with a pathetic story. Forty years ago there was an unusually heavy fall of snow, and, upon the road being cleared, the corpse of a European was found firmly wedged into the fork of a wild pistachio tree. The then Governor-General made inquiries, but in vain, and to this day who the solitary traveller was remains a mystery, and one which is hardly likely to be cleared up. We crossed the range by the Deh Bakri pass, 7380 feet above the sea (it is thus more than 3000 feet higher than the Gishu pass), and revelled in the superb view, which ranged from fertile Jiruft to the south, and covered league upon league of dull yellow Lut to the north. From Jiruft, as mentioned above, I was on a familiar route, and a few days after crossing the Jabal Bariz we reached Kermán, thus completing a most successful tour, during which every district of importance to the east and south-east of Kermán had been visited by the mission.

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* Cf. Strabo, bk. xv. cap. ii. 7: "There was a plant resembling the laurel, which if eaten by the beasts of burden, caused them to die of epilepsy, accompanied by foaming at the mouth." This description is most accurate.

IV.

In February, 1905, I received instructions to the effect that I was appointed to Meshed, and the ensuing weeks were among the busiest that I have ever spent, as not only had I just returned from a long tour, which invariably means an accumulation of work, but my small office had, in addition, to cope with the accounts of the Commercial Mission. Farewell visits, too, took up much time, and I realized fully how great was the wrench of leaving Kermán when some of my oldest friends said that we should never meet again, and felt that, humanly speaking, this was the truth. However, there was little time for reflection, and at the end of March we said good-bye to Kermán, after a connection lasting for twelve years, which is not, I hope, finally severed.

The direct route to Meshed across the Lut was ruled out of court, as I was travelling *en famille*, and no carriage can cross it, whereas a brother of the Governor-General had reached Kermán from Khorasán but a few months previously *viâ* Yezd and Tabas, and this fact determined the route we were to follow. As far as Yezd I was on familiar ground, but the journey across the Lut from that town was new to me, and promised to be of considerable interest.

During the nine years which have elapsed since I first had the honour of reading a paper before this Society, I have been constantly studying the great desert of Persia, which stretches in a south-easterly direction from close to Tehrán to the British frontier, a distance of perhaps 800 miles. Its width varies considerably, but it is never much less than 200 miles. I propose on the present occasion to deal with the subject somewhat more fully than I was competent to do at a time when I had only traversed it in one direction, whereas I have now either crossed or skirted it in almost every part. I am, unfortunately, not competent to discuss Persia from the point of view of a geological expert; but we have the authority of Blanford that during the Eocene period much of Baluchistán and Persia were under water. Mr. Huntington, to whose valuable and suggestive work on 'The Basin of Eastern Persia and Seistán' I would also acknowledge my indebtedness, considers that there was apparently oceanic connection between the Arabian sea and the Samartian sea, covering the Caspian basin, during which period the interior of the Irán basin formed a portion of this sea. We do not, however, know when the sea retreated; but it is evident that, as long as it remained, the climate of Asia must have been much moister than to-day. All this is, however, prehistoric, and has only been referred to as a necessary introduction to a description of the country as it is to-day, and, before proceeding farther, a brief reference to the physiography of Persia seems to be desirable.

The Irán plateau, as it is termed, but perhaps with little exactitude, consists of two great inland basins, the westerly one including the major portion of Persia. The easterly basin, which is mainly formed by the areas drained by the Helmand and Hari Rud, includes most of Afghanistán, part of Baluchistán, and only the eastern provinces of Persia, chief among which in geographical interest is Seistán. These vast basins are enclosed between two ranges, both of which take their origin in "the Roof of the World," as the Pamirs are picturesquely termed. The northern ranges run at first approximately south-west under the names of the Hindu Kush, the Kuh-i-Bába, and then the classical Paropamisus, the latter being the range to the north of Herát. Where this range terminates, a gap in the giant wall, which is some 1500 miles in length, allows the Hari Rud, known in its lower reaches as the Tejend river, to escape to the deserts of Turkestan. In Khorasán, the Kara Dagh is the name for the range north of Meshed, the rugged defiles of which are referred to in this paper in connection with my journey to the famous fastness of Kalát-i-Nádiri. Further west, in its central section, the Elburz range, by which name it is then known, separates Persia from the Caspian sea, throwing up the stupendous peak of Demavand, which rears its glorious cone to some 20,000 feet above sea-level, and is the joy of all lovers of beauty at Tehrán. The remaining section maintains a considerable elevation, albeit the passes are less difficult, and, trending to the north-west, this mighty barrier terminates in the Armenian plateau, which boasts of legendary Ararat, itself a peak some 17,000 feet in altitude.

The southern series of ranges is less imposing, but the chains are much longer owing to the fact that they form a rough semicircle to the diameter of the northern ranges. From the Takht-i-Suliman, the legendary home of the Afghans in Zhob, to the Kermán province, the ranges, which run at first south-west and then parallel to the Arabian sea, are more remarkable for their ruggedness than for any exceptional altitude. South of Kermán, however, are the Hazár and Lalazár ranges, both of which I climbed, and found the altitude to be about 14,000 feet, and, although this record is not exceeded, the ranges remain lofty until their regular north-west trend unites them to the northern series in the Armenian plateau.

With this brief introduction, which proves how completely the Irán plateaux are surrounded by mountains, we return to the Lut, whose existence is summed up in the one word "aridity," which aridity, it is to be noted, lies like a blight over the whole land. In more favoured lands, basins formed by upheavals are quickly converted into valleys, down which rivers rush to the sea. In Persia, on the contrary, the water forces were wholly inadequate to keep pace with the upheavals, but withered away before forming trunk river systems; in consequence, the scanty streams are lost in basins, known as *Hámun*, within which are immense gravel slopes, salt lakes, and square leagues of sandhills. In no case does this drainage reach the sea. Observations for rain have been taken at the Meshed Consulate General for several years, and show that the average rainfall is only about 7 inches. The snowfall is now being recorded for the first time, and may average 3 inches.* At Tehrán, the average for the last five years of both the combined rain and snow fall is 9·19 inches.† These figures thus fully establish the arid nature of Northern Persia, which yet boasts of a heavier rainfall than South-east or Central Persia. The results of aridity are well described by Prof. Davis, and I cannot do better than quote him as follows: "When maturity, in an arid country, is so far advanced that the initial highlands of deformation are greatly dissected and degraded, we may picture the region as consisting of three kinds of surfaces: first, a central plain of aggradation, with fine-textured waste towards its centre, but with coarser-textured waste around its margin; second, degraded, rock-floored plains veneered with irregular patches of gravels and sands, and graded so as to slope gently to the central aggraded plain; and, third, residual mountains and hills, composed chiefly of those rocks which best resist arid erosion." ‡ Nor should the power of the wind be overlooked. In a humid land, vegetation protects the soil; but, in Persia, the entire surface of the land is exposed to erosion, and it is by no means unusual to march over solid rock with but the very scantiest covering of gravel or sand, washed across it by flood action. From one point of view aeolian forces have more power than water, as the latter is checked by the fact that, however powerful it may be, the sea is its ultimate bourne, whereas wind can scoop out as it lists, and there is less ultimate limit to the degradation it can cause to a surface which is suited for its operations.

Of minor importance, but yet not to be neglected, is the enormous range of temperature in this treeless country, which is a powerful ally to the wind and other disintegrating forces. There is, I imagine, no country where the extremes are greater, and thus another and a potent force is ever weakening the rocks and co-operating with rain and wind for their destruction. Again, Persia is not only continental, but is surrounded on every side by countries all cursed with aridity. Thus there is little moisture in its wind. Owing to the extraordinarily complete series of ranges referred to above, most of such moisture as there is discharges on the outer wall. This is particularly the case in the Caspian provinces, where there is an excess of humidity, which

* I would mention that a small meteorological observatory is about to be constructed at Meshed, at which wind observations will be added to those already taken. It will be interesting to see whether the climate of India is in any way affected by that of Central Asia.

† In 1901, 5·28"; 1902, 9·52"; 1903, 10·38"; 1904, 13·02"; 1905, 7·76".

‡ *Vide* "The Geographical Cycle in an Arid Climate," in the *Geographical Journal*, vol. 27, No. 1, of January, 1906.

makes it a hotbed of fever, whereas little or no moisture crosses the Elburz range to fertilize the plateau situated to its immediate south; in fact, the difference could not well be more striking. Yet another factor is that the basin-nature of the interior of Irán supplies no ranges of sufficient importance to attract clouds, and as the prevalent wind is from the north-west, *i.e.* from a cold to a hot region, no pressure is put on what clouds there are to discharge their contents. Nature has indeed been the reverse of lavish with her gifts, and man has systematically aggravated this unfortunate condition of affairs by ruthlessly burning every tree or bush and never attempting to replace the loss by planting. To-day, the coal deposits of Persia being scarcely touched, fuel is supplied either from fruit-trees grown by means of irrigation, or by scrub, with the result that there is no more treeless country in the world than Irán.

To conclude this brief sketch of the origin of the Lut, so far as can be judged, both Europe and Asia are drying up, a question dealt with in a paper termed "The Desiccation of Eur-Asia," by Prince Kropotkin.* It is there clearly demonstrated that, more especially in Central Asia and in Russia, there has been an alarming decrease in the rainfall, and that swamps and lakes are disappearing at a comparatively rapid rate. Recent Antarctic exploration also shows that there has been a noticeable recession of glaciers in the comparatively short period which has elapsed between the Ross and Scott expeditions. To summarize, the Lut is but the central and most arid portion, or, in other words, it is the most forcible expression of a generally arid country. Its aridity is caused by the general desiccation of Asia, by its continental position, and by the basin-like nature of the country and the prevalent winds. As if these disadvantages were not sufficient, man has destroyed almost all the forests which, until some few centuries ago, existed in various parts of the country. Finally, this aridity is increasing, and, except to an inappreciable extent, cannot be remedied by man.†

The horrors of the Lut are vividly described by various travellers; but by none better than by Mukaddasi, who once took seventy days to cross it, and refers to the ever-barring ranges, the dangerous salt swamps, and the extremes of heat and cold. At that date, and indeed until the last generation, the Baluchis, "a people with savage faces, evil hearts, and neither morals nor manners," as Mukaddasi calls them,

* *Vide Geographical Journal*, vol. 23 (1904), p. 722.

† In March, 1906, I received a letter from Dr. Sven Hedin, whom in Oriental phraseology one might well term the "Son of Geography." He wrote from Tabas that he had traversed the Lut from Tehrán to Jandak, whence he had crossed the Great Kavir from north to south. We may thus hope for a full scientific account from his pen of this same desert. Dr. Sven Hedin has since completed his examination of the Lut as far as Seistán.

terrorized the desert, and those whom they captured they did to death "as one would a snake, putting a man's head on a boulder and beating upon it until it be crushed in." This policy was adopted on the theory of dead men telling no tales, and the barbarous fashion of the murder was justified on the grounds that it saved the edge of their swords.

I now propose to make a few remarks on the nomenclature of this funereal waste. The Arab writers almost invariably used the term *mafáza*, which is an Arabic word signifying a wilderness.* Persians too, generally speaking, employed the same term, which was, however, in time replaced by that of *Kavir*, or *Kafa*, as it is pronounced in Southern Persia. The etymology of *Kavir* is uncertain, but it signifies a salt desert. Until quite recently, this word appeared on all Persian maps as the designation for the great waste which occupies the heart of Persia. To-day, however, *Kavir* in its turn has been replaced by the word *Lut* as the one general expression, *Kavir* being reserved for such portions of the desert as are salty. In the north huge expanses are known by this term, and also separate tracts, as, for instance, the wide strip which runs from the south of the basin of the Zenda Rud past Sirján, in the Kermán province, and which has already been referred to above; in fact, all over Persia these *kavirs* are numerous.

The origin of the word *Lut* is interesting, and deserves our close study. In various parts of the desolating area guides tell the traveller of ancient cities which were destroyed by the Almighty with fire from heaven. Upon inspection, it is evident that these so-called "cities" are but bluffs worn and fretted by the action of the fierce winds and rain until they—

> "Formed turret, dome, and battlement,
> Or seemed fantastically set,
> With cupola or minaret." †

Here, in my opinion, the origin of the word is to be sought, and surely no more fitting name than that of *Lut*,‡ as Abraham's nephew is termed in the east, could possibly be connected with a waste which extends so far and is so terrible that its blighting influence separates provinces more effectually than a stormy sea or any range of mountains. It is only fair to state that some Persians derive the word from *Lut*, which signifies "naked;" but the above is, I think, the true derivation. Before arriving at the conviction that I was correct in what I have stated above, I not only questioned many Persians likely to know, but I also consulted various modern Persian works on geography. In the

* Násir-i-Khusru, who, in A.H. 444 (1052), travelled from Náin to Tabas, refers to the desert as the *Biyaban*, or "Waterless Land."

† "The Lady of the Lake."

‡ I would add that the story of Lot is well known to Mohammedans from the Koran, and that, as may be supposed, their language has been profoundly affected by it. "In the year of Noah" is also an expression taken from the Koran, which is in common use.

older ones, written perhaps twenty years ago, the word *Lut* never appears. However, in an atlas published some seven years ago the word *Lut* is rightly shown as the one general name. Its spelling is that of the theory rejected by me. I next turned to Arabic works, and in the modern Arabic Geography, known as the *Annukhbat-ul-Azarhia*, or the "Fresh Shoots," and published in 1903, the word *Lut* is printed so as to corroborate my views.* Geography is not much studied in Persia, and philology a good deal less, and I think that this somewhat obscure question of nomenclature may now be considered to be finally settled.

To the north-east of Yezd the Lut is narrower than at any other point, and, in consequence, a caravan route has from the earliest times undoubtedly crossed the desert in this section. The north-west trend of the ranges of Persia is its best known orographical feature, and as our direction lay north-east, we regularly crossed range after range at right angles, each range decreasing in height as we neared Tabas. At distances sometimes exceeding 40 miles are *robat*, or fortified villages, where scanty supplies can be purchased at high rates. Between them there is an occasional *áb-ambár*, or water-tank, which is probably full in the spring and empty in the autumn. The monotony of these sterile ranges, the drainage of which runs south-east to be lost in the Lut, is more than trying; but yet many of the villages along the route are flourishing, as their inhabitants possess a monopoly of supplies.

Four sowars and a hospital assistant had been despatched from Turbat-i-Heideri to replace our Sikhs, from whom we parted with great and—I believe—mutual regret at Yezd. To give an idea of what the Lut actually is, I propose to describe a typical march, and have selected that from Kharána to Sághand, a distance of 37 miles. Kharána, I would mention incidentally, is the Khazána of Ibn Khurdadbih, the earliest of the Arab geographers, who wrote in the third (ninth) century.

We started off, as usual, about an hour before dawn, or, in other words, as soon as it was safe for the carriage to move. A caravan of pilgrims, bound for Meshed, was also afoot, and it was most interesting to watch the motley procession. Men of position rode horses, their wives being packed into *kajáva*, which are two square crates slung across a mule. The poor rode donkeys or walked, and every now and then a prayer would be started and repeated with genuine fervour by all present. A few sleek *mullas* were particularly assiduous in reading prayers, mainly to ladies, as the caravan moved along in picturesque confusion; but there were no signs of any one

* Lot, the nephew of Abraham, is written لوط. The word signifying "naked" is لوت.

being on the alert, and, as the event proved, their remissness was severely punished. Kharána is picturesquely situated, and has a curious aqueduct. It is surrounded by much broken ground, which, although pleasing to the eye, was very trying for the carriage, the wheels of which were lashed together, while villagers were engaged to support it on each side. With much difficulty it ultimately slid down unbroken into a stony but wide river-bed, where our guides informed us that there were no further obstacles ahead, and we paid them off. Four miles from Kharána we passed a round watch-tower, inhabited by a single family, with a tiny strip of cultivated land, and, quitting the watercourse 3 miles lower down, we skirted a huge gravel slope, which stretched for many miles up to a low range of hills and was typical of the Lut, being absolutely naked, sun-scorched, and desolate. At 18 miles we crossed the level salty valley bottom, which is also typical, and began to rise steadily, the ruined caravanserai of Rizáb being visible in the distance. Approaching it, at some 24 miles, we found it to be situated close to a rough defile, by which the road from Náin joins that from Yezd. Rizáb is sinister both in appearance and in fact, and only a year previously my cousin, Mr. Herbert Sykes, had had his advance camp attacked at this spot. I took all possible precautions; but as it was out of the question for the carriage with my son, who was less than two years old, to keep with the mules, we were obliged to split up the party, and consequently suffered much anxiety. The four willing carriage horses and our own riding-horses required rest and a feed after travelling so many miles across the stony waste, and we consequently halted at Rizáb for some hours with a sowar on guard, until our mules overtook the carriage. We then allowed them an hour's start, and proceeded on our journey, accompanied by a second caravan of pilgrims which we had overtaken at Rizáb. The coachman from his high seat said that he saw men watching us from the gorge, and the event proved that he was right, for two hours after our departure a gang of some twenty robbers swooped down on Rizáb and captured the caravan with the pious ladies and the sleek *mullas*. Every one was bound and carefully searched, and, after being relieved of most of their clothes and all their valuables, the disconsolate pilgrims were released.

(*To be continued.*)

THE INDIAN OCEAN.

BEING RESULTS LARGELY BASED ON THE WORK OF THE PERCY SLADEN EXPEDITION IN H.M.S. "SEALARK," COMM. B. T. SOMERVILLE, 1905.*

By J. STANLEY GARDINER, M.A., Fellow of Gonville and Caius College, and Demonstrator of Animal Morphology in the University of Cambridge.

WE may at this point, before proceeding to the Seychelles, consider some of the bearings of our cruise on the formation of coral reefs.

1. Starting with the land, we are met everywhere with evidences of a change of level having been largely responsible for its formation. This is true also of the groups of atolls in the Pacific, and seems to be a regular phenomenon in the Indo-Pacific. At the same time, we have indubitable evidence of certain islets on coral reefs having been formed by the piling up of reef material. The change required varies from 10 to about 25 feet, and, while admitting that in places such a change of level could be accounted for by the attraction of the surrounding continents on the water, we consider that it must rather be explained by some general phenomenon. This must be left to other investigators, but we draw attention to the matter as one worthy of study.†

2. The lagoon of every atoll we visited seemed to be increasing in size. Sir John Murray, in an unpublished comparison that he made of the charts of 1837 and 1885 of Diego Garcia, which he has favoured us with, points out that in the part recharted the lagoon would appear to have increased about 2 square miles in size. Without discussing this result in any way, I may merely note that we found the whole lagoon shore of Diego Garcia to be fringed with low cliffs, or with fallen and undermined cocoanut and other trees. In Salomon there were indications of land having extended out to the edge of the present lagoon reef, and in St. Joseph the increase was no less clear. Elsewhere the evidence all pointed in the same direction, and a rule seems to be established for the whole region.

3. The fringing flat around the seaward sides of the islands would appear generally to have been formed by an outgrowth and upgrowth of corals and nullipores, and to be everywhere growing outwards; off St. Pierre and Eagle it was, however, formed by the cutting down of the present islands. Above 5 fathoms it is being built mainly by nullipores; but below, down to 30 fathoms, of reef corals, which are being simply cemented by these algæ.

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* Read at the Royal Geographical Society, June 11, 1906. Map, p. 424. Continued from p. 332.

† If we suppose the south polar regions to have been free from ice in recent times, and to be now covered with 109 feet of ice (or 100 feet of water), we find that, supposing no change to have taken place meantime in the topography of the world, about 5 feet of water would have been withdrawn from every part of the ocean, reducing it by the same amount in height.

SOUTH ISLAND, FARQUHAR, SHOWING THE HIGHEST POINT OF THE SAND RIDGE.

4. The steep, which was found round every reef and bank save to the south of Great Saya de Malha, is built up by masses of coral rock from the reef above, its angle representing that at which such material comes to rest in sea-water. It is being consolidated to some degree by fragments of coral and shell, and by foraminiferal sand, as well as by sponges, polytrema, and polyzoa. The outer slope beyond this depends very largely on the contour of the original mound on which the reef or bank was built up, but is also greatly affected by the tailing off of the deposit forming the steep.

5. The formation of a reef depends on the interrelations of a large series of conditions, but a main factor is the depth down to which corals and nullipores can live and flourish. A series of over a hundred dredgings on the submerged banks near the Seychelles, made partially to settle this point, gives the limit for reef corals at 35 fathoms, and for nullipores at 65 fathoms; but it should be noted that these forms can grow with extraordinary luxuriance at 28 and 50 fathoms.

6. Non-calcareous marine plants may be generally neglected in so far as they affect coral reefs, but on all the banks of the Seychelles and Farquhar series they were extraordinarily abundant. Marine algæ would seem, indeed, to cover large areas of their surfaces down to about 50 fathoms, and would, of course, bind together mud and sand and prevent deepening. The presence of broad reef flats, as to the east of Coetivy, in no way hollowed out inside, and the smallness of the

lagoons, as at Farquhar, are largely to be ascribed to the binding together of the sand and coral by the roots of two or three species of Zostera.

Lastly, it may not be out of place if we add a few words about the Seychelles. They comprise two coral islands and seventeen granite islands, of upwards of 150 square miles in size, situated on a bank about 300 miles long by 100 broad, perhaps 12,000 square miles. The two coral islands lie to the north-west of the bank, where alone there is a trace of a barrier commencing to grow up. The granite islands all rest on the centre of the bank, and such shoals as occur near them are not, so far as we could ascertain, of coral origin. Immediately around the granite islands are here and there fringing reefs, especially in bays; but these, if of any great size, have in every place that we saw around Praslin, La Digue, and Mahé granite islets, or masses, to give them, as it were, support and to show their foundations. Nullipores practically do not enter into their composition, and such coral masses as grow are of comparatively small size. Indeed, most owe their origin to the piling up of calcareous and siliceous sand in bays, or to the cutting down and removal of the granite above the sea-level. Yet the absence of nullipores is the important point, nothing else really being wanting for the formation of true coral flats. In no case do these calcareous plants grow well in lagoons or enclosed waters, and their absence from the centre of the Seychelles bank—they grow well on the edges—is presumably due to the churning up of the water and to the removal

NODDIES NESTING ON SIREN ISLAND, CARGADOS CARAJOS.

ST. JOSEPH ATOLL, AMIRANTE GROUP. VIEW OVER THE LAGOON FROM THE EAST END.

from it of all carbonic acid gas by seaweeds, etc., before it reaches the islands.

The granite throughout the Seychelles is very uniform in its composition, but it exhibits here and there dykes of finer grain, down which the streams have cut their courses. Exposed mountain faces, and even quite isolated rocks, are deeply scored by the rain, which averages at least 120 inches a year. There is a marked tendency to form precipices, at the foot of which accumulate rectangular masses of granite, the splitting up of this rock being horizontal in the first instance. The tendency of all granites is, of course, to form massive domed hills or bosses. But the hills in the Seychelles are so deeply furrowed and cut up into sharp ridges that they bear striking testimony to the long period during which atmospheric agencies have been at work. The result, no doubt, has been mainly brought about by the weather, but to some degree marine erosion by the coast may have played a part. Around Praslin Mr. Foster Cooper found in five places masses of coral attached to granite rocks at various heights up to 30 feet above the sea, and to the south of Mahé there are also evidences of a similar change of level. Even then the sea could not have produced much effect, since generally the precipitous slopes of the hills arise at a much higher level and some way back from the shore. The island of Mahé is the most characteristic, in that it slopes along its eastern (or windward) face up from the beach to a line of precipices, arising at 150 to 250 feet above the sea, situated a quarter to half a mile behind the shore, and cut only where mountain streams descend. Its western face is similar, but the slope is more gradual everywhere, and the precipices are less marked. Even at first we were struck by the resemblance of the eastern line to the cliffs of parts of the Devon and Irish coasts, and near Mamelle stream we saw what appeared to be traces of marine erosion. Unfortunately, there was no elevated deposit, but this is scarcely surprising when we consider the rainfall, and notice the deeply scored granite masses near the coast. However, the line of cliffs so remarkably resembles a coast-line that we are still inclined to believe that it was so formed, and that there has been a comparatively recent elevation of upwards of 200 feet.

At this point we cannot avoid some consideration of the terrestrial fauna and flora of the Seychelles (which are extraordinarily rich in endemic species and genera) in reference to its possible connections in the past with other lands. It is a truism to remark that the fauna is largely a function of the flora, since it is in the last instance entirely dependent upon it; the two, therefore, should be considered together. As a general rule we are inclined, in the first place, to suggest that not only the presence, but also the absence, of each form of life is of importance for our purpose in any lands we are investigating. We should prepare a list of the organisms of the areas, showing both the species and genera common to each pair of districts, and the proportion they bear to their respective faunas and floras. We should probably by this means be enabled to establish which is the parent area, if there be one. Next we inquire how many, or what proportion, of the common forms might reasonably have passed from the parent to the daughter by existing means—in the present case to the Seychelles from Madagascar—by aërial or marine transport. Our opinion is that such means are much underrated, especially in the Indian ocean, as we found driftwood on nearly every island we visited, large trees, squared timbers, and quantities of bamboos, the latter only found by us growing on Mauritius and the Seychelles.

A *prima facie* connection being established between any two lands, we examine one by one the origin of the forms not the same, to ascertain why each organism or group is not found in each locality. Here it will be necessary to consider the geological ages of the different groups of organisms. This, from the forms common to the two lands, will enable us to trace to some degree the date of any connection, and allow some reconstruction of their life at that period. Lastly, but of perhaps greater importance, we have to investigate the special geographical problems involved. We must ascertain whether each area has similar environments, and to some degree we must especially compare the organisms of such. We also require to examine the topographical changes of our daughter area in the past, so far as we know them, in connection with physical conditions. This is of the greatest importance in respect to islands exhibiting either volcanic activity, or increase or decrease in

DIEGO GARCIA ATOLL, CHAGOS. LAGOON SHORE OF SOUTH END, WITH OVERHANGING CLIFF.

size by elevation, subsidence, or marine action. The latter will be obvious when one remembers that a reduction commonly implies an increase in the salinity of the air, in the force of the wind, and in the rainfall, and that these may induce a profound change in the vegetation, with necessarily almost as great a change in the fauna.

Could the organic life of the Seychelles, granting its special relationship to that of Madagascar, have been derived from the latter locality by existing means of transport? To answer this we require to briefly consider its fauna and flora. As there are no mammals (except rats and bats) in the Seychelles, any connection could only have existed before Madagascar was peopled with mammals. There is one freshwater chelonian (*Sternothœrus sinuatus*), a form which might well have been brought by man from East Africa, and a limited number of lizards and snakes, all of which might have come by sea.* Three cœcilians, primitive beasts probably going back to the early Secondary period, are more difficult to explain, as well as a mountain-loving frog. The other two batrachians and the two fish do not give much evidence compared with the large number of each in Madagascar, while the existence of only about twenty-six species of land shells (some of which certainly attained their specific characters in the islands) is surprising on the assumption that the localities were ever connected. Tracheate arthropods are of no assistance, and there are only three freshwater crustaceans, very few earthworms, one Planarian, and a Nemertean, which probably became adapted to a terrestrial existence within the group itself.

If the Seychelles is indeed the remains of a large land at one time connected with Madagascar, we would inquire how its fauna could have become so restricted. In the absence from competition with new forms from large land areas, its islands should certainly have some animals retaining primitive characteristics beyond the cœcilians. Seeing the resemblances of the two faunas, we should have to suppose, taking the latest possible date antecedent to the pangolin and lemurs having reached Madagascar, that a large number of genera have remained the same since the early Tertiary period in both localities, or, as an alternative, that there has been parallel evolution. If we allow the latter, we must further grant that the same environment may have called out, in course of time, the same characters in forms once perchance widely separated.

When we examined the flora of the Seychelles, it was at once obvious that its species must be divided into two classes, *i.e.* those which affect a subsoil mainly composed of limestone, and those which affect the siliceous grounds. A considerable number of each kind of plant will live on areas intermediate in their subsoils, but not 5 per cent. of each really encroach on to the other's land. Now, the lime-

* There is the analogous case of a tortoise in Diego Garcia, almost certainly introduced by the negroes. A crocodile existed in the Seychelles, certainly less than a century ago, and its remains have been found sub-fossil; a crocodile may be semi-marine.

ST. JOSEPH ATOLL, AMIRANTE GROUP. LAGOON SHORE, SHOWING REMAINS OF FIVE BEACHES LEFT ON THE FLAT AS THE ISLAND WAS WASHED AWAY.

stone, or calciphilous, plants are precisely the same as we found in the Chagos, in the Amirantes, in Coetivy, and in Farquhar, any former land connections of which are out of the question. Of course the areas suitable for such plants in the Seychelles are not large, but the point is a most important one. It is, of course, possible to regard the calcareous land as of quite recent formation; but even then we should expect to find some calciphilous plants evolved from the siliciphilous, whereas the two floras are sharply distinct. The question at once arises as to whether the siliciphilous plants could not also have been carried over an intervening ocean in the first instance. The palms and many of the large trees are peculiar species and genera, but supposing that they have always had seeds more or less similar to what they at present possess, they could certainly have been ocean-borne; the lower plants, too, with their spores, could just as assuredly have been carried by the wind. The flora, indeed, obviously requires a closer examination and analysis than it has as yet been afforded.*

We are now left, both from the fauna and the flora, with the most meagre evidence of any former land connection of the Seychelles with Madagascar, and we have only, in conclusion, to consider it in reference

* It is interesting to note that the flats, wherever they exist around the Seychelles islands, are covered with green algæ of species never found by us elsewhere during the cruise.

to the geography of the two localities. We would at once emphasize the fact of the existence of an Indo-Madagascar continent, and also that our two localities are formed of the same, or closely related, granites, a class of rock associated with continental areas. We observe that there is no sign of any marine action over four-fifths of the present land of the Seychelles islands, and that there is evidence that atmospheric agencies have been acting upon the rocks and hills for a long period of time. Supposing that the Seychelles were connected to Madagascar in the late Secondary period (when the cœcilians and perhaps other animals and plants came in), and that the island when first cut off was the size of the present bank, is it not probable that the subsequent changes from an area of 12,000 square miles to one of 150 in seventeen isolated islets would cause the extinction of nearly all the fauna and most of the flora? Judging by the analogy of other islands, the central part, where the present islets would have been situated, must have been a moderately dry savannah country, whereas it is now a regular tropical moist district. In the process of reduction

VIEW ON PRASLIN, SEYCHELLES. SCORED GRANITE CLIFF, WITH COCONUTS BELOW.

very many, if not most, of the plants would have disappeared. Vast numbers of insects would have died out, together with all animals which fed on them. Finally, the destruction of most of those which still managed to survive would have been wrought by more efficient forms arriving from over the sea, or evolving out of the same, this new set that which now certainly dominates the fauna, and very probably the flora as well.*

We may add one word in conclusion as to the importance to this country of the Seychelles. Commercially it is at present depressed, but it was for many years the leading vanilla-producing country of the world. That industry was largely destroyed by the discovery of a chemical substitute, but the islands will again flourish under Para rubber and coconuts—and when English law replaces the Code Napoleon. The inner harbour at Port Victoria, Mahé, is a good one, with deep water close to the pier, and there is a large protected outer roadstead with sufficient water for the deepest-draught ships.

Situated almost equidistant from the track around Madagascar and from the exit of the Red sea, and also lying outside the hurricane zone, with an equitable climate, with high lands close to the sea, and with no tropical fevers or diseases, the Seychelles would form an ideal centre and sanatorium for an Indian ocean squadron. With it as a base, with fast cruisers possessed of wireless telegraphy, no movement of an enemy's fleet in any direction could escape notice between Mauritius and Aden, while the position absolutely dominates East Africa and one end of Madagascar as well. Furthermore, it might be a valuable coaling station between the Red sea and Australia, and was indeed, as was also Diego Garcia in the Chagos, once used as such. Of course, with our stations at Aden and at the Cape, the Seychelles may not be of much use to us, but our supremacy in the western half of the Indian ocean would be seriously affected were it in the hands of a hostile power.

Lastly, there are certain forms of work on board ship which in the tropics are scarcely suitable for white men, and "seedee" boys are commonly employed. Some of the Indian lascars are excellent; but the crew, up to the sarang and tindals (boatswain and his mates), must be of one nationality. This is a serious drawback, but the Seychelles negroes answer every requirement for the purpose. Largely the descendants of negro slaves from captured dhows, they are thoroughly loyal to the English. Reared of mixed negro bloods, in an excellent climate and accustomed to the sea from childhood, they are of grand

* I would like here to express my gratitude to my friend and teacher, Dr. Gadow, for discussing with me the questions relating to the distribution of the land animals and plants. I have received many valuable suggestions and much useful information from him, but I alone must be held responsible for the opinions expressed in this paper.

physique, and remarkably free from disease. Christians in religion, with no trace of their own cults, cheerful, laughing, and happy in their dispositions, their highest ideals the British bluejackets, con-

PORT GLAND, MAHÉ, SEYCHELLES. FRINGING REEF, WITH GRANITE ISLETS AND MASSES; ÎLE THERESE TO RIGHT.

siderably more intelligent than the Africans, and absolutely fearless, we venture to think that they may, if encouraged, form a race of hardy navigators of immense value to the British dominion in the Indian ocean.

In conclusion, we would desire to express our indebtedness to the Admiralty for allowing H.M.S. *Sealark* to undertake this cruise from Ceylon to Seychelles; to the late Admiral Sir William Wharton, and to Captain (now Rear-Admiral) Arthur M. Field, hydrographers (under whose orders the cruise was arranged), for their most willing aid and personal interest; to Commander Boyle T. Somerville and the officers of H.M.S. *Sealark*, who carried out most of the topographical, meteorological, and oceanographical work; to Mr. C. Forster Cooper, naturalist; to Mr. T. Bainbrigge Fletcher, paymaster, and Surgeon Simpson, who assisted respectively in the land zoology and botany; and especially to the Royal Society, to Mr. Adam Sedgwick, to the late Dr. W. T. Blanford, to Sir John Murray, to Prof. Herdman, and to many friends for their assistance and advice. The expedition was largely financed by the managers of the Percy Sladen Memorial Fund, by the managers of the Balfour Fund, and by the British Association.

Before the paper, the PRESIDENT: I have now to introduce to you Mr. Stanley Gardiner, one of our most thoughtful and experienced biologists, who gave us an excellent paper in January, 1902, on the subject of his explorations in and about the Maldive islands. Prior to that, as far back as ten years ago, Mr. Stanley Gardiner was biologist of the well-known expedition of H.M.S. *Penguin*, then commanded by the present Hydrographer, Admiral Field, who is here to-night. Recently Mr. Gardiner has devoted himself to the subject of the Indian ocean, and after much preparation, he spent a great part of 1905 examining the geography and the biology of its islands. This work, which he is about to describe to us to-night, was very successful, thanks in the first place to the Admiralty, who (moved by the Royal Society) were good enough to allow Mr. Gardiner to voyage about in H.M.S. *Sealark*, then employed in hydrographical work in the Indian ocean. I hope that Admiral Field will, later on, speak about that point. A large portion of the money needed for the expedition was found by Mr. Gardiner himself; another large portion of it was found by the Percy Sladen Fund, about which I may say a few words, for although I think memorials have been somewhat overdone of late years, some are most useful. The Percy Sladen Memorial was initiated by Mrs. Percy Sladen in the memory of her husband, who, as you know, was a distinguished zoologist. The amount collected was about £20,000, and, as through its help excellent work such as that done by Mr. Stanley Gardiner is enabled to be carried out, we must, I think, agree that the fund has justified its existence. I will now call upon Mr. Stanley Gardiner to read his paper.

After the paper, the PRESIDENT: I will ask the Hydrographer, Admiral Field, to say a few words.

Admiral FIELD: The scientific results of this expedition would, I think, take very much longer time to work out thoroughly than the time during which the expedition lasted. The idea of the expedition was originally suggested by Mr. Stanley Gardiner to the Admiralty about two years ago. It was backed up by the Royal Society, and the Admiralty found themselves able, I am glad to say, to lend a ship. Our survey vessels are so few in number that, although the Admiralty have every desire to assist scientific research, in view of the incessant demands for modern surveys for the benefit of practical navigation, it is very difficult indeed to set aside a ship for purely scientific purposes, for any lengthened period at any rate. The original programme was unavoidably and considerably curtailed, I am sorry to say, as it was necessary to bring it within the limits of the time for which the Admiralty could give the ship; but it was possible to spare the *Sealark* for six months when she was unable to work on the coast of Ceylon. The Indian ocean has been very little traversed by our survey ships of late years, and in comparison with the north and south Atlantic, and the south-west Pacific in particular, very little sounding has been carried out there in recent years. There is an immense deal of surveying work to be done in those waters, both in the Chagos archipelago, Seychelles, and other coral banks of large extent, besides deep-sea exploration. From a purely hydrographical point of view, the time was too short to be able to do much more than fix the astronomical positions of certain points in order to adjust the existing surveys and to make use of them to the fullest extent; but it was possible to combine such surveying work with the scientific researches which Mr. Gardiner desired to carry out, which will be of very great value. Turning to a few points in the lecture, the lecturer assumes the land connection between India and Madagascar, and suggests the action of tides of extraordinary force in the open sea, which he supposes to have extended at that period about halfway round the world near the equator, and that these tides would be instrumental in the disappearance of the land as it then existed. That assumption would involve currents of enormous magnitude, I should imagine—much more than we have ever been able to trace in the present day, at any rate; and the tides would have to have been very greatly enhanced in those days to produce such results. But Mr. Gardiner has rather assumed the existence of these very deep and strong currents, and I do not think that we have sufficient evidence yet to say positively that they do exist at a very great depth in great strength. The evidence which he has adduced, derived from the trend of the sounding-lines and dredges, I think I should be inclined to investigate a little more closely before I should be disposed to accept it altogether; and we have no positive evidence. We have not put a current-meter down at those depths, and until we get that current-meter down, I should be inclined to suspend judgment on the point. Upon these great currents depends very much the argument of the theory. There is, however, I may say, one instance that I know of supporting the view of deep currents. There is the case of breakers having been reported in localities which, when they were subsequently examined, showed no sign of shallow water; depths having been found in one instance of 800 fathoms, and in another of 200 or 300 fathoms. I think there was no doubt about breakers having been seen, and I should be inclined to ascribe them to tide rips caused by the tidal undulation meeting obstruction in the ocean, and setting up a local current which made itself apparent at the surface. So there is that degree of evidence, I admit. The deep-sea soundings of the *Sealark* have added very considerably to our knowledge of the topography of the Indian ocean; but the area to be investigated is so great, and the Indian ocean has unavoidably been so much neglected, compared with other parts, that any attempt to draw contour-lines must still, I am afraid, be an effort of the imagination. Still, it must be admitted that it is astonishing what can be done in the way of drawing contour-lines with very scanty material, as shown by Sir John Murray's work, when viewed in the light of subsequent soundings which have been obtained since he drew his contour-lines. As an illustration of how contour-lines drawn on insufficient data may be upset, I may mention a coral bank of 34 fathoms, lying midway between Mauritius and Cargados, within 30 miles of one of the *Sealark's* soundings of nearly 2000 fathoms. This bank was accidentally discovered by a passing steamer a few months after the *Sealark* was there; she was letting her sounding-wire run out to see if the Thomson machine was clear, and so discovered this bank. It was unfortunate that both of the *Sealark's* deep-sea sounding machines became disabled before the end of the cruise, and that prevented exhaustive searching for vigias. These vigias are often very troublesome to disprove owing to the vague reports of their position. Searching for them is very anxious work for the commanding officer, as I know well in my own experience. Of late years, from our knowledge of the probable slopes of submarine banks at different depths, it is possible to form some idea of the limits of the safety zone surrounding deep soundings. For instance, I know of no case of a dangerous bank existing within 6 or 7 miles of a 2000-fathom sounding, and one can feel tolerably certain that there is no danger within 3 or 4 miles of 1500 fathoms; but a danger may exist within 2 miles of a sounding of 1000 fathoms. These rough practical rules I have found of great service, both in avoiding dangers at night and in searching for them in the daytime. I think it is right to point out that there is some danger in drawing conclusions, such as the lecturer seems to suggest, from a comparison between charts of sixty or seventy years ago and those of the present day. The work of many years ago was carried out, of course under great difficulties, by sailing ships, and in many cases is not in sufficient detail to allow deductions of the kind that are suggested to be safely drawn. The limitations of time, and the immense area that had to be covered, and was covered, by the older surveyors, would necessarily preclude details unimportant to navigation being accurately charted. And I think that there is considerable danger with people who are not acquainted with the way in which hydrographic surveys are carried out, that they may be inclined to think the work more accurate than it is. In former days it was not possible to do it with the same degree of accuracy as it is in these later days. I will not detain the meeting with any further remarks, but before sitting down I should just like to thank Mr. Gardiner for his very interesting lecture.

The President: As this is rather a sailors' night, I would ask Captain Creak to say a few words.

Captain Creak: I am afraid, after the full discussion of this subject to which we have already listened, I cannot add very much. Recognizing the connection between geology and terrestrial magnetism, I would point out that on the East Coast of Africa, and in the region under discussion, where the magnetic needle had been comparatively restful for many years previous to 1880, there has since been a remarkable outburst of magnetic change, continuing to the present time. Whether that has any connection with the observed rise and fall of the land, I would not yet venture to say, but I may give an instance in point. After the great explosion of Krakatoa there was a marked change in the behaviour of the magnetic needle at the neighbouring observatories. I would suggest the desirability of a proper magnetic survey as one means of settling the matter. I think that Admiral Field has adduced a strong point—that there is as yet no evidence for currents of the strength suggested in the paper, and until we have tried all these places with the current-meter at different depths, I do not think we have any ground to support us in thinking that they exist. I have never heard of any ocean current which would produce the great changes that are going on. I think there must be some other cause. Perhaps, as the lecturer says, in seventy or eighty years we may know more about it.

The President: I think we should now like to hear something on the geological side of the question, and perhaps Mr. Lydekker, who is on the Geological Survey of India, and who is also a geographer, will favour us with a few remarks.

Mr. R. Lydekker: It is rather difficult to criticize a paper of such length, which covers such a wide field as that which Mr. Gardiner has laid before us this evening. I may say that I can only discuss one very small portion of it, and at this late hour of the evening I will do so very briefly. Mr. Gardiner talks, I believe, about Madagascar and India being connected by a narrow zone during the Secondary period, but I think he has put the clock on a little bit too fast. A Fellow of this Society, who perhaps did more to enhance our knowledge of the distribution of animals than anybody else, the late Dr. Blanford, expressed very strongly the opinion that there was a great belt of land which connected Africa, Australia, and America together, and that this persisted during the whole of the Secondary period. The evidence is convincing, because we get the same plants in India, in Africa, and in South America. There is also reason to believe that there was a strip of land, during the Secondary period, connecting Madagascar and India. I venture to think, however, that the reader of the paper has made a little too much point of bringing out the latter connection as a main feature, when I think it is a minor feature. Undoubtedly it existed. If Fellows will refer to an article in this month's *Popular Science Monthly*, an American magazine, they will see an interesting account of South American fishes, in which the writer argues that the connection between Africa and America must have persisted to the Eocene period, when our author says apparently only the India-Madagascar line remained. I believe, therefore, that the main equatorial connection existed much later than the author says. With regard to the action of currents on the connection between Madagascar and India, you have to take into consideration that most of the old land connection between India, Australia, and Africa has been removed; and I do not suppose any one is going to tell you that currents cut out the whole Indian ocean. The probability is there must have been continuity of action, and that the action which carved out the Indian ocean must have also been the main cause that separated Madagascar and the Seychelles from India. There must have been some cause other than currents, and I think subsidence must have played a very important part.

I ought not to trespass further on your time at this late hour, but there is an interesting point about this connection between Madagascar and Ceylon I should like to have explained. I believe the connection must have still existed in the Miocene period; but the Seychelles, which are granite islands, we are told, are apparently not remnants of that connection, and I do not therefore see how they got their tortoises. [Here the speaker was corrected by the author in regard to the Seychelles.] I accept this correction, but still fail to see how the giant tortoises got to the other islands, which are said to be purely coral. It is all right to find them on the Seychelles, but I want it explained how they got on the others. My chief points are, first, that the clock has been put a little too fast, and that the main equatorial belt persisted later than the author believes, and that the Madagascar-Ceylon connection, I should say, was also rather later. With regard to the current question, I maintain that whatever carved out the great Indian ocean, the same action must have cut away the connection between Madagascar and Ceylon, although it may have been finally aided by the currents. The whole matter is a very interesting and a very difficult problem; and I am sure that, though we may differ in details, we shall agree that what Mr. Gardiner has done is of great interest and importance.

Dr. Mill: The main point in this paper is not, I think, the palæontological speculations, but rather the proof—and I think I may say that Mr. Gardiner has given a definite proof—of the great depths at which currents can produce an effect upon the floor of the ocean. I remember very well the great impression that was made when Sir John Murray demonstrated that the Wyville Thomson ridge, at the depth of about 250 fathoms, was swept clear of mud by the currents of the ocean. It was formerly supposed that no action disturbing the floor of the ocean took place below 100 fathoms; the discovery of the Wyville Thomson ridge showed action at several hundred fathoms, and now it is shown that mud and sand are swept away at 1000 fathoms, and that is a fact of real importance. Whether in the past the equatorial tides have produced much greater forces than are now at work, I do not know, nor do I think that I greatly care. There is still so much to find out about the condition of things at the present time that I appreciate Mr. Gardiner's solid addition to our store of facts. I was distressed to hear the Hydrographer say that the current-meter had not been sent down to great depths. One valuable result of the work of the International Council for the Study of the Sea has been the great improvement of oceanographical instruments, including the current-meter, and all forms of apparatus are now far better than those in use at the time of the *Challenger* Expedition. Mr. Gardiner was provided with one of the best forms of current-meter, and I must own that I was disappointed to see the instrument looking so clean and new as it lay upon the table in the other room. I think that in future, before sending out any expeditions, we want more preliminary study and more scientific guidance in the provision of all the apparatus that could reasonably be foreseen to be required. I hope that the time is coming when we may have oceanographical expeditions fitted out for the sole purpose of research. I know the magnificent services that have been rendered to science by the Navy in its hydrographical surveys, but oceanography has gone beyond the needs of the Navy into the deep waters outside those that must be charted for any purpose of navigation; it has gone into a region at present interesting only to scientific men where only a purely scientific expedition, with ample money given openly and solely for scientific purposes, can advance it. When we see how much can be done under conditions that, while favourable, are not perfect, we cannot help feeling how much more will be done in the future when the Government of the country, and perhaps even the scientific societies of the country, fully realize the importance of doing this work. I think Mr. Gardiner must be congratulated on having given us a most stimulating paper, and one that has given rise to a livelier and pleasanter discussion than I have heard in the Society for many years.

Dr. Gadow: I can only speak as a zoologist, but still a few words from the zoological point of view may not be amiss, if only for this reason—that zoologists are responsible for having advanced this problem of the connection between South Africa and India. This supposed land connection naturally implies the fate of islands like the Mauritius and Seychelles, and I think the way in which zoologists about forty years ago used to set about to prove this connection was rather what we would now call crude. It was based upon the well-known fact that in Africa and India existed a number of well-known types of animals like lemurs, rhinoceros, pittas, etc., and when it happened that fossil hippopotamus were discovered in Madagascar and in India, this was looked upon as proof positive of the correctness of the former existence of "Lemuria." But then it came to pass that one understood that it was easier to account for the similarity of the fauna of Africa and India in another way, namely, by assuming that the centre of dispersion was somewhere in Eurasia, whence similar or closely allied creatures spread into Indo-Malaya and into Africa, whilst in the northern parts the originals died out. However, zoologically, there are quite a number of creatures which suggest very strongly that such a connection must have existed, not only in the bygone periods of Mesozoic times, but even in the Tertiary, perhaps as late as the Miocene, period.

For instance, if you take the amphibia of Madagascar, you find that they have a very strong resemblance, which cannot be accidental, with those of India and Malaysia; and, what is stranger still, the amphibian fauna of Madagascar has more affinity with Malaysia than it has with South Africa. We have now to sift our material more carefully than has been done until recently. The absence in Madagascar or in India of certain groups of animals is just as important a feature as the presence of others. But one good fact goes a long way, much further than many speculations. Mr. Gardiner showed us the photograph of a tortoise. Now, such gigantic tortoises existed, not only in Aldabra, but in Madagascar and still further east, in Mauritius and Rodriguez. These land tortoises are such well-defined forms that it is almost certain that this type cannot have been developed independently in different countries. Moreover, they are so absolutely terrestrial that wherever we find them, unless where they have been brought artificially by man, these tortoises must have got there by land. So far as I know, there is no fact brought to light as to the distribution of animals or plants which is dead against this idea of the Africa, Madagascar, and India connection, a connection, I insist, which must have lasted right into the middle of the Tertiary period. There is nothing against it. There is strong reason to compel us to think that it existed. Now, curiously enough, it seems that from the oceanographer's and from the geologist's point of view, Mr. Gardiner feels certain that the connection existed, but that even with these newer and more exact methods he fails to prove his point. As a zoologist, I think we ought to be grateful to him for giving us a hint of how to get out of the difficulty. We feel that disappearance of the land must be of comparatively recent date. The problem still stands, although we do not yet exactly know how to tackle it or bring forward definite proof.

The PRESIDENT: As we have not before us the æons of time that Mr. Gardiner can command for his phenomena, we must terminate our discussion now, especially as Mr. Gardiner has some replies to make to the points brought forward by other speakers. I shall, therefore, now propose a hearty vote of thanks to him for what, I quite agree with Dr. Mill, is one of the most interesting papers I have heard in this hall.

Mr. J. STANLEY GARDINER: I have, in the first place, to express my great indebtedness to you for the kind manner in which you have passed a vote of thanks to me, and also for the very patient way in which you have listened to-night, particularly since I am sure to be regarded by some as having been putting forward *crack-brained* theories. In spite of the lateness of the hour, there are one or two points to which I must refer. First of all, the question of deep-sea currents: it does not, as Dr. Mill pointed out, want a current-meter to prove their existence. The bottom deposit, or rather the absence of a bottom deposit, does give a definite indication, and these indications, when cumulative, give an absolute proof of the existence of such currents. There have been numerous soundings in channels between the islands of the Malay archipelago, many of which are so closed in as to be apparently unsuitable for the existence of such deep currents. I consider that the bottom characters, ascertained by these soundings, give definite proof of the presence of deep currents in that region, and make the existence of similar ones easily understandable between India and Madagascar. Further, I have not yet seen the contentions put forward by Mr. Buchanan in 1895 seriously contested with regard to the currents between the Canary islands.

I am particularly grateful to Admiral Field for coming and speaking. I am afraid I may have been in the past guilty of laying too much stress on the comparison of charts. I am accused of regarding Admiralty charts as being more correct than they really are, but Admiral Field should be the last to accuse me, since my conceptions were derived from seeing his surveys in H.M.S. *Penguin* ten years ago. I was specially interested in the new soundings between Cargados and Mauritius. In one chart, prepared for the Maldive expedition, I joined these lands on purely theoretical grounds within the same 1000-fathom line. In a chart prepared for this evening, I separated them, in view of our soundings, and I am happy in now being able to include them again, as I think Mauritius and Bourbon must have been connected with the Cargados-Seychelles crescent.

The questions raised by Mr. Lydekker go very deep, and are scarcely suitable for consideration now. At this hour one cannot go into the question of the geographical distribution of animals and the very divergent views that people take about parallel and convergent evolution. He suggested that I was wrong in considering to-night the ocean between Madagascar and India by itself; but the expedition only explored that line, so I naturally confined myself to it. I quite accept a great deal of what he said, and of the considerations put forward by the late Dr. Blanford, who largely assisted me in the scheme for my expedition. I do not see why the subsidence which formed the bay of Bengal should have also disconnected Madagascar and Ceylon. I am sure most geologists will be agreed that the Madagascar-Australia connection was broken down long antecedent to that of Madagascar with India, the Bay of Bengal having then been formed. Now as to the question of the tortoises. How did they get to Aldabra? Aldabra must have been connected to Madagascar! Is this possible? It is a recently elevated limestone island, and we should have to imagine a complicated series of upheavals and subsidences in quite recent periods, making and destroying a bridge, but leaving a little speck of land peopled by tortoises. I confess that this supposition is to me incomprehensible, and I must fall back on such methods of marine transport as brought tortoises to the Chagos and lizards to so many lands. The question of the means by which such distributions were effected is a difficult one, and surely too complicated and detailed for discussion at this late hour.

NOTES ON THE GEOGRAPHY AND PEOPLE OF THE BARINGO DISTRICT OF THE EAST AFRICA PROTECTORATE.

By C. W. HOBLEY, C.M.G.

This district comprises an area of about 10,000 square miles, and was until the last few years one of the least-known portions of the protectorate, and it is on this account that it is considered that the following notes may interest the Society.

Personally, only a small portion of the district is known to me, and the bulk of my information has been collected from the reports of Mr. G. F. Archer, who has energetically administered it during the last two years.

Geographical.

From an altitude of 3325 feet at Lake Baringo the country drops steadily towards Sugota and Rudolf lake (1250 feet), where the heat becomes intense and the grazing-grounds are scorched by a withering sun. About March or April torrential rains usually occur, and the numerous dry watercourses are transformed into great rivers—in a few days half the country is under water or converted into quagmires. The soil, however, is so sandy and porous that a few weeks later the water has all disappeared again.

Owing to this scarcity of water, there is little in the district to attract the European settler, and this area may be definitely looked upon as a native reserve; the only change might come from the discovery of minerals, but the very recent volcanic formations of which the country is composed do not offer hopeful prospects. In spite of the aridity of

TURKANA CHIEFS AT BARINGO. AJIGWA THE GOVERNMENT CHIEF, ON EXTREME RIGHT.

the area, the grazing is declared by the natives to be marvellously good, especially for sheep; but, owing to the precarious water-supply, they are forced to adopt a nomad existence and move on from one water-pool to another. In some places they depend on brackish springs, and often dig wells in the dry watercourses to a depth of over 20 feet.

One of the most curious features of this region is the river Sugota, which, when visited by Mr. Archer in September last, was a rapid stream about 10 yards wide and 2 feet deep. It is hot and brackish, but drinkable in its upper course. It runs on northwards for about 70 miles without widening out in any way, and when it approaches the vicinity of the Andrew volcano, which is on its east bank, suddenly disappears into the ground. North of this point there are great flats covered with

TURKANA, SHOWING HEADDRESS.

deposits of natron (the magadi of the natives), and in the middle there is a small lake fed by two small streams from Mount Nyiro.

The enormous Lake Sugota of the Intelligence Division map, No. 1429 (*d*), is non-existent, and it is difficult to understand how it became delineated. The Sugota river is bounded by great walls of lava, so could hardly have flooded the plains. It, however, may be that Cavendish or one of the earlier explorers saw the whitey natron deposits from the slopes of Mount Nyiro, and took them for water.

There are also natron deposits higher up on the Sugota river, at a place called Pirias, and at this point the stream becomes quite undrinkable, and, according to native account, if camels and sheep drink it they die in a few minutes.

The native accounts of the Andrew volcano are rather interesting. They are firmly convinced it is the home of Engai (a Masai word meaning "God"), and are afraid to approach it closely. Strange rumbling and hissing noises are continually heard in the vicinity; the ground all round for several miles is broken up by great fissures in which boiling water is visible; and, most appalling of all, frightful cyclones pick up objects near the mountain and carry them into the crater. When these occur, the Turkana say they huddle together on the ground, and their spears and shields are often carried away; they laughed at the idea of a European being able to pitch his tent anywhere near, and said it would be swept into the crater like a herd of their camels had been a year or two ago. The essence of all this farrago is that the volcano is probably only approachable from the east side, on which occurs the only fresh water which is to be found in that locality.

A rough analysis has been obtained of the water of the Sugota river, and it is said to contain the following salts: Sodium sulphate, magnesium chloride, sodium chloride, potassium chloride, calcium carbonate, traces of iron. It also gives off odour of sulphuretted hydrogen after keeping.

The country bordering the upper part of the Sugota river, though intensely hot, is very pleasant to the eye, a profusion of palms taking the place of the ubiquitous sansevieria aloe; lines of magnificent wild date palms mark the course of the river, and the broken jagged lumps of lava which are strewn over so much of this country gives place to hard sandy soil, which renders travelling pleasant.

SUK: TABOLAY, KAMUTA, SAGWALAN.

Native Tribes of the Baringo District.

Five tribes are represented in the Baringo district, for, besides the Suk, Turkana, and Njamusi, there are sections of the Kamasia

TURKANA FIGHTING MEN COMING TO CAMP TO PAY THEIR RESPECTS.

and Elgeyo peoples, and it may be of interest to trace the history of the people inhabiting this stretch of country during the last half-century.

Originally the whole of the valley from Lake Baringo to Loroghi was occupied by the Samburu, but, being frequently molested and raided by the Elburgo Masai, they gradually trekked away north to the neighbourhood of Mount Nyiro for safety. The country was then left uninhabited for a while, till the Suk—an offshoot of the Karamojo, and not of the common Laikipia stock—who till this time had confined themselves to the country to the north-west of the Kerio river, began to work southwards, and were followed by the Turkana from Lake Rudolf. These two tribes came right down to Lake Baringo, the Suk keeping more or less to the western side, and the Turkana to the east, with the Ribkwa escarpment as the dividing-line between the two, and after a while made a combined attack upon the Njamusi (a numerous people living at the south end of the lake), which was successful; then, however, they quarrelled amongst themselves, with the result that the Turkana, in trying to get rid of the Suk, were beaten themselves, and had to return whence they had come, leaving the Suk in possession of the country and large herds of their cattle and sheep.

The raid on the Njamusi must have taken place about forty years ago at Lakasissio; the old chief of Njemps was then a "laioni," and is interesting as showing that at that time the Turkana were occupying the very part of the country to which they are now anxious to return.

The Suk, however, suffered much at the hands of the Masai after this, and to this day still cherish unpleasant memories of the Morans of Ongatabus. To this fact, however, is due in a great measure their attitude towards Government, which they now have come to look upon as a benefactor in preserving them and their stock from these raids, and also their willingness in paying up their hut tax, for they realize that if the Masai had been allowed to continue in their predatory habits, and the Government had not stepped in to offer them protection, by this time they would have very little left. They admit they cannot stand against the Masai, though of the Turkana, curiously enough, they have but little fear.

Turkana and Suk.

The range of the Turkana at present extends from just north of Labur, on the north-west side of Lake Rudolf, to the north end of Lake Baringo, a distance of some 250 to 300 miles. On the west side the tribe is bounded by Karamojo to the north and Suk to the south;

CORACLES ON LAKE BERINGO.

on the east by Lake Rudolf, Mount Nyipo, the river Sugota, and the Loroghi mountains.

The Turkana are, numerically speaking, very strong, and one section alone, the Tuo, I am told, considerably outnumbers the whole of the Suk pastoral people.

The subdivisions of the tribe are as follows:—

Section.	District.	Chief.
Ngolio	Kerio	Onameri. Mutellili.
Kotonya	Kerio	Katodi. Ajigwa (Govt. chief).
Ataacha	Kerio	Apuche.
Ngaboto	Dorobo of the upper Tirkwell	No recognized chief. Ngamatak.
Ngamatak	Tirkwell	Rioball ("Tumbo" of the Swahilis).
Nisir *	Tirkwell	Lobwin.
Tuo *	"	Akeno.
Apacheros	Tirkwell, near Naremet, Lake Rudolf.	
Ceyagwara	Tarash	Engelecha.
Herimong	"	Unknown.
Ngur	"	"
Nisir	"	"
Lukumomong	"	"
Atokomemwa	Labur	"
Nisigar	"	"
Kalabong	N.W. Lake Rudolf	"

From this it will be seen that there is no one paramount chief, nor, so far as can be ascertained, is there a Laibon. Lokorechum, an Ngolio of the Kerio who died about two years ago, is said to have been the last of the medicine men.

The Suk have only three subdivisions, viz. the Kasawarie, Lagit, and Kajiribkwa, and of these the first is by far the biggest. Lagwalan, Kamuta, and Karorlay, the three Suk chiefs of the Baringo district, are all Kasawarie; Lotonyalli is the chief of the Legit, and Aribomoi of the Kajiribkwa. With regard to the customs of the Suk and Turkana, it may be well to point out, to begin with, that these two tribes, particularly the latter, are exceedingly moral, and I do not suppose that there has ever been a case of a Turkana woman joining a trader's caravan when in the interior.

* Living together they form practically one big section, the most numerous and powerful in Turkanaland.

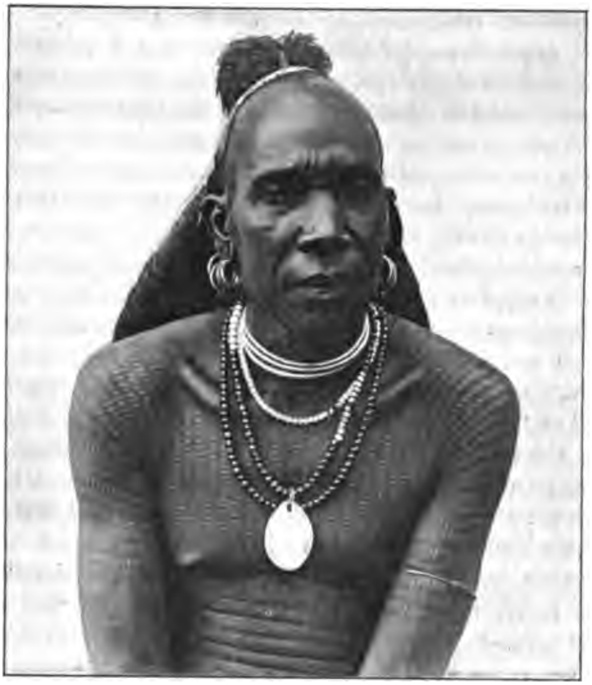
In the matter of the purchase price of a woman, it is interesting to note the difference between the Turkana and the Masai, for instance. A Masai pays as an outside price a cow or two, probably a few sheep; a Turkana a hundred head of cattle, ten camels (which are valued higher than cows), and droves of sheep. The reason given for this is the scarcity of women in Turkana, a fact largely attributable, it is imagined, to Abyssinian raids and oppressions. Those men, however, who can afford the luxury of a wife are well pleased with their investment, for in their own words, "our women are more prolific than dogs," and children to them mean wealth. Compare this, again, with the Masai tribe, who, on account of the comparative sterility

NJEMPS KUBWA. FIG TREES UNDER WHICH JOSEPH THOMSON CAMPED.

of their women, are believed by some to be on the road to extinction. The Suk pay nothing like so large a price for their women, though a rich man may pay as much as twenty head of cattle. An ordinary price is three or four cows and thirty sheep.

Of all serious offences amongst the Turkana adultery ranks first evidently, for the penalty, as a general rule, is death by spearing. In exceptional cases, however, when a man is very rich, the confiscation of every single head of stock he possesses is considered sufficient punishment. Amongst the Suk confiscation of all property is the invariable rule, and the hut, or manyatta, of the offender is also burnt to the ground.

Cases of murder seldom or never occur amongst either tribe, long



TURKANA CHIEF.

curved sticks only being used to settle differences where amongst the Masai spears or knobkerries would be the order of the day. In the event of murder, however, being committed, it becomes simply a matter of compensation in stock to the murdered man's brother or next of kin, final decision in the matter being left to the elders of the tribe.

The only other customs worth mentioning, perhaps, are the various methods of making peace amongst these tribes. The one in which the dog appears is common to several other tribes in East Africa, among which are the Bantu Kavirondo, the Nandi, and the Elgeyo. In this case the leaders of the two parties concerned grasp respectively the fore and hind legs of a sacrificial dog, along the back of which is laid a wisp of grass. A sharp spear is then used to cut the dog in two, during which process the chiefs cry aloud, "If my people do anything to your people, so shall God do to me," or words to that effect. This is absolutely binding and ensures a *bonâ fide* "amen." Why the dog should be selected as the victim is not clear. The general method employed in Turkana, however, is simply the exchange of sticks between the chiefs, on which are bound solitary long white ostrich plumes. Another method is for two spears to be laid on the ground parallel, when all concerned, if they wish for peace and friendship, walk between them.

It is commonly supposed that the Suk and Turkana, from a general likeness of appearance, are akin, but this is not proved, and it is curious to note that the Turkana say they are more nearly related to the Masai; and the Masai declare that the Turkana are the survival of the Laikipikiah section of Masai. The latter statement is, however, undoubtedly an exaggeration. The Turkana, moreover, do not circumcise, which may be taken as evidence that the two tribes are not very closely allied.

Their adopted country of burning sand, scant vegetation (acacia scrub and aloes), and salt water, however, seems to have agreed with them, for they are for the most part enormous men, and their women, too, are tall and well set up, and very different from the undersized Suk women.

Their kraals consist of a zeriba of bushes containing a number of temporary shelters of palm leaves and grass; these seem to be put together more as a protection against the sun than rain, for they are not in the least weather-proof. Two of the principal features of the kraals are the number of donkeys and children to be seen.

The women and children seem to be fearless, and usually come out and dance to meet a traveller whose *bona fides* they are assured of.

TURKANA CHIEF.

Their dancing is the same as the Suk, and, when the men join in it, is really rather a fine spectacle, for with their huge "chignons," waving plumes of black, white, and orange-dyed ostrich feathers, and their yellow clay-bedaubed faces, they present a fantastic and war-like appearance, and one realizes that here at least one is among really unsophisticated natives.

They are very rich in stock, with numbers of camels (which, however, they do not know the use of as draught or riding beasts), cattle, sheep (the white-bodied black-faced variety), and numbers of donkeys, which run about more or less wild and quite unattended. These donkeys go out in the morning to their grazing-grounds and come back again at night, sleeping anywhere near the kraals in the open. The surprising thing is that they are not the prey to troops of lions, but the Turkana say that if a lion gets amongst them at night, so far from stampeding, all the others go to the rescue, and generally the remains of the intruder are found in the morning kicked to pieces.

They will sell their sheep and male donkeys for trade goods or cattle, but are most averse to parting with their camels or donkey mares, as they use them for milking. Male camels are often killed for meat. They have no idea of using the camel as a beast of burden.

One has read much about giant Turkana, and there is not the least doubt about it, the men, generally speaking, are enormous, for if they are not invariably tall they make it up in breadth. They are literally twice the size of Kikuyu, and weigh, I should think, on the average very nearly double as much. What struck me most, however, was the size of quite young "Laionis," who have great thighs and hips just as big as full-grown Suk, and their bones seem extraordinarily big.

RUWENZORI AND THE FRONTIER OF UGANDA.

By DOUGLAS W. FRESHFIELD.

His Royal Highness the Duke of the Abruzzi, who has paid a visit to London since his return from Africa, has promised to offer a paper to the Society on his recent ascents in the Ruwenzori Range, of which he has made the complete conquest, having climbed the twelve highest snow-peaks, which all stand in a close cluster within a radius of a few miles; none of them, he tells me, exceeds 17,000 feet. The paper will be read in January, and will be illustrated by a number of Signor Vittorio Sella's photographic panoramas and views, which completely elucidate the topography of the upper region above the snow-level. Further details of the meeting, at which His Royal Highness expects to be present, will be duly announced to Fellows.

Dr. Wollaston, a member of the party sent out by the Natural History

Department of the British Museum to explore the Ruwenzori region, has sent home a letter, which contains the following account of his failure to reach the snows from the west:—

"I think I told you in my last letter that I hoped soon to get round to the west side. After many difficulties and delays, we arrived at Fort Beni, the Belgian post on the Semliki, about the middle of July. From there we set out with an escort, which the Belgian officer insisted on our taking—and which proved the cause of our undoing—and made the Butagu valley in three days. I left the party camped at 7000 feet (Kakalongo, in Stuhlmann's map), and started full of hope for the upper parts of the valley, with ten porters, a camera, and your old Himalayan ice-axe. A good but very steep track, accurately marked in Stuhlmann's map, took me up to 11,000 feet, and I was just leaving my second camp, with only a short march ahead, when a message came from below that a detachment of the escort had been attacked a mile or two below our camp (at 7000 feet) by natives armed with guns; one soldier killed and five wounded, two fatally. My services were required to bring them together again and my porters to carry them, so there was nothing for it but to go downhill as speedily as possible. As we retreated down the valley on the following day—the day on which I ought to have been within reach of the glaciers and taking photographs of immense interest—the snow-peaks were all clear, as if to spite me, for an hour or more after their usual time, and I saw some superb views. It was impossible to take photographs, as we were dodging spears and arrows all the time; in fact, it was a sort of running fight for three days all the way back to Beni; a good many natives killed, but none of our people badly hurt. It was, I think, the cruellest disappointment I have ever known—to be within half a day's journey of one's most coveted goal, and then to be compelled to turn one's back upon it. The root of the evil lay in the Belgian who had charge of the escort. In spite of protests, he camped in the natives' gardens, cut down the shambas, at one place shot the village cow, while his soldiers looted the houses. In return for these barbarities, they rose up against him, and we suffered for it. I am convinced that, had they let us go without escort, we should have had no trouble at all. When we left Beni a week ago, they were preparing a punitive expedition to quell these wretched people, and will doubtless make bad worse. So until all the natives have been killed off, or until the Semliki becomes the Uganda boundary, the west side of Ruwenzori will not be a very wholesome place for a white man.

"The rare views that I got of the range from the west show it to be much finer than from the east, as one would expect, the Semliki being only about 2900 feet at Beni. There is a very fine valley I looked into (Russirubi in Stuhlmann; Paka is the name I got for it from a native thereabouts) which leads up to the snow on the northern slopes of the highest peaks, I should imagine. No European has ever been into it yet. I confess that I am more than ever anxious to come back at the earliest opportunity; and this is a valley that would be well worth exploring. The Belgian Dr. David went up the Butagu valley, but how far he went I have been unable to find out.* I found the relics of an English pair of breeches at 10,000 feet—perhaps Scott Elliot's of 1894. Stuhlmann's photograph is of the highest peaks looking a little north of east.

"The two northern peaks must be those that I saw north-north-west from Kiyanja. Those to the right of the picture are the snow-peaks seen north-west from Kiyanja; they are all part of the same mass, and they run from north-east to south-west. From Beni, almost due west, I got a clear view for a few moments, and saw a large mass of snow to the north of the highest peaks, but not I think connected directly with them; probably on the far side (right bank) of the Russirubi. The highest peak cannot be much over 17,000 feet. This rough chart is as accurate as I can make it in my present state of ignorance. Probably by the time this reaches you, you will have got the Duke of the Abruzzi's finished map, and mine will be found wanting in many important points. I hope the Duke will find some good native names for the highest peaks. 'Birika' (boiling-pot) is the only name I heard on the east side for the snow.

"I have a photograph of 'King Edward's Rock,' taken from above Bujongolo, which shows it as evidently the lowest point of the Mubuku ridge. This expedition comes to an end at Entebbe in a few weeks, then I am off to the volcanos Mfumbiro, at the south-west of Lake Albert Edward.

"If you think any extracts from this are of sufficient interest for publication, please send them with apologies. Writing in this forest of pygmies and okapis is none too easy.

"Believe me, yours truly,

"(Signed) A. F. R. Wollaston.

"Approximate height of peaks—

Highest peaks	17,000–17,200 feet.
Duwoni	15,893 „
Kiyanja	16,379 „
Peaks north-west of Kiyanja	16,700 „
Big Snow	16,000 „

"I shall be interested to hear how near these are to the Duke of the Abruzzi's heights.†

"A. F. R. W."

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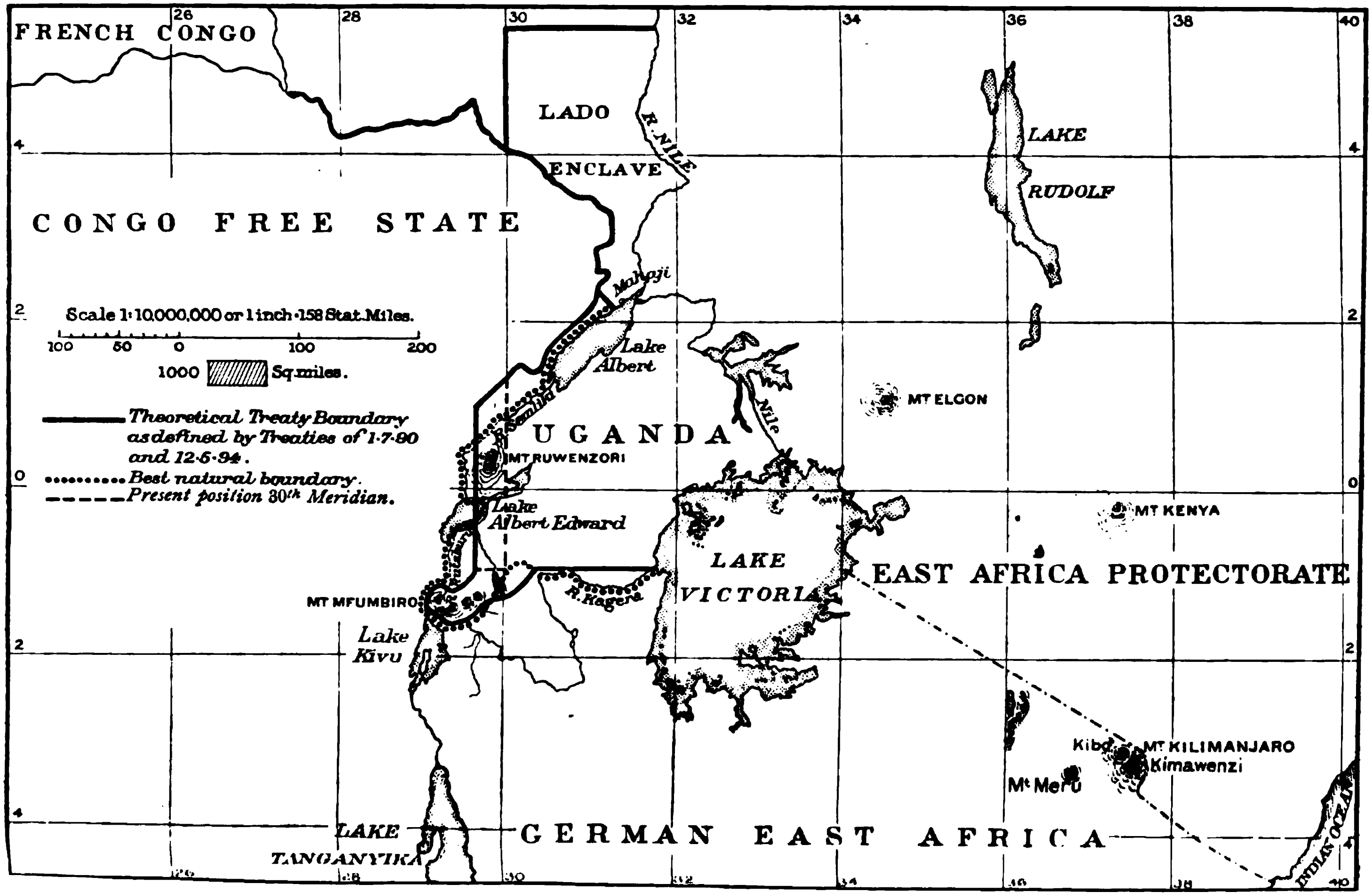
* Is not the Russirubi the valley Dr. David visited? His route is described as north of Dr. Stuhlmann's.—D. W. F.

† The Duke of the Abruzzi informs me that his heights, when finally worked out, will differ but slightly from those obtained by Captain Behrens (see *Geographical Journal* for July last).—D. W. F.



FRENCH CONGO
CONGO FREE STATE
LADO
ENCLAVE
R. NILE
Mahaji
Lake Albert
Semliki
UGANDA
MT RUWENZORI
Lake Albert Edward
R. Kagera
MT MFUMBIRO
Lake Kivu
LAKE TANGANYIKA
LAKE VICTORIA
Nile
MT ELGON
LAKE RUDOLF
MT KENYA
EAST AFRICA PROTECTORATE
Kibo
MT KILIMANJARO
Kimawenzi
Mt Meru
GERMAN EAST AFRICA
INDIAN OCEAN
Scale 1:10,000,000 or 1 inch = 158 Stat. Miles.
100 50 0 100 200
1000 Sq. miles.
Theoretical Treaty Boundary as defined by Treaties of 1.7.90 and 12.5.94.
Best natural boundary.
Present position 30th Meridian.
26
28
30
32
34
36
38
40
4
2
0

Having regard to the pending question with respect to the frontier of Uganda and the Congo State, alluded to in Dr. Wollaston's letter, the following explanation may be opportune. In order to make the facts intelligible a map, such as that here supplied, is essential. It will be observed that from the north end of Lake Albert to 1° N. of the equator the British frontier has been drawn along the edge of the great escarpment, leaving the slope draining to the Nile to the Uganda Protectorate. From this point to 1° S. the 30th meridian of E. longitude was in 1894 taken as an approximate and provisional indication of the situation in which a definite frontier might be delimited at a future date. This arrangement was embodied in an agreement between the Congo Free State and the British Government dated May 12, 1894.

Beyond 1° S. the Uganda frontier had already been regulated by the Anglo-German treaty of July 1, 1890, the terms and conditions of which were recognized on behalf of the Congo State in the later document. Between the Indian Ocean and Lake Victoria the frontier had been deflected north in order to give Germany the Kilimanjaro highlands; in return, it was deflected south to give Great Britain the well-defined Mfumbiro highlands south-west of Lake Albert Edward, first discovered by Speke and afterwards seen by Stanley. In 1894 this term, Mfumbiro, was in use, on the authority of Dr. Stuhlmann, for *the whole* of the volcanic region forming the watershed between Lake Kivu and Lake Albert Edward, and it was well known to geographers that these highlands lay, for the most part, west of the position *then* assigned to the 30th meridian east of Greenwich.* There appears, therefore, to be no room for dispute as to our frontier south of 1° S. lat., which should occupy the position laid down on the accompanying map. In this district, therefore, British territory extends considerably beyond the 30th meridian.

Since 1894 a discovery has been made which has apparently led to some needless doubts with regard to the western frontier. It has been found that the 30th meridian east of Greenwich does not lie in the position previously assigned to it on all maps of Africa, but some miles farther east. In consequence, in place of intersecting Lake Albert Edward and the Ruwenzori range, it runs wholly east of the former, and east of all but a portion of the north-west extremity of the latter. It can, however, hardly need to be stated that in considering the terms of the agreement of 1894, every competent statesman must accept as final the position given to the meridian on maps of that date, the only one that could possibly have been in the minds of the parties. The frontier is, in fact, indicated in that position in the sheet 3 of the "Carte de la Province Orientale Nord et du District de l'Aruwimi," on

* See *Mitteilungen von Forschungsreisenden und Gelehrten aus der Deutschen Schutzgebieten*, vol. 48, Heft 1. Das Volkangebiet des Centralafrikanischen Grabens von Hauptmann von Herrmann. With map.

the scale of 1 : 1,000,000, bearing the imprint "Etat Independent du Congo," and the date 1904. Yet, despite this fact, the British Government have, as I learnt on the spot, temporarily withdrawn their outposts from the territory west of the newly assigned position of the meridian, and, consequently, their protection from tribes which had enjoyed it for more than ten years.

This frontier was, admittedly, a provisional frontier. The maps of that date were by no means a blank in the district in question, but the details of local topography were obscure and the relative importance of the distinctive features uncertain. The negotiators were not, or thought they were not, in a position to decide finally whether a mountain crest or a river course, or possibly a combination of the two, might furnish the most convenient line of demarcation. In these circumstances they left the matter to be settled at a later date.

The extensive knowledge of the district gained in the last twelve years, has shown that no line can be satisfactory that bisects the Ruwenzori range, the intricate valleys of which are inhabited by closely connected tribes. Moreover, history shows that, as a general rule, a frontier region is peculiarly liable to disorders where among primitive peoples it runs through the heart of a chain. In the instance under consideration, an arbitrary and imaginary line cutting first across the plain on the right bank of the Semliki and then transversely across innumerable forested spurs, must prove a most undesirable boundary. The time has now come when a frontier can readily be drawn in accordance with the physical features of the country. Nature has provided a natural boundary in the Semliki river. It should be adopted. It has been recognized that Lake Albert is wholly British. But it may not be found impossible to compensate the Congo State for any loss of territory on the right bank of the Semliki by a corresponding grant west of that stream.

At the present time a Congo State "Geographical Expedition" is working along the boundary in question, and it is understood in Uganda that a British Survey Commission will shortly visit the district. It is of the greatest importance that its instructions should allow it to survey and thoroughly examine all the country as far westwards as the frontier lines shown on the accompanying map, whichever of them may happen to be the farthest west. Unless this is done, His Majesty's Government will not have the full knowledge of the local topography necessary in order to arrive at a final and satisfactory arrangement.

The boundary lines shown on the German frontier indicate, where they diverge, a possible "give-and-take" which would bring the frontier into closer connection with natural features, and thus prove advantageous to both parties. This, however, is a matter for separate consideration.

COAST EROSION.*

I. By CLEMENT REID, F.R.S.

Any one living on our sea-coasts, or even visiting them, must have noticed the rapid waste of the cliffs under the attacks of the sea. This waste is particularly noticeable in the east and south of England, and it will therefore be most useful to confine our attention to those regions.

We notice the melting away of the land, and we naturally think of it as a steady process—intermittent, it is true, according as the season is more or less stormy, but varying little when the average is taken for successive groups of years. Closer study, however, compels us to recognize that the changes now in progress are by no means confined to a continuous attack of the sea on the land. There are compensating, but less conspicuous changes, such as the accumulation of shingle-beaches and sand-dunes, and the silting up of our estuaries. There are unexpected geological complications which should lead us to pause and consider before we say that the loss is an unmixed evil and should be stopped. It soon becomes clear that the whole of the changes now in progress on our coasts must be studied together, and that we cannot separate the loss of land from the other phenomena which accompany it.

If we study the physical geography and geology of the region, noting the outline and cross-section of the coast, measuring its annual rate of loss and the annual rate of accumulation, we soon arrive at a somewhat unexpected result. We learn that there was a definite date at which the changes now in progress began. We find not merely that we are losing annually a strip of land of noticeable width, but that the whole character of our coast-line is altering.

The process is not very conspicuous, it is true, in a single generation; but if we read the geological history carefully, its importance is far greater than we had imagined. The Britain that Cæsar invaded was very different in its coast-line from the Britain of to-day; the Britain of three thousand years ago was still more unlike. Not only has the coast receded; it is becoming less indented by navigable estuaries and harbours, and the existing harbours are rapidly silting up. Our cliffs, also, are nearly everywhere becoming higher and more conspicuous.

In order to understand the nature of the changes that are now going on, it is necessary to look back some three or four thousand years to see what the country was then like, otherwise the existing irregularities of our coast-line will be unintelligible. I do not propose to go back further, for it is not necessary for our present purpose to deal with any period earlier than that of Neolithic man, when the sea stood about 60 feet below its present level. This statement may seem somewhat dogmatic, but space will not permit me to give in detail the evidence. I can only say that a close study of the buried land-surfaces, found in the alluvium at various depths down to about 50 feet below the sea-level, shows that oak trees flourished on the lowest of these ancient soils. This proves that the sea then stood so far below its present level that no sea-water could reach the roots of these trees.

This former low level of the sea has consequences that are not generally realized. During that period the seaward end of each valley was lowered by the scour of its river, till the valley-bottom near the coast reached the sea-level. Consequently the greatest depth of every one of these channels will be found at a level about 60 feet below the present river bed, though of course its exact position may not coincide with that of the present channel. We cannot say for how long a period the land stood

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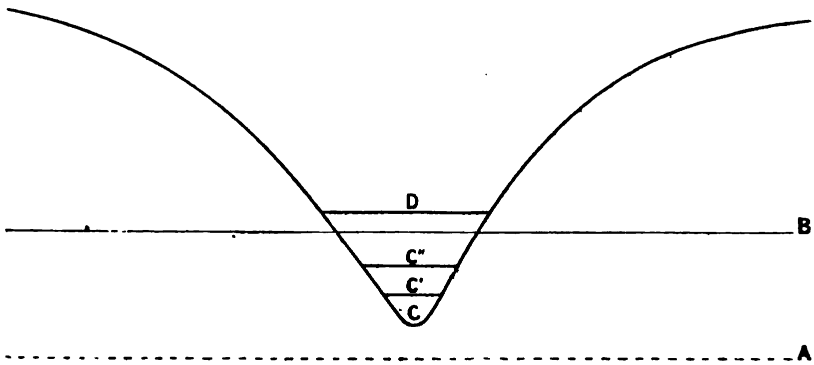
* British Association, Sections C and E, York Meeting, August 3, 1904.

at this high level, for this part of the geological record is unfortunately still somewhat obscure. The period was, at any rate, sufficiently extended for the V-shaped sections of these valleys to be well developed (see Fig. 1). Engineers must remember the existence of these buried channels in any designs for docks occupying estuaries; the channel is sure to occur, and its exact position may be of very great importance, when it is a question of works that need a solid foundation. The channel is usually narrow, but it is filled with loose alluvial deposits.

Thus far I have only spoken of the deepening of our river-channels, and it may be asked, What connection has this with coast-erosion? Theoretically, it may have little connection; but, owing to peculiar conditions, the relationship in Britain is a most vital one, and I will explain in what way. When the sea stood at a level 60 feet lower than now, most of our coast was fringed by a belt of low ground, extending out approximately to what is now the 10-fathom line. On the landward



A. Ancient sea level. B. Modern sea level. C, C', C". Submerged forests indicating successive stages in the subsidence, and in the filling up of the valley. D. Existing alluvial flat.

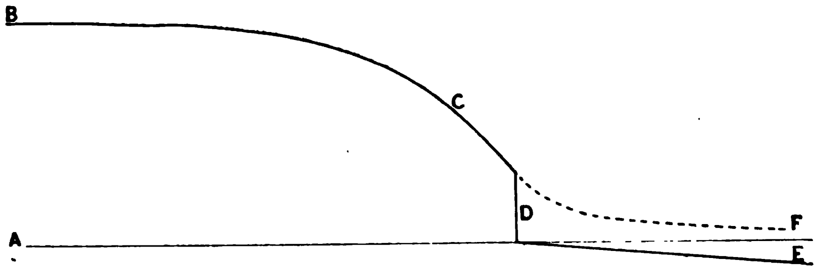
FIG. 1.—DIAGRAM SECTION ACROSS A SILTED-UP VALLEY.

side of this belt was, and in many places still is, a steep grassy slope, representing the position of a still more ancient line of cliff, the face of which has been hidden by rubbish washed from the slope above. The south and east coast of England, at the period with which we are dealing, must have been utterly unlike what we now see. Instead of bold cliffs, there was this wide coastal plain, like the plain which still extends for many miles west of Brighton, reaching a width of 8 miles at Selsey Bill.

About four thousand years ago there set in a fairly rapid, but intermittent subsidence of the land, or rise of the sea; we do not yet know which it was, but for practical purposes the effect is the same. This rise of the sea-level flooded a great part of the coastal plain, and brought the waves within striking distance of the rising land behind. It also submerged the lower part of all our valleys, turning them into winding sea-lochs, or fjords, which penetrated far into the land.

The question may be asked, Why do I say that this process was both rapid and intermittent? As a follower of Lyell, I perhaps ought to say that it was gradual and almost imperceptible. However, the facts are stubborn things, and the geological evidence seems clearly to prove that the process was more rapid and more jerky than any change which has been recorded of late years. We cannot go fully into the evidence, but a close study of the alluvial material and old buried land-surfaces which now fill so much of these valleys leaves little doubt. All our big submerged valleys tell the same tale, whether it be the Humber, the Wash, the Thames, Southampton Water, the Severn, or the small Cornish rivers whose buried channels have been so thoroughly mined, far below sea-level, in the search for stream-tin. Wherever we can see the deposits, sift, wash, and examine them, or wherever careful records have been kept, we find masses of rapidly deposited marine silt, alternating with beds of peat and thin soils in which trees are rooted. But the vegetation is usually nothing but brushwood or quick-growing trees, and the peat also is of rapid growth. Only at the very bottom, far below the present sea-level, have I seen oaks of more than a hundred years. Usually the evidence suggests the rapid accumulation of warp to the level of high water, then a few years of peaty swamp or alder car, followed by another subsidence, and the accumulation of more warp. And so the process goes on through the whole 50 or 60 feet of sediment deposited in the silted-up parts of the estuaries.

This rise of the sea-level may have been completed about 3500 years ago, at about the date when Stonehenge was being built. Whatever may be its exact



A. *Sea level* B.C.D.E. *Present contour.* (B. *Plateau.* · C. *Slope.* D. *Cliff.*
E. *Plain of marine denudation.*) F. *Coastal plain (now destroyed)*

FIG. 2.—DIAGRAM SECTION SHOWING SEAWARD SLOPE LEADING TO THE COASTAL PLAIN, OR, WHERE THAT IS DESTROYED, TO THE EDGE OF THE CLIFF.

date, the completion of this rise is the starting-point for our present inquiry. Only then commenced the coast erosion which we now see; only then did our existing shingle-beaches and sand-dunes begin to form.

At first erosion must have been rapid, for the sea was merely eating into loose talus, or into cliffs of little height, and protective banks of shingle and sand take time to form. But as the land was cut into, these loose masses were steadily removed and their harder parts were rolled into shingle-beaches, which greatly protected the coast. The cliff also became higher as it was cut back. In short, everything tended, and still tends, to make the width of the strip destroyed annually less and less.

Many may be surprised when it is affirmed that all this can be read in the contours we meet with all round our coast. A section drawn across the coast to the sea in the east and south of England shows nearly always the same feature. It does not exhibit the sea eating into a tableland; it usually shows a plateau ending seaward in a long slope, which slope is steadily being cut into by the sea. The cliff is not nearly so high as it will be a thousand years hence, and it is far higher than it was at the date of Cæsar's invasion (see Fig. 2).

This brings us to the rate at which the loss has taken place since the sea stood at its present level. It is very difficult to obtain trustworthy data, but, roughly, the loss for the coast south of Flamborough Head to the Thames seems to average about a yard a year. Not only is the land eaten into, but the submerged coastal plain is steadily eroded by the scour of the tide during storms; so that sites of ancient towns, like Shipden on the Norfolk coast, are now covered by several fathoms of water. Coast erosion does not cease, as is sometimes thought, at the sea-level; it continues to whatever depth a strong current combined with wave-oscillations can be felt. This submarine scour is particularly strong close to the coast, where the tidal current is often confined to a definite channel between the coast and sandbanks outside.

The importance of the submarine scour need not be dwelt upon; but I may mention a striking instance of it noted nearly thirty years ago on the Norfolk coast. A gale of exceptional violence, with a north-west wind and a spring tide, drove the water into the North sea, so that the flood-tide ran like a mill-race past the projecting coast. The loss of land was exceptionally great during this gale, more going during a few hours than the average for a year. The whole foreshore at low tide was seen to be ploughed into deep channels parallel with the cliffs, and other similar channels were cut out well below tide-level. Heavy slabs of ironstone were thrown up on the beach. I wished to ascertain the source of this ironstone, so took a boat and dragged for it a few days after the storm. We found the sea bottom quite altered. Normally there was nowhere a depth of more than 5 fathoms in the part examined; but we found 10 fathoms, and then the drag dropped off a submarine cliff into a hole of 15 fathoms. Taking the boat back across this channel, we were suddenly brought up by the grapnel we then used getting fast. I could not succeed in detaching a slab of the rock; but when at last the grapnel was cleared, it was found to be bent back, its point having played against a ferruginous rock like the slabs thrown up by the storm. This shows that the storm had been able to scour to a depth of at least 15 fathoms, not only in loose sand, but in strata containing slabs of hard rock. A few months afterwards nothing could be found but the ordinary shallow sea with a gravelly and sandy bottom.

We must not forget this submarine scour when we talk of building sea-walls or high groynes on a coast where there is no solid foundation, and where, to add to the difficulty, there is a high cliff of loose material with a base of loam or quicksand, so that the cliff is ever moving slowly and almost imperceptibly seaward. I have seen several generations of groynes and sea-walls built and destroyed on stretches of coast where these natural conditions have been ignored.

We will next inquire what becomes of the land thus lost, for there are compensations. The coarser material in part is washed into deeper water and lost; but much of it is piled into shingle beaches, which form our best barrier against inroads of the sea. The sand partly forms shelving beaches, on which the sea spends its force with little effect; or it is blown up by the wind into dunes, behind which large tracts of marshland may be preserved as pasture. Sandbanks and dunes have a protective effect which must not be forgotten: they enable valuable pasture to exist below the level of high water. Behind the banks the rise and fall of the tides may scarcely be felt, and dry land may exist only a little above the level of mean tide. Of course, if the erosion of the coast were stopped elsewhere, as it has been in certain places, shingle beach and sand-dune will themselves wear out and disappear, and the low lands may be left unprotected during storms.

Another compensation for the loss of land must be mentioned, though here all do not agree. I allude to the great gain of alluvial land in the sheltered estuaries, such as those of the Humber and Wash. It is often stated that the many square miles reclaimed during the historic period are merely the deposits from the rivers. To a certain extent this is true; but I have stood on Dimlington beacon after a gale, when the Holderness cliffs had suffered great loss, and have watched the thick yellow stream that swept down the coast with the flood tide and rushed into the Humber. Here was an amount of mud carried in sufficient to add considerably to the marshes, as the particles were strained out by the submerged vegetation. We do wrong to neglect this source, especially when we see that certain of our harbours, which receive few or no streams, are yet silting up with great rapidity. To what extent the gain in these marshlands compensates for the loss on the coast, I cannot say, for exact measurements are impossible to obtain.

This silting up of the submerged estuaries, however, may be looked at in another way, and then it becomes a loss, not a gain. It means that many of our harbours are rapidly becoming useless, and that numerous arms of the sea, formerly navigable for miles inland, have dwindled to shallow streams flowing through alluvial flats or sandbanks.

Before we take for granted the desirability of attempting to stop the wearing away of our coasts (except near towns) we must strike a balance between loss and gain. On the one hand, we lose considerable areas of agricultural land, our sea-coast towns are injured, and our harbours tend to silt up. On the other hand, we gain considerable areas of valuable agricultural land—more valuable than the average of that lost, and through the accumulation of shingle beach and sand-dune we obtain protection for certain low lands which otherwise would be flooded and spoilt. If the loss exceeds the gain, there will still remain the question whether we shall obtain any sufficient compensation for the enormous cost of any works put up to protect agricultural land.

Some curious problems are suggested by this inquiry. Many may think them of no practical importance; but to the geologist and the geographer they are of great interest, and cry aloud for a solution. If what I have said is correct, and since civilized man lived in Britain there has been a rapid change of sea-level, followed by a long rest, what are the prospects of a similar period of rapid change again setting in? To answer this question, we must know whether it was the land that sank or the sea that rose, and what was the cause of the movement. We have had many speculations; but thus far we can neither explain the cause of the phenomena, nor predict future movements. It is a problem of great importance, for a new rise or fall of the sea-level to the extent of a few feet would have most disastrous effects on all our coasts and harbours, and would seriously interfere with our inland drainage until things were again adjusted. Are we now living in a period of exceptional stability, both of sea-level and climate; or is it, as geology suggests, a mere interlude which may at any time give place to rapid change?

II. By E. R. MATHEWS, A.M.I.C.E., F.G.S., Borough Engineer of Bridlington.

Mr. Mathews pointed out that no part of our coast was changing more rapidly than that line of coast that was situated between Bridlington and Spurn Point, which is known as the Holderness coast of Yorkshire. He said that this coast-line was scarcely the same for two consecutive days, and that this was easily accounted for by the fact that the material forming this coast consisted of glacial drift, which was more easily eroded than any other material. He pointed out that it had fallen to his lot to have to design and carry out for the Bridlington Corporation, in order to prevent the inroads of the sea, £30,000 worth of sea defence works, and for several years past he had made a special study of the erosion of this part of our coast, with the result that he was able to give certain information respecting it, the following table being a summary of same:—

SUMMARY *re* EROSION ON THE HOLDERNESS COAST.

Part of coast.	Formation of cliffs.	Distance.	Rate of erosion in yards per annum.	Height of cliffs.
Flamborough Head to Bridlington	Chalk for 3 miles, then glacial drift	5	0·5 yd. to 2 yds.	80 ft. to 130 ft.
Bridlington	Glacial drift	2	Protected	—
Bridlington to Barmston	" "	5	8 yds.	10 ft. to 30 ft.
Barmstone to Ulrome ...	" "	5	1½ yd. to 4 yds.	10 ft. to 20 ft.
Ulrome to Skipsea ...	" "	1½	2 yds.	25 ft. to 35 ft.
Skipsea to Skirlington...	" "	2	2 yds.	—
Skirlington to Atwick...	" "	1	2½ to 3 yds.	30 ft.
Atwick to Hornsea ...	" "	2	—	—
Hornsea	" "	—	Protected	—
Hornsea to Hornsea Burton	" "	1	2½ to 4½ yds.	30 ft. to 40 ft.
Hornsea Burton to Mappleton	" "	1½	2 to 3 yds.	50 ft.
Mappleton to Aldborough	" "	3½	2 to 2½ yds.	70 ft.
Aldborough to Ringborough	" "	2	3 yds.	50 ft.
Ringborough to Withernsea	" "	7	3 to 4 yds.	25 ft.
Withernsea	" "	—	Protected.	—
Withernsea to Dimlington	" "	5½	3½ yds.	—
Dimlington to Easington	" "	1	5 yds.	—
Easington to Kilnsea ...	" "	2½	3 to 4 yds.	—
Kilnsea to Spurn point	Sandhills	—	—	—

Mr. Mathews then gave the meeting some interesting calculations that he had made respecting the erosion on this part of our coast since the earliest times. And in quoting from a paper read by him before the Institution of Civil Engineers, he said that, assuming the average height of the cliff to be 18 feet, and the weight per cubic foot of the glacial deposit and boulder clay to be 120 lbs., no less than 1,904,194 tons of cliff are washed away annually. The erosion has been estimated by some engineers to be 3,000,000 tons per annum, but he thinks that the figures given are more correct. Further, assuming that a rate of erosion of 3 yards per annum has been going on for the past century, no less than 3052 million tons of cliff have been swallowed up during that time. As to area lost, assuming that 1 acre per mile of coast-line has been swallowed up annually, and that loss at this rate has been continuous, no less than 66,600 acres have been swallowed up by the sea since the time of the first Roman invasion under Julius Cæsar in the year 55 B.C. If the coast-line between Flamborough Head and Bridlington—5 miles in length —be added, and the rate of erosion of that part of the coast be taken at an average of 6 feet per annum, the loss is found to be 3⅝ acres per annum, or 7180 acres swallowed up in the period named. This makes a total of 73,780 acres, or 115 square miles of land lost since the time of the Roman invasion, between Flamborough Head and Kilnsea (near Spurn Point), an area almost equal to that upon which London stands. Again, the average rate of erosion of the coast between Bridlington and Kilnsea is 11 feet per annum. Assuming that erosion since the Roman invasion had been continuous at the rate of 3 yards per annum, the sea has made an inroad upon the land during that time to the extent of 3⅓ miles.

He then dealt with the abnormal erosion and destruction that had been done by the sea during the past winter, and referred to the flooding that took place in March last on the Holderness coast between Easington and Kilnsea, when over a thousand acres of agricultural land was transformed into a series of lakes of salt water, which in some places were 8 feet in depth. He pointed out that Kilnsea for a time was a complete island, and illustrated this by a map which he produced, and which showed the point at which the sea broke through. Mr. Mathews pointed out what a serious matter it would be for the navigable channel up to Hull if the sea and the Humber made a permanent juncture at this point. He pointed out that such an occurrence was not altogether improbable, seeing that the lowlands that were flooded were in many places 6 feet below the level of the sea. He also stated that the erosion on the Holderness coast received considerable impetus during this and other storms which have taken place during the past winter.

He said that, although the huge lakes referred to soon disappeared, the withered and brown wilderness, with sea-drift scattered about, here and there a wrecked agricultural implement, told its own tale of what had only a few months ago occurred.

Mr. Mathews then gave some interesting information respecting the growth or diminution of headlands on the east coast. The growth of Spurn Point (Yorkshire) was one of the most remarkable instances cited. The position of Spurn, he said, was a variable one, and was constantly changing. He pointed out that it was built up largely by the eroded material from the Holderness coast, and consisted of vast quantities of sand and shingle, which were steadily accumulating. He said that at one time this was an island, and its connection to the mainland was a more or less gradual process. In 1660 the high-water mark extended just to the south of Kilnsea, Spurn being simply a heap of shingle, some distance to the south.

Collins, in his chart dated 1684, shows Spurn connected to the mainland, but it is difficult to say whether this was correct, as later surveys show Spurn to be still an island. From 1820 to 1852 Spurn was only an island at high water. In 1852, however, high water spring tides only submerged two places.

In December, 1849, during a north-north-west gale, a serious breach was made in this nich of land, about half a mile to the north of the then High Lighthouse. It was 320 yards wide, and at high water ordinary spring tides it had 12 feet of water in it. It was subsequently made good by the deposit of chalk.

Since 1852 Spurn has been well protected by groynes, and it is gradually extending to the south and west. Mr. A. E. Butterworth, the engineer to the Humber Conservancy Board, stated in a paper entitled "Notes on the Growth of Spurn," read before the Yorkshire Naturalists' Union in July, 1904, "that the westerly movement of Spurn between 1851 and 1888 has been at the rate of 8 feet per annum on the east or North Sea side, and 17 feet per annum on the west or Humber side, showing that the Point has increased considerably in width."

He next referred to Dungeness point (Kent) as being a remarkable headland, the growth of which seawards between 1689 and 1844, according to Mr. J. B. Redman, was at the rate of 7 yards per annum. He stated that the Trinity House records show the seaward advance of Dungeness point to have been at the rate of 9 feet annually between 1792 and 1850; 13 feet to 14 feet between 1850 and 1871; and 8 feet between 1871 and 1897. The lighthouse, he stated, had been shifted seaward three times during the last century. The vast extent of this shingle deposit may be gauged from the fact that at 100 yards from the shore at the point at low water there are 4 fathoms of water, and 330 yards from the shore at low water there are 15 fathoms of water. He then pointed out that the remainder of the headlands on the east coast were receding—Flamborough Head, which consists of chalk cliffs 80 to 130 feet in height, at the rate of 1·5 foot per annum; Lowestoft Ness (Suffolk), which is the most easterly point in England, the cliffs here consisting of glacial drift, and the beach widening at the foot of the cliffs, forming a broad expanse of "denes." This point receded between 1854 and 1901 1100 feet, or 23·4 feet per annum, these figures being based on evidence afforded by a series of surveys and plans in the possession of Trinity House.

The Naze (Essex), which consists of low cliffs of gravel and sand overlying London Clay, is receding at the rate of 9 feet per annum. The North and South Forelands (Kent), which consist of chalk cliffs 20 to 150 feet in height, are receding at the rate of 2 feet per annum.

Mr. Mathews then proceeded to show how the estuaries of rivers were becoming changed, and referred to the interesting growth of Sunk island at the estuary of the Humber. He said that at the close of the seventeenth century this was an island of only a few acres, but that it had now an accumulation of warp or silt of over 15 square miles' area, and formed valuable pasture land. In 1660 it consisted of two huge sandbanks with a channel between them. In 1684 7 acres were enclosed. In 1744 1561 acres had been enclosed. In 1850 7000 acres had been enclosed. In 1906 9600 acres, or 15 square miles, had been enclosed. He stated that there were other large areas in the estuary of the Humber, covering nearly 100 square miles, which have also been reclaimed from time to time by warping.

The Tees estuary, he said, was formerly over 4 miles in width at its mouth, but more than 10 square miles of marsh land have now been reclaimed between Stockton and the sea. He also pointed out that the Wash, which forms the estuary of the Nene, Witham, Glen, Great Ouse, and Welland, previous to the Roman invasion extended many miles inland, covering large areas in the counties of Huntingdon, Lincoln, Cambridge, and Norfolk. The Romans reclaimed a vast area of land in this estuary, now known as Marshland and South Holland, by the construction of embankments over 50 miles in length.

The great level of "the Fens" was largely reclaimed in the seventeenth century, chiefly under the direction of the Dutch engineer, Vermuyden, and his work was extended from time to time to the last century. Mr. Mathews pointed out that this vast tract of most fertile land extends to over 1000 square miles.

On the north side of the Thames estuary the principal reclamations were Mersea island and lands bordering the river Blackwater, Wallasea isle, Foulness isle, Shoebury isle, Canvey island, Fobbing marsh, Tilbury marsh, and the long succession of lowlying lands bordering the river to a considerable distance west of London. On the south side similar reclamations have been made extending from London to Whitstable flats, including the Woolwich, Erith, Dartford, and Gravesend flats, Cliffe marsh, Stoke marsh, and parts of the isle of Sheppey.

He then briefly referred to the erosion and accretion that was taking place on the east coast generally, and pointed out that from the Tweed to the Tyne (Berwick to Tynemouth, 60 miles) the coast for the most part was rocky, consisting chiefly of limestone with shale and sandstone beds, and that little or no serious erosion had taken place during historic times. From the Tyne to the Tees (Tynemouth to Hartlepool, 28 miles) erosion had only taken place where the cliffs were of a soft nature, such as just to the north of South Shields, where the low cliffs are of glacial drift, and immediately to the south of Sunderland harbour, where the cliffs are formed of the same material, and in these places the erosion is at the rate of about 2 feet per annum. The remainder of the coast-line is rocky, and no erosion is taking place. He pointed out that north of Hartlepool large traces of blown sand occurred, which have driven the high-water line seawards.

From the Tees to Flamborough Head (59 miles) erosion is taking place, varying with the geological formation of the coast-line, and landslips are of frequent occurrence where glacial deposits occur, and in situations such as Runswick, where masses of clay overlay the slippery shale. The coast-line is intersected by deep becks, many containing large deposits of glacial drift and boulder clay. At Filey the headland of hard calcareous grit known as Filey Brigg has resisted the erosive action of the sea, but to the south the glacial cliffs have been seriously eroded, forming a deep bay which extends as far as Speeton.

Flamborough head to the Humber (45 miles) has already been referred to. Humber to "the Wash" (45 miles).

The Lincolnshire coast is lowlying, and consists of boulder clay and alluvial deposits. Sand-dunes fringe the coast, and here form an excellent protection, especially by planting and encouraging the growth of marram grass. Where erosion on this coast has occurred it has been very slight indeed; and, generally speaking, accretion is taking place, especially in the estuary of the Wash, as already referred to.

From "the Wash" to the Thames (Norfolk and Suffolk coasts) the coast-line, generally speaking, consists of glacial drift and boulder clay, with here and there sandhills or wide alluvial deposits and flat sandy banks. The sea-bed for many miles from the shore is very shallow. Great erosion is taking place on this coast.

The average rate of erosion at Sheringham during the past hundred years has been 2 feet per annum. At Southwold the loss has been estimated at from 5 to 15 yards per annum. Whole parishes and townships have been swept away on this coast within historic record. He said that Mr. J. B. Redman places the erosion of the coast-line between Cromer and Mundesley at an average of 14 feet per annum. At Cromer the sea is believed to have encroached 2 miles since Roman times.

Mr. Carey, M.I.C.E., says, "Considering how near to the coast-line are the broads and waters, like Lake Lothing, and also considering the great indentation of this outline, the apprehension which exists in the counties of Norfolk and Suffolk of serious inroads of the sea beyond the mere fronge of coast-line would appear to be justified." Between Lowestoft and Pakefield the loss of cliff is estimated by Mr. Wheeler, M.I.C.E., to be at the rate of 11 feet per annum.

From the Thames to Dungeness. At Herne bay the erosion is very great: between 1872 and 1896 it amounted to over 1000 feet; in 1903 an enormous landslip occurred. In fact, landslips are of frequent occurrence. Minster church, which a hundred years ago was 2 miles from the river, is now close to the latter. In Pegwell bay the chalk cliffs are being worn away. The average erosion of the chalk cliffs of Thanet is stated by Mr. Woodward to be about 3 feet per annum. The cliffs between Sheerness and Reculvers consist mainly of London Clay. South of Pegwell bay to Deal and Walmer is a low tract of marshland reclaimed from the sea. The chalk cliffs recommence at Kingsdown, 2 miles south of Deal, and extend to Folkestone. Between Folkestone and Hythe the cliffs consist of the Lower Greensand beds.

Mr. Mathews, in concluding his remarks, briefly referred to the satisfaction which had been given throughout the country generally by the appointment by the Government of a Royal Commission to investigate into the important question of coast erosion, which was a matter, in his opinion, not only of very great importance, but of national concern.

GEOGRAPHY AT THE BRITISH ASSOCIATION: YORK MEETING, 1906.

It is well known York was the first meeting-place of the British Association. It was chosen for geographical reasons, being conveniently central in days when transportation facilities were very different from what they are to-day. York is still central, and there are many other reasons, historical and physical, which make it interesting to geographers to meet there. The Geographical Section, however, is not yet composed of a sufficiently large body of trained geographers to permit such use of the meeting-place for papers on special local problems and for interesting excursions as is made by the members of, say, the Geological Section. Indeed, geologists being generous and friendly folk, the geographer makes most use of the meeting by attending the Geographical Section in the morning and the geological excursions in the afternoon. The most enjoyable excursion was an "unofficial" one arranged by the geologists. It extended over two days, during which the features of the eastern half of the York moors were examined, under the guidance of Prof. P. F. Kendall, well known for his works on the glacial lakes of Cleveland and on the glaciation of Yorkshire, and for his excellence as the leader of such an expedition.

Coming to the work of the Geographical Section itself, it will be seen from the account given below that it was, as usual, both varied in its subject and its treatment. The section was constituted as follows:—*President:* Right Hon. Sir George Taubman Goldie, K.C.M.G., D.C.L., F.R.S. *Vice-Presidents:* Major C. F. Close, R.E., C.M.G.; Colonel D. A. Johnston, R.E., C.B.; J. Scott Keltie, LL.D.; H. R. Mill, LL.D., D.SC. *Secretaries:* E. Heawood (*Recorder*), A. J. Herbertson, E. A. Reeves, G. Yeld. *Committee:* Dr. Tempest Anderson, Major J. H. Beacom, J. Bolton, R. N. Rudmose Brown, Colonel Feilden, Major Forbes, J. Stanley Gardiner, Major E. H. Hills, C.M.G., D. G. Hogarth, Prof. G. W. Hoke, Prof. Emory Johnson, J. McFarlane, Dr. J. Milne, F.R.S., James Murray, J. L. Myres, H. Yule Oldham, J. Parkinson, Staff-Commander Dubois Phillips, J. Howard Reed, Clement Reid, F.R.S., Major P. Molesworth Sykes, John Thomson, and A. Trevor-Battye.

A large concert-hall was assigned to the section, which unfortunately had so bad an echo that it was very difficult to hear the speakers, and discussions were curtailed in consequence. With a crowded audience, the echo did not occur; but popular though the Geographical Section is, the whole hall was never filled during its meetings.

The President's address on the Progress of Geography during the quarter of a century which has elapsed since the last meeting of the Association at York has already appeared in the *Journal*. Several of the communications read to the section will also appear in the *Journal*. They will only be mentioned by title here.

The exploration papers were by (*a*) Major P. Molesworth Sykes, on a "Tour in South-East Persia," with an account of the ancient cities of Narmáshir; (*b*) Dr. Longstaff on his journey in the Central Himalayas and adjacent parts of Tibet. Major Sykes's tour was undertaken in connection with a commercial mission, which left Kerman in January, 1905. It is described in the paper printed in the present number of the *Journal*.

Dr. Longstaff's journey took place during the summer of 1905, the traveller being accompanied by an Italian Alpine guide and a porter. From Kumaon, the eastern glaciers of the Nanda Deví group were explored, and heights of over 20,000 feet attained. After a visit to the glaciers north of Nampa, in the north-west corner of Nepal, the party accompanied Mr. C. A. Sherring on his mission to Western Tibet. From Purang (Taklakot) Dr. Longstaff made his way to Gurla Mandhata (25,350 feet), reaching a height of about 23,000 feet. The whole party afterwards traversed the neck of land between lakes Mansarowar and Rakas Tal, and examined the channel connecting them. On August 28 Dr. Longstaff crossed the Chor Hoti pass into Garwhal, and in October made a reconnaissance up the Kuramtoli glacier. A detailed account of the mountaineering experiences has appeared in the August number of the *Alpine Journal*.

Mr. Stanley Gardiner gave an account of the Percy Sladen Expedition in H.M.S. *Sealark* to the Chagos archipelago, in amplification of part of the report of the British Association Committee for the Exploration of Parts of the Indian Ocean, of which Mr. Gardiner is secretary. The general results of the expedition have already appeared in the *Journal*.

Two lectures, admirably illustrated by lantern-slides, was the outcome of last year's visit of the Association to South Africa, and both attracted large audiences. Mr. Yule Oldham described the route and experiences of the official party, and Mr. Trevor-Battye gave an account of an expedition he made up the Zambezi above the Victoria falls into a still almost unknown region. Mr. John Thomson gave a lecture on "Photography for Explorers," illustrated by specimens of his own work, which will be illustrated in the *Scottish Geographical Magazine*. Another illustrated lecture had for its subject the Limestone Caves of Western Australia, the wonders of which were vividly described by Prof. W. B. Bottomley.

The section was fortunate enough to hear from Prof. W. M. Ramsay a summary of the results of his many expeditions to Asia Minor and long years' study of its past. After pointing out the importance of the geographical situation of Asia Minor as bridging the sea between Asia and Europe, the lecturer showed that the conquest by the Turks meant the reduction of great part of the country from the settled and civilized state to a semi-nomadic stage of society, the nomad Turks, or Turkmen, being the real conquerors of the country. In the cities the industries of the Roman Empire survived, but most of them gradually and slowly died out, largely owing to the difficulty of communication over the country. In earlier Turkish time trade passed with difficulty from city to city by aid of the large and splendid khans, which were, however, not a proof of civilization, but of the submergence of civilization, being fortresses in which caravans might rest safe from the nomads at night. The land also to a great extent passed out of cultivation. Only in recent times has a revival of prosperity taken place, the chief cause being the restoration of communication, partly through railways, partly through road-making, which in turn have led to a revival of industries and agricultural development. The lecture concluded with a discussion of the Bagdad railway and its prospects.

Two papers were of economic interest. The valuable, lucid, and interesting summary of the history and present position of irrigation in the United States, by Major Beacom, the American Military Attaché in London, will be communicated to the Society during the coming season, and will be printed in the *Journal*. Prof. Lyde contributed a note on the climate of Central Canada in its bearing on wheat-growing, showing the way in which advantage is taken for this object of the salient features of each season: the sudden and short spring, in which plough, harrow, and drill are hard at work; the rains of the three growing months, May, June, and July, with a rapidly rising temperature, the mean on the Brandon-Battleford curve being 62°·5 Fahr., or that of the best English wheat-land; the long summer days, with a high percentage of sunshine, but a comparatively long *cool* spell at night, particularly advantageous to wheat; the dry harvest weather; and the long cold winter, which guarantees the cleansing of ploughed land.

Prof. G. W. Hoke, of the Miami University, Ohio, urged the importance of a study of social geography, in a paper which it is hoped to print in the *Journal*.

Four papers dealt with physical aspects of geography. One by Mr. J. Parkinson, Principal of the Mineral Survey of Southern Nigeria, gave a valuable account of the configuration and structure of that part of the empire, which will be printed in full in the *Journal*.

Mr. James Murray contributed a summary of the work of the Scottish Lochs Survey from 1902 to 1906, of which very full accounts have appeared from time to time in the *Journal*. He pointed out that, relatively to their size, the Scottish lakes are very deep. Most of the more important are U-shaped in cross-section, and the bottom is usually covered with a black peaty mud, though there are also yellow, green, and red clays. As regards the biology, the outstanding facts seem to be—(1) The great prominence in the lakes in summer of conspicuous species of crustacea belonging to the Arctic association of plankton species; (2) The exceeding richness of the phytoplankton, especially in desmids; (3) The abundance of certain orders of microscopic animals (Rotifera and Tardigrada) at the lake margins. The third fact probably indicates merely the habitual neglect of those orders in lake studies. Mr. Murray dwelt especially on the internal seiche which has been brought to light in some of the lakes. This was explained as resulting from the action of a gale, which causes the *Sprungschicht*, or plane of most abrupt fall of temperature, to take an oblique position. When the gale ceases, the fluids of different densities separated by this plane are free to oscillate, but, owing to the slight amount of difference, the period may be long and the amplitude great (three days and 150 feet in Loch Ness).

A most interesting discussion on the important question of coast erosion was introduced by Mr. Clement Reid, and continued by Prof. Kendall, Messrs. Whitaker, Mathews, and others. Mr. Reid's paper and an extension of Mr. Mathew's communication appear in the present number of the *Journal*.

The fourth paper was by Major Hills, on the Proposed Remeasurement of Geodetic Arcs in the United Kingdom. Members of Section A (Mathematics and Physics) attended this and took part in the discussion. Major Hills pointed out that the fundamental triangulation of Great Britain and Ireland was completed fifty years ago, and that, though excellent work for the time at which it was done, it is now far behind the standard of modern work of its class. The result is that the British work cannot be co-ordinated with the Continental series for the purpose of geodetic discussion, such as a determination of the figure of the Earth, and this though the necessary observations to connect the two series were actually made at considerable expense. To remedy this defect, it is merely necessary to connect geodetically, by as good a set of triangles as can be selected, the three extreme points of our island, viz. (1) Saxavord, the northernmost point of the Shetlands; (2) Valentia, on the west of Ireland; (3) the stations on the coast of Kent trigonometrically connected with France.

Were this done, amplitudes of 10° and 11½° respectively would be added to two very important lines of geodetic triangulation—namely, the meridional arc, though the longitude of Greenwich, and the longitudinal arc, along the parallel of 52° N. lat., which at present extend from the north-east corner of France to Ain Sefra in Algeria, and to Orsk in Russia, respectively—amplitudes of 18° and 57°. As a result of improved methods, and notably the invention of invar, the rate of progress of geodetic work has been greatly increased, while a much higher standard of accuracy can at the same time be realized.

Major Hills held that the work should be done by the Ordnance Survey Department, which was, he believed, quite ready to undertake it, and the total cost would be quite trifling compared with the existing national expenditure upon survey work.

The report of the committee on the survey of the Indian ocean has already been alluded to; that by the Rainfall, Lake and River Discharge Committee was an interim one. The committee of the section asked for the reappointment of the latter committee with the unexpended grant. They also recommended the reappointment of a committee on changes of sea-level in the Mediterranean, with Mr. Günther as secretary, and this was ultimately obtained with a grant of £50. The sectional committee also supported the application of Section I (Physiology) for the reappointment of a committee on the relations between Climate and Health, and one by Section H (Anthropology) for a committee on the further archæological exploration of South Africa, this last being, however, eventually withdrawn, owing to the insufficiency of the funds available for scientific investigations.

In the work of other sections, the following papers presented points of geographical interest: Mr. H. Brodrick, "On Faults as a Predisposing Cause for the Existence of Pot Holes on Ingleborough;" Mr. R. D. Oldham, "A Criterion of the Glacial Erosion of Lake-basins;" Mr. F. W. Harmer, "The Glacial Deposits of the East of England;" The Rev. W. Lower Carter, "Notes on the Glaciation of the Usk and Wye Valleys;" Dr. H. Johnston Lavis, "Recent Observations at Vesuvius." Dr. Tempest Anderson's evening discourse on "Volcanoes" should also be mentioned.

One of the pleasantest features of the meeting was the informal afternoon gathering in the gardens of the Philosophical Society, at the invitation of Dr. Tempest Anderson, the president.

REVIEWS.

EUROPE.

The Balkan Lands.

'Remarks on the Ethnology of the Macedonian Slavs. By Dr. J. Cvijić. Translated by A. O'Brien (privately printed). 1906.

'Macedonia: its Races and their Future.' By H. N. Brailsford. Illustrated. xx. + 340. Methuen & Co. 1906.

'A Military Geography of the Balkan Peninsula.' By L. W. Lyde and Lieut.-Colonel A. F. Mockler-Ferryman. vi. + 203. A. & C. Black. 1905.

'Pictures from the Balkans.' By J. F. Frazer. Illustrated. xii. + 298. Cassell & Co. 1906.

'By-paths in the Balkans.' By F. W. von Herbert. Illustrated. ix. + 269. Chapman & Hall. 1906.

The mere traveller cannot hope to advance knowledge of the geography of the Balkan lands in any other respect than the actual distribution of political groups, and to do even so much he must possess rather unusual qualifications; for, in a country like Macedonia, things are rarely what they seem on the surface. An acquaintance with vernaculars, sufficient to render a traveller independent of his dragoman, and a considerable knowledge both of Near Eastern ethnology and the workings of the Near Eastern mind, are absolutely necessary, if his impressions are to have any serious value. The books before us bear abundant unconscious witness to the truth of these premisses. The author who is the best qualified to know is conspicuously the least prepared to dogmatize; and to all travellers in Macedonia, who, like Mr. Foster Frazer and Mr. von Herbert, find little difficulty in deciding on ethnical matters, we would recommend, in all confidence, a study of Dr. Cvijić's pamphlet. The learned Servian professor knows, at any rate, how little is known, and has no hesitation in stating the fact. In doing so he does very valuable service, for, though almost entirely destructive, he clears the ground of a jungle of half-truths and entire misconceptions which pass current for the facts of the political geography of Macedonia. The main results of his deliberate and temperate study on the spot issue in two conclusions: (1) that, ethnically, the Macedonian Slavs are Macedonians, and not either Servian or Bulgarian Slavs; (2) that they have no strong or ancient sense of identity with any other Slav nationalities, but are a floating unit, easily influenced by whichever of those nationalities offers at a given moment the most obvious hope for the future. Incidentally he demonstrates the exceedingly unsound character of the maps and statistics on which almost all other writers have based their conclusions. He is studiously impartial; but, considering his treatise impartially in our turn, we cannot fail to remark that his destructive criticism makes very considerably for Servian interests. To begin with, he excludes the Kossovo vilayet from Macedonia, claiming that without question for Servia. For the rest, the false growth which he clears away is almost entirely Bulgarian, and if the Serb gains nothing the Bulgar has much to lose. The latter's propaganda has had a long start and gone far, while that emanating from Belgrade is comparatively recent, and has penetrated but little south of Uskub. Bulgarian patriots will inevitably say that, by negativing their ethnical and historical pretensions equally with the Servian in the Monastir and Salonica provinces, Dr. Cvijić deals a blow at Greater Bulgaria ten times more heavy than that which he aims at Greater Servia.

Nevertheless, though we cannot help hoping that another ethnologist, as well equipped as Dr. Cvijić, but wholly above suspicion of having any "axe to grind," will verify his results in Macedonia, we do not withhold assent from his main contention. The experience of every well-qualified observer, who has seen the people with his own eyes, goes to prove that the national sense of nine-tenths of the Macedonian Christian population is still quite fluid, and that the stress laid by rival claimants on linguistic and historical considerations has created a mass of false opinion in Europe, which is not shared in the country itself. Except in certain frontier districts, like Razlog on the one side, or the lower Vistritza valley on the other, the population is essentially Macedonian, and only accidentally or temporarily Bulgar or Greek; and beyond that fact let us admit at once that we know uncommonly little about it. Originally, it was, probably, to a large extent, one with the Slavonic mass upon which the North Asiatic Bulgar imposed himself in the lands immediately south of the Danube; and it differs now from the Bulgarian just in that one all-important respect—that it remains pure Slav, and not Bulgar-Slav.

With Dr. Cvijić's treatise before one, it is impossible to attach much importance to such records of less instructed travellers as are set forth in either the 'Pictures' of Mr. Frazer, or the 'By-paths' of Mr. von Herbert; but we would distinguish between these books, to the advantage of the former. Mr. Frazer's volume is quite a good bit of "special correspondent" work. He knows nothing of the vernaculars, and he galloped over well-trodden paths; but he shows himself acute, sensible, and laudably fair according to his lights. Mr. von Herbert, on the other hand, evidently knows something of the Turkish and a little of the Bulgarian tongue, and he implies, rather than states, that he penetrated many dark corners. But a writer who infuses so much meretricious romance into his narrative, has only himself to blame if he convinces least when he wishes to do so most. He may know "things not generally known" about the gipsies of the Balkans and about many other picturesque individuals, but few who read his book would accept his evidence without a deal of corroboration.

Mr. Brailsford is in a different category. He has not Dr. Cvijić's qualifications for discussing the ethnology of the Macedonians, but, on the other hand, he has enjoyed unusually good opportunities for studying the actual political grouping in the most disputed districts. His acquaintance with Greek populations is not of yesterday, and he went to the Slavs of Macedonia under circumstances which enlisted their sympathies in an especial degree. He has studied the latter with an open and well-instructed mind, and, so far as he was able, has penetrated below the surface. As an account of the modifications introduced into the political grouping by the Bulgarian activities of the past five years, his book is by far the best we have, and as a fair record of the state of things up to the present date, it will retain permanent value. He concerns himself in the main with actualities, and has as little belief as Dr. Cvijić in the practical value of the historic claims put forward by the rival claimants. If those interested in the Balkan question will read Dr. Cvijić first, and then Mr. Brailsford, discounting the latter's certainty by recollection of the former's scientific doubts, they will arrive at as fair a view as is attainable in these latter days.

The work of Mr. Lyde and Colonel Mockler-Ferryman stands quite apart from the rest. It is an attempt to state the effect which the permanent geographical conditions of the Balkan lands, and the recent modifications introduced into them by military engineers, would have on strategic operations in the future. A short account of the Balkan campaigns of the eighteenth and nineteenth centuries is added by way of proof and illustration. The book is very interesting, and one feels throughout that one's idea of the geographical conditions gains much precision by reading a consideration of them from a single point of view. At the same time the book often lacks the touch of one acquainted at first hand with all the country described, and, we fancy, would be annotated considerably by, say, the Austrian general staff. The dogmatic laws of the military school are subject to a good deal of modification—*ambulando !*

D. G. H.

AMERICA.

The Selkirk Range.

'The Selkirk Range.' By A. O. Wheeler, F.R.G.S. Ottawa: Government Printing Bureau. 1905.

The Dominion Government have issued the first volume of what is, practically, a monograph on "the Selkirk range" in British Columbia. The author, Mr. Arthur O. Wheeler (Topographer to the Department of the Interior), describes the work of his first year's survey thus: "A continuous zone has been topographically surveyed for some miles on either side of the railway (connecting with a previous survey of the Columbia valley), forming a base from which the work can be expanded in any required direction. During the second year the survey was extended southward to embrace all previous travel and explorations of the higher Selkirk summits, and to enable a reliable guide-map to be furnished to tourists and mountaineers."

The Dominion Government were fortunate in their selection of Mr. Wheeler for such a work, and he has produced a most readable book, profusely illustrated. Photographs of mountains and glaciers predominate, but those of the characteristic plants amid their natural environment, by Mrs. Charles Schäffer, cannot fail to interest other readers than those who can call themselves botanists, and the appendices on geology, zoology, botany, and meteorology make the work complete.

Now that the Selkirks have been pierced by a railway, trails opened, and forests burned, it is hard to realize the barrier which this range formed in its primeval grandeur. The rivers through the prairie regions and the streams of British Columbia were the routes followed by the fur traders of the early days. In many cases these pioneers from the east pushed their way into the Rockies, and in course of time crossed the Divide and made their way down into British Columbia. The Athabasca pass, however, which avoided the Selkirk region, was the favourite route.

In 1857 an entirely new system of exploration was inaugurated, when an Imperial Commission was appointed to explore for a railway route to connect ocean with ocean. When boys of the generation now passing away were reading Fenimore Cooper's novels, and living in imagination with buffaloes, grizzly bears, and Red

Indians, Captain Palliser, Sir James Hector, and their party were exploring for a pass to the Columbia, and when the Kicking Horse pass was discovered, the exploration of the Selkirk range flanking that pass to the west had to be tackled. In 1872, "Mr. Walter Moberly and his assistants were the first, of whom there is a record, to penetrate the northern portion of the Selkirk mountains. . . . It was not till sixteen years later (1881) that Major Rogers traced the Illicellewaet river to its source, . . . and gazed upon the little marshy meadows nestling snugly among patches of spruce trees at the summit of the pass through which the railway was destined to run."

In the appendix is a most interesting account of Major Roger's journey, by his nephew. Travellers nowadays will be surprised at the "iron-clad contract" that was necessary to compel his Indian packers to go through with the job. Passing from these early explorations, Mr. Wheeler devotes Part iii. of his book to "Previous Surveys." The railway was pushed through before any map of the range was attempted, and I must take this opportunity of thanking Mr. Wheeler for his appreciative remarks on the rough survey which, with the assistance of the Royal Geographical Society, I carried out in 1888.

The Selkirks have now lost much of their mystery, and fire has deprived them of some of their beauty, but they are now accessible, and guides brought from the Bernese Oberland are to be found at Glacier every year, to pilot visitors over the glaciers and to the summits of peaks, from which views of surpassing beauty in the clear air of the Selkirks may be enjoyed. Beyond the zone now surveyed there are still untrodden glaciers and unclimbed peaks, and in approaching them mountaineers of the future will meet with all the difficulties presented by the primeval forests which rendered the Selkirks so perplexing to the early pioneers.

Mr. Wheeler, in dealing with "Mountaineering in the Selkirks," says, "Many fine peaks have not been approached at all. Noticeably, an isolated rock tower with several outlying spurs and dependent glaciers immediately to the west of Mount Bonney. It has been named Mount Smart." "North of Hermit range at least three isolated peaks rise supreme above their fellows, one of them, that to the north-east, undoubtedly the highest in the Selkirk range. There is much that may yet be done before these peaks are known, named, and mapped." Mr. Wheeler has here touched a note which will, no doubt, find a response in the near future.

W. S. G.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Survey Methods.

'Hydrographic Surveying: Methods, Tables, and Forms of Notes.' By S. H. Lea. New York: The Engineering News Publishing Co. 1905. *Price* 8*s. net.*

This book is intended for the instruction of surveyors of water in any shape or form. It is obvious that sounding work is more expeditious and accurate if carried out from a steam or motor boat than from a row-boat. The author might specially note this point in a future edition. In one or two matters, such as sounding with ordinary lines, the author's method seems rather antiquated, but his directions for carrying out the operation are clear and good. There are some interesting chapters on fixing the flow of water in a river, and many ingenious instruments and the methods of using them are described.

Weirs and their construction are discussed, a matter about which there is still much to learn. The book deals only with methods in use in the United States, but will prove a useful and instructive manual to those who are engaged in similar work over here.

D. W. B.

Tides and Waves.

'A Practical Manual of Tides and Waves.' By W. H. Wheeler, C.E. London: Longmans. 1906.

This useful manual gives an interesting account of the tides and of wave-formation, setting forth the different theories and methods of their investigation and the practical results obtained. The author shows that there are many mathematical problems involved in the elucidation of the correct history of the tidal system. The chapters on the effects of wind and atmospheric pressure are clear and good. Many examples are given. The chapter on tides in rivers is also interesting. There is a good account on the effect of the wind on the waves at sea, and also of the occurrence of what the author calls seaquakes, and of the great single waves sometimes encountered with disastrous results. It is curious that the author goes back to the beginning of the last century for some of his data on these points, but entirely overlooks the fact that there have been quite recent investigations on the effect of wind force on waves at sea.

The book is a useful one, and can be confidently recommended to all who are interested in the problems treated of.

THE MONTHLY RECORD.

EUROPE.

The Frische Haff, on the German coast of the Baltic, is the subject of a paper by Dr. G. Braun, of Königsberg, who has previously been known to geographers for his investigations of some of the North German lakes (*Zeitschrift f. Gewässerkunde*, VII. Band, 3 Heft). Dr. Braun has worked up the data scattered in previously existing literature with the results of his own observations, so as to present a concise view of the general physical conditions of the lagoon. The morphological features are marked by considerable diversity, as the Haff touches not only the East Prussian zone of depression, but the more elevated ground formed by the diluvium of the ice-age. The coasts show three distinct forms: that of the low-lying alluvium, the so-called "Hakenküste" formed by dunes, and the cliffs of the diluvium. The alluvium is extending its area and introducing modifications of form, while the higher portions are being more slowly worn away. The Haff (which word is the equivalent of the Danish *Hav*, "sea," while the distinctive epithet refers to the comparative freshness of its water) was formed, on the site of a depression dating from the ice-age, by the heaping up of the material brought down by the Vistula, under the action of the current which runs along this coast. Dr. Braun deals fully with the *régime* of the water and its movements. The lagoon is remarkably shallow, the maximum depth being only 16½ feet. The water-supply is derived mainly from the Nogat branch of the Vistula and (to a less extent) from the Pregel. An admixture of fresh and salt water takes place through the "Tief," or outlet, near Pillau, the currents in which vary under the influence of winds. For a considerable proportion of the year there is an influx, even at the surface, and observations of temperature and salinity show that when there is an outflow of fresh water at the surface, there is frequently an undercurrent of salt water setting inwards. Cases are known in which the flow from surface to bottom has been reversed in a single day, though the process is usually slower. The conditions are similar outside the outlet, where the lagoon water can be sharply distinguished from the sea water by its colour. The salt undercurrent can often be traced almost to the inner extremity of the lagoon, but is confined to the central channel. The Königsberg ship-canal is generally filled with brackish water, though the rest of the lagoon may be entirely fresh. Great variations of level occur under the action of the wind. Dr. Braun concludes with some notes on the economic relations of the Haff, which by means of the ship-canal participates in over-sea commerce, while standing at the head of the German coast waters for interior traffic. In the days of smaller craft the position was more favourable than at present to the towns round its shores, most of which have of late years seen their prosperity diminish. Königsberg, however, forms an exception, since the opening of the ship-canal, which has favoured it at the expense of Pillau.

Geography in Hungary.—From the annual report of the President of the Hungarian Geographical Society, Prof. L. von Lóczy, the following statements indicative of the present state of geographical research as pursued in Hungary may be cited. In his treatise, 'Regularization of Rivers and Improvement of Soil in China' (in the Hungarian language), Dr. Jenö Cholnoky, well known for his travels in Eastern Asia, has given an excellent picture of the hydrography of the great Chinese plain. At the instigation of the Oriental Congress at Rome there has been formed an International Union for the Anthropogeographical Study of Asia, and to this union a Hungarian commission has also been affiliated. Dr. George Almásy and the geologist, Dr. Gyula Prinz, will shortly enter on a journey of research in the interior of Asia. The Russian explorations in the Caspian sea confirm an old opinion of Lóczy's, according to which animal bodies, rotting at the bottom of retired seas in foul, stagnant water, and covered with a layer of mud, yield petroleum. The ancient petroleum-beds, in the early Tertiary strata of the Caucasus, as also of the Carpathians, may in their time have arisen in land-locked sea-basins in the same way as the deposits of animal bodies on the present floor of the Black and the Caspian seas. Towards the investigation of their own land contributions have again been made, more particularly by the Royal Geological Institute and the Hungarian Geological Society connected with it. For the study of the South Carpathians and the Transylvanian Alps the work of Baron Fr. Nopesa, jun., on the 'Geology of the District between Gyulafehérvár, Deva, Russkabánya, and the frontier of Roumania' (in Hungarian), will hardly be dispensed with by the geographer. The treatise, too, of Vilmos Güll, Aurél Liffa, and Imre Timko, on the Ecseder moor and its agricultural conditions, has a geographical bearing. Both works appear in the Year Book of the Royal Hungarian Geological Institute (14th vol.). Among the agro-geological reports noteworthy observations on the physiogeographical conditions of the Alföld are to be found. In the region of the Krapina commune (Styrian frontier) Prof. Goryanovics-Kramberger of Agram discovered remains of diluvial man, together with remains of the *Rhinoceros Merkii*, and placed the results of his investigations before the Hungarian Geological Society. The same geologist is also publishing, with explanatory text, the geological map of Croatia, on the topographical basis of the Austro-Hungarian special map-sheets on the scale of 1: 75,000. In the journal of the above-mentioned society has also appeared (in German) a treatise by Dr. Fritz Frech, professor in Breslau University, on the animal world of the marine deposits of the Carboniferous period in Hungary, a paper of no small importance for the palæogeography of Hungary. For over twenty years the hydrographical department of the Ministry of Agriculture has been occupied with the study of the waters of the land. In its service the hydrologist, Odön Bogdánfy, has published (in Hungarian) his 'Hydraulics of Natural Running Waters.' In these two volumes the data bearing on the hydrography and hydrology of the Hungarian rivers have a geographical import. By the publication (in Hungarian) of Viczian's work on the water-power of Hungary, the Ministry has rendered a service, not alone to technology, but also to national economy and to geography. Of geomorphological importance is the prize-essay of Vilmos Sóbányi, on the 'Hydrography of the Tributary Rivers on the Left Bank of the Danube, with special reference to the Formation of Terraces,' published by the Academy of Sciences. Of the geographical literature of a popular character, published in Hungary, mention can only be made here of the magnificent work of Franz Gáspár in several volumes, richly illustrated, entitled 'The Book of Culture' (in Hungarian). Of this work one volume, wholly devoted to geography, is now being printed. A large Hungarian general atlas is also in immediate prospect of publication. The interruption which has occurred in the publication of the 'Results of the Scientific Exploration of the Balaton Lake' (in Hungarian and German), is connected with the political situation. Among the publications under this head, the great work of the lamented Janos Jankó, on the 'Ethnography of the Dwellers surrounding the Balaton Lake,' is being re-written and translated into German. Lastly, the Berlin International Seismological Conference of August, 1905, has founded the "International Union for the Observation of Earthquakes," and has elected as its secretary Dr. Radó von Kövesligethy, Professor of Geophysics and Geodesy at Budapest. Under this stimulus a seismological station of the first rank has now been erected in Budapest, the management of which has been committed to Kövesligethy.

ASIA.

Mr. and Mrs. Workman in the Nun Kun Mountains.—A correspondent writes: "Mrs. Fanny Bullock Workman and Dr. William Hunter Workman have successfully completed their exploration of the Nun Kun mountain group in Suru, Kashmir, the expedition having occupied ten weeks.* They were accompanied by the Italian guide, Cyprien Savoye, who was with them in Baltistan in 1903, and six porters. The entire circuit of the Nun Kun group was made for the first time, this involving a rough journey of between 90 and 100 miles from Suru, just north of the mountains, out and return. The distance was considerably increased owing to the necessity of making three extra marches up the Randun valley to find a fording-place over the glacier-fed Suru river, greatly swollen from the unusual melting of the ice, due to the prolonged fine weather and great heat. In making this circuit, three glaciers were ascended and two descended, three snow-cols of over 17,000 feet and one 500 feet lower crossed, and one steep pathless rock mountain traversed, probably never before trodden by human foot. The central portion of the Nun Kun massif rises sharply high above the steep jagged peaks that guard the approaches to it on all sides. At an altitude of over 20,000 feet it culminates in an oblong glacial basin, 3 miles long by 2 wide, enclosed by five rock and snow summits, three of which tower to heights of over 23,000 feet, the highest having been fixed at 23,447 feet. To explore this portion, a base camp was established above the north lateral moraine of the Shaffat glacier, at an altitude of 15,100 feet, from which two snow camps were made on the wild, broken, glacial slopes above, at altitudes of 17,657 and 19,893 feet, and two more in the high glacial basin at altitudes of 20,632 and 21,300 feet. On the two nights passed at this camp, the temperature fell to $-4°$ and $-6°$ Fahr. The highest peak having been found to be inaccessible from the basin, an ascent was made of the next highest, 23,264 feet, its steep, broken, ice-covered slopes demanding hours of step-cutting and the exercise of the greatest caution. At a height of 22,656 feet, as clouds were beginning to obscure some important

* A first exploration of this group, by Dr. A. Neve and the Rev. C. E. Barton, was described in the *Alpine Journal* for February, 1903 (see *Journal*, vol. 21, p. 671).

landscape features, Dr. Workman and one porter stopped to make observations and take photographs before the view should be cut off; while Mrs. Bullock Workman, with guide and one porter, went on to complete the ascent, which gives her a place in the small category of those who have passed 23,000 feet. The continued daily exertion in rarefied air, the loss of sleep owing to disturbance of respiration by the altitude, and the effect of the great cold upon the vital powers thus weakened, proved trying to all, and, after five sleepless nights at 19,900 feet and above, all felt the need of returning to lower altitudes. Later, from the Barmal La, 17,228 feet, ascents were made of two sharp snow-peaks, one on each side of the head of the Barmal glacier, whose final slopes rose at from 70° to 73°. The first had an altitude of 18,750 feet, and the second, D 41 of the Survey, that of 20,168 feet. On the summit of the latter, the party was enveloped in a dense fog, accompanied by an icy wind, which lasted for several hours. In this the descent was accomplished by following the trace which had been made in ascending. The topographical features of the region were found to differ materially from those shown on any existing map.

Mr. W. Rickmers in Central Asia.—Mr. Rickmers writes from Garm, in Bokhara, under date September 1, 1906, stating that he has traversed the Zarafshan valley throughout the whole length, ascending to the very head of the glacier beyond the point reached by Mushketoff in 1880. He found the Macha pass to be only a lateral saddle. The glacier has receded considerably of late, having lost about 100 feet of its length since last year. Mr. Rickmers has made some interesting observations on the glacial and other phenomena of the district, and has visited the Fantagh group, mapping its southern portion, and studying the lakes, moraines, landslips, and glaciers of the Pasrut valley. Writing again on September 22, he reports having completed a thorough investigation of the central portion of the Peter I. range.

Great Britain and Tibet.—The text of the Convention between this country and China, signed at Peking on April 27 last, confirming the treaty negotiated by Sir F. Younghusband in 1904, has been printed as a parliamentary paper ('Treaty Series,' No. 9, 1906). By Art. 2 Great Britain engages not to annex Tibetan territory, nor interfere in the administration of Tibet, while China undertakes not to permit any other foreign nation to do the like. In regard to the section of Art. 9 of the original treaty, which stipulated that no concessions for railways, roads, telegraphs, mining, and other rights shall be granted to any foreign power, it is now stated that such concessions are denied to any state, or the subjects of any state, other than China; permission being, however, given for the telegraphic connection with India of the trade-marts to be opened in accordance with the former treaty. The text of that treaty is printed as an annex.

Dr. Tafel's Journey to Tibet.—A letter from this explorer is printed in the ninth number of *Petermanns Mitteilungen*, which shows that, nothing daunted by the disaster which befel him on his first attempt to enter Tibet from Kuku-nor, he has made a renewed advance in this direction, though it does not appear how far he had penetrated at the time of writing, his letter (written on April 17 last) being merely headed "Tibet, Lagerplatz IV., ca. 1700 m. hoch." He is travelling as a Kashgarian merchant, his caravan-bashi posing as a second, while his ten men, most of them experienced in travel in Tibet and neighbouring regions, and apparently trustworthy, are all armed with Remington rifles. He had been waiting for some days in a snowstorm in order to complete his supply of baggage animals, which he hoped to make up to one hundred, seventy of them yaks. He complained of the treatment he had met with from the local authorities in the Kuku-nor district, having received nothing in the way of indemnity for the plunder of his caravan, although the Amban had exacted a fine of about £150 from the chief in whose district the attack had taken place. In his opinion, a new Boxer revolution was in full course of being hatched in that part of the empire.

AFRICA.

The Rainfall of Africa.—An attempt to bring together in generalized form the now rapidly accumulating data on the rainfall of Africa has been made by Dr. G. Fraunberger, who has published the resulting rainfall map compiled by him in *Petermanns Mitteilungen* (1906, No. 4). This map deals only with mean annual rainfall, and the important question of seasonal distribution is not touched, but so far as it goes, the author's work is a valuable step in advance, being based on a careful study of almost all the available data, while, although necessarily still showing only the broader features of rainfall distribution, it enters into considerably more detail than previous attempts in the same direction. With one or two exceptions,* Dr. Fraunberger seems acquainted with all the important contributions to the subject that have yet appeared, but though he has embodied a good deal of the previous results, he has throughout made an independent study of the data (which consists of observations from over four hundred stations), and has not hesitated to make corrections where necessary. He has, perhaps, in one or two instances shown too great a confidence in previous work, much of which has necessarily been given in an exceedingly generalized form, and though positive errors have, as already remarked, been eliminated, the map might possibly have been still more valuable had it been based solely on an independent study of the records, though this might have involved more labour. In the accompanying letterpress Dr. Fraunberger mentions the principal points on which his conclusions differ from those of his predecessors, and also sketches the influence of geographical and other factors in determining the distribution. The actual observations being still far from adequate to afford a complete basis for such a map, it is, of course, necessary to rely to a certain extent on *à priori* deductions or indirect evidence. Thus the author depends more than once on the facts of vegetation distribution, though these are, perhaps, not quite sufficiently established to be a trustworthy guide. One point of difference from former maps is the smaller annual rainfall assigned to the Air and Tibesti highlands near the southern border of the Sahara, which Dr. Fraunberger, on the basis of Foureau's observations in the former, places at under 200 mm. (8 inches). This is the lowest step in his scale, which ascends in the main map by eleven gradations to an amount of over 4000 mm. (160 inches). The heavy precipitation near the head of the Gulf of Guinea is shown on an inset by a different scale, which distinguishes a maximum, along the small strip of coast west of the Kamerun mountain, of over 10,000 mm. (393 inches). The author points out the influence the rift-valleys (especially in the case of Nyasa and Tanganyika) have on the distribution of rainfall, the eastern sides being markedly drier than the western. He is unable to account for the comparatively small amount of precipitation on the Gold Coast, which still awaits a satisfactory explanation. Some corrections will, no doubt, be necessitated when the data become more complete. Thus it seems possible, at least, that the rainfall assigned to the Ruwenzori range is too small, being shown as considerably less than that of various other mountainous areas of East Africa. A table gives the observed annual precipitation at about four hundred stations, with a statement of the number of years (still far too few in the majority of cases) during which observations have been made.

Mr. Vischer's Expedition.—A Reuter telegram from Tripoli, dated October 19,

* No account seems to have been taken of Mr. Sutton's work with respect to South African rainfall, or Sir Harry Johnston's rainfall map of Uganda, printed by the Intelligence Division in 1900.

reports that Mr. Vischer (*ante*, p. 181) was attacked by Tuareg near Tejirri (a place on the route south from Murzuk, about 120 miles from that town), but repulsed his assailants with the help of the villagers. The date of the occurrence is not stated.

Colonel Laperrine in the Sahara.—A new expedition into the heart of the western Sahara has, as is stated in *Globus* (**90**, No. 12), been carried out this last summer by the indefatigable Colonel Lapperrine, who reached Taodeni, the site of the well-known salt deposits. The march, in the heat of summer, was an exceedingly trying one. On the outward route no pasturage was found for a distance of 125 miles, and the animals suffered much, while the badness of the water-supply caused great difficulties on the homeward march. Colonel Laperrine does not share Prof. Gautier's opinion that Taodeni is the site of a former inland sea on which the drainage of a large part of the Sahara converged, as the salt deposits cover but a small area. If such a basin exists, he thinks it must be sought elsewhere.

Dr. Frobenius in the Congo Basin.—This traveller has now returned to Germany after completing his researches in the southern Congo basin (*Zeitschrift Ges. Erdkunde, Berlin*, 1906, No. 7; cf. *Journal*, **26**, 672; **27**, 629; **28**, 181). The last section of the journey was devoted to the basin of the Sankurru, the northern tributary of the Kasai first explored by Dr. L. Wolf, but which has generally remained more or less off the routes of travellers. Although Wolf's map was an excellent piece of work, he gave no detailed account of the river, and Dr. Frobenius is able to add to our understanding of the general characteristics of the country through which it flows. During its passage across the plateau land proper, a striking feature is the regular alternation of low and high banks, due to its having cut through the surface undulations of the sandstone formation. About the point where it first takes a westerly course the banks form walls of stone, 150 to 200 feet high, relieved by tall forest. To the south of this, steppe, and to the north, forest prevail. The river passes at Batempa through a rock-gate and enters the flatter land. The traveller was struck by the rapid increase in size of the streams within short distances, especially in the case of the Lubi, which must receive most of its supplies by percolation from the plateau swamps through limestone strata. The lower part of the Sankurru is very unpleasant to navigate, being very shallow, and obstructed in the dry season by many more sandbanks than the Kasai. Though there is an extensive forest in its upper basin, its westward-flowing section is merely bordered by a narrow strip of forest. Dr. Frobenius thinks that the forest through which Kund and Tappenbeck passed in their journey to the north of the Kasai cannot extend far from the banks of the Lukenye. A strange tradition among the natives has it that in ancient times the Sankurru flowed north, and the accounts of the arrival of people from this direction in boats recalls some of the stories told to Stanley on his descent of the Congo. The rainfall in this region has been extraordinarily heavy this year, and stories are told of whole villages being inundated and the inhabitants forced to build platforms on piles and move about in boats. With regard to the native tribes, the traveller says that about Lusambo there is a meeting of races such is hardly to be seen elsewhere in Africa. His study of the Bassongo Mino, the truculent tribe of the lower Sankurru, led to the unexpected conclusion that they form part of a series of tribes, occupying a very large area within the bend of the Congo, who all speak practically the same dialect, use the same bows, shields, and other articles, and live in similar houses. Light is thrown on the past movements of races by the present distribution of ethnological characters, among others the use of the throwing-knife.

The Frontiers of Nigeria.—As has been mentioned in the *Journal*, joint commissions, representing Great Britain and France and Great Britain and Germany respectively, met in London in the early part of the year for the purpose of making proposals for the drawing of the boundary-lines of Nigeria, to the north and south respectively, on the basis of the surveys of the commission which had previously examined the country on the spot. The recommendations of the Anglo-French commissioners were adopted in a convention signed in London on May 29 and since ratified, which has been printed as Treaty Series, No. 14, 1906. The frontier decided on follows a very irregular course defined by certain fixed points which are specified in the text of the Convention, and shown on a large-scale map in two sheets annexed to it. It is impossible to define it in few words, but it may be said that the result is to adhere to the general line of the frontier as fixed in 1904, though one or two modifications of more importance are made in favour of France. Thus, south of Zinder the line runs considerably south of its position according to the agreement of 1904, while, after striking Lake Chad at the mouth of the Komadugu, it slopes to the south-east before reaching the meridian 35′ E. of Kuka, which has hitherto formed the extreme eastern limit of Northern Nigeria, as indeed it continues to be south of 13° N. This is to secure to France the whole eastern shore of the lake, which, owing to the growing restriction of the water area on this side, would not otherwise be the case. Among other provisions of the convention is one guaranteeing free navigation on the lake both to British and French subjects or protected persons. The southern frontier of Nigeria, from the neighbourhood of Yola to Lake Chad, was defined in accordance with the recommendation of the commissioners by an exchange of notes between the British and German governments on July 16, and is shown on a map given in the *Deutsches Kolonialblatt* for September 15. The same system has been followed as in the case of the northern boundary, straight lines as a rule being avoided, but the line defined by a number of points or natural features in the topography of the country. For more than half its course the line follows the Yadseram stream, which loses itself in the swamps south of Chad in the neighbourhood of Dikoa, and, curiously enough, diverges to no great distance on either side of a straight line from the Benue near Yola to Lake Chad. The last part of the boundary cuts the meridian 35′ E. of Kuka, at a point just above high-water mark of the lake, which was marked on the spot by two pillars during the course of the boundary surveys.

The Place of Hornemann's Death.—The circumstances of Hornemann's death were such as to render it little likely that all the uncertainties connected with it will ever be cleared up. According to the report sent to Captain Lyon in Murzuk in 1819, the traveller made his way to Noofy (Nupe), at the chief town of which, "Bakkanee," he died. Dr. Pahde, in his memoir of the traveller published in 1895, thought that he must have reached the Niger between Say and Gomba, and was inclined to identify the place mentioned with Bikini, one of the localities touched at by the German Togo expedition of 1895. This involved the supposition that the influence of Nupe extended, in Hornemann's time, further north than in more recent years. The writer of a note in *Globus* points out, however, that a place named Bokane exists in Central Nupe, a little north of Rabba, and that this was probably the place in question. This view is supported by the statement of Clarke ('Specimens of Dialects,' p. 81: Berwick, 1848), in reference to a people in the Nupe country near Rabba, that "it was in this part of Africa that Hornemann died." Bokane may once have been the chief centre of Nupe, as Flegel mentions an extensive wall surrounding it, and enclosing cotton plantations and scattered groups of houses.

The Gold Coast Interior.—A Colonial Report (No. 493) for 1905, on the Northern Territories of the Gold Coast, records the opening of a new administrative post at Navarro, commanding the district between the Sissili, the Red Volta, and part of the White Volta. Twenty-four thousand square miles in area, the Territories have a population estimated at 2,500,000. The rainfall for 1905, 55·71 inches, greatly exceeded that of any of the last three years. A large market has already sprung up, and many Hausa traders have settled at Navarro. A complete reorganization of the administrative centres will, it is hoped, serve to draw more closely the bonds between the more populated regions and the British Administration. The demand for clothing which has suddenly sprung up is being supplied at present by the Germans in Togoland. The Lobi-Dagarti and Dagomba countries, too, have to obtain a great deal of cotton for cloth-making from Moshi traders, who get it from French territories. There is a promising field for the growth of sugar and rice. The country is eminently suitable for cattle-raising. A large force of young men is available for labour in the Tarkwa and Ashanti mines, their utilization for this purpose being approved by the chiefs. The year under review is further notable for the issue of the first reliable maps of the northern territories.

AMERICA.

Ascent of Mount McKinley.—According to a Reuter telegram from New York, dated October 3, Dr. F. A. Cook, whose new expedition to Mount McKinley was referred to in the August number of the *Journal* (p. 183), has succeeded in reaching the summit of the mountain, which is the highest known peak in North America. It will be remembered that Dr. Cook (who took part in the Belgian Antarctic Expedition) made the circuit of Mount McKinley in 1903 (*Journal*, vol. **24**, p. 592), and, though unable to complete the ascent on that occasion, reached a height of over 11,000 feet. The total height assigned to the mountain by the Geological Survey is 20,464 feet.

Drainage Modifications in the Black Hills and Bighorn Mountains.—Among the many studies of drainage modifications within recent geologic times which have been taken up with so much ardour on all sides, is one by Mr. G. R. Mansfield, in respect of the above-mentioned districts of the United States, which has appeared in the *Bulletin* of the Museum of Comparative Zoology at Harvard (Geol. Ser., vol. **8**, No. 3). A marked feature in portions of the Black hills district is the occurrence of beds of gravel and boulders, sometimes of great thickness, and occupying not only broad valleys like that of Boulder creek, but saddles on the divides and patches on the shoulders of the boundary slopes far above the present streams. Although the idea has been held that some, at least, of the deposits were formed on the shore of an ancient lake, Mr. Mansfield considers it preferable to regard them all as fluviatile in origin, the region having, since their formation, been subjected to considerable changes in its drainage system. The writer has carefully mapped the deposits, and compared the boulders collected with samples of rocks occurring *in situ* in the district, with the result that he has been able to lay down in a map the lines of movement from possible places of origin. These agree remarkably in indicating a source, in each case, roughly towards the south-west, and it may therefore be supposed that the ancient stream had its headwaters in this direction. But while both the drainage basin and direction of discharge have remained practically the same to the present day, the lines along which that discharge takes place are not identical. Mr. Mansfield believes that the Post-Oligocene incision, which has brought about the changes referred to, began as the result of an increase in relative humidity, but that later the process was continued as the result of tilting, which brought about readjustments of drainage. In the Bighorn mountains the history has been somewhat similar, extensive gravel deposits having accumulated during the Pleistocene period, since which the streams have entrenched themselves deeply below the old valley-floors. In this case, too, uplift, and not climatic oscillation alone, seems to have played its part, and great opportunity has been given for the development of adjusted drainage, striking examples of which are given in the paper.

Nicaragua and the Mosquito Territory.—Last year, on April 19, a treaty was signed at Managua between Great Britain and Nicaragua, by which the former recognizes the absolute sovereignty of Nicaragua over the former Mosquito Reserve, as defined in the treaty of Managua (now abrogated) of January 18, 1860. Certain privileges are, on the other hand, secured to the Mosquito Indians and Creoles born before 1894, including exemption from military service and from all direct taxation for fifty years from the ratification of the treaty. This took place in August of the present year, and the text of the treaty has since been issued as No. 11 (1906) of the Treaty Series of Parliamentary papers.

AUSTRALASIA AND PACIFIC ISLANDS.

The First Crossing of Mount Cook.—The story of the first crossing of Mount Cook is told by Mr. Malcolm Ross in the May number of the *Alpine Journal*. The start was made by Messrs. Fyfe, Graham, Ross, and Turner on Tuesday, January 9, 11.15 p.m., from Bivouac rock on the Haast ridge, whence earlier climbers too have set out to scale the highest pinnacle of the Southern Alps. Leaving Glacier dome, 1300 feet above the Bivouac, ten minutes past midnight, and making a descent of 700 feet, the party went 4 miles across a plateau (7000 feet high) to the foot of the north-east ridge. Climbing the long snow-slope, they encountered in the eerie dusk before dawn a serious bergschrund. Deftly overcoming this, they were startled by an avalanche crashing with thunderous din from the ice-slopes of Mount Tasman to the plateau. Three hours twenty-five minutes' grim work from the schrund gained them the Zurbriggen arête. By 9 a.m. they stood 10,0C0 to 11,000 feet high, commanding views of Mount Tasman close on the north, Lendenfeldt, Haast, Haidinger, De la Bêche, Elie de Beaumont, and the Hochstetter dome. Across the valley towered Malte Brun. Farther away to the north-east stretched a 100-mile vista of range on range far as eye could reach. After an hour's rest, the party again set to cutting steps up another very sharp snow-ridge. Finally at 1 p.m., Wednesday, January 10, thirteen hours forty-five minutes from the time of leaving the Bivouac, the mountaineers put underfoot the topmost pinnacle of Aorangi, 12,397 feet above the sea. The mountain having been climbed from the Tasman side, it was boldly resolved to descend it on the Hooker side. This descent, perilous in places, was happily accomplished, and on Thursday morning, just after midnight, the mountaineers stepped on to the upper slopes of the Hooker glacier.

The Structure-lines of Oceania.—This is the subject of a paper by Dr. T. Arldt in Nos. 5 and 6 of the *Zeitschrift* of the Berlin Geographical Society for the present year, the object of which is to extend the investigations of Dana into the prevailing directions of the structure-lines of Oceania by a more detailed examination of the region. Dr. Arldt points out in an introductory section what diverse views have been held as to the past geological history of the Pacific, some holding that ocean to be the site of a vast former land mass, while others, adhering to the view of the permanence of ocean basins through long geologic ages, believe it to be the field of action of forces which have only in recent times begun to thrust up mountain ranges from below. A decision between these two opposite views is impossible in the existing state of our knowledge of the geology of the region; while the fact that the original formations of so large a part of the area are masked by deep-sea deposits makes it particularly difficult to gain an insight into the past physical history. The study of the structural lines observable in the island groups is therefore of special importance. Dana, in his 'Manual of Geology,' pointed out the striking parallelism which prevails in the directions of such lines, and, in order to throw further light on this point, Dr. Arldt undertook the task of determining, for each group throughout the whole area, the direction of the loxodromes of the main tectonic lines, the angles being measured from north through east to south. He divides the whole area into an inner and outer arc—the former comprising all the groups nearest to the archipelago and Australia (Melanesia, New Zealand, etc.); the latter the Polynesian groups—with the additional arc of the Marianne islands showing special features of its own. This division accords in the main with the geological characteristics of the areas, the inner zone forming, *e.g.*, a wide girdle of Mesozoic and Tertiary folds ranged outside the pre-Carboniferous folded ranges of the Australian continent, and marked by volcanic activity and the depression of certain areas within it; it is to be regarded throughout as an old continental area. The character of the outer zone is not so clearly marked. The result of Dr. Arldt's calculations is to confirm the main theses laid down by Dana, though the parallelism is not always quite so striking as that writer supposed. Thus, in the case of the Polynesian groups the greatest difference of direction amounts to 21°, instead of the 8° which he supposed. Of Dana's characteristic directions (west-north-west and north-north-east), the former holds good for the outer zone as a whole, and in a less degree for the north-west part of Oceania as a whole; but the latter does not agree so well with the reality. Rectangular intersection of different systems is seen in a limited number of cases. Dr. Arldt thinks that, though the character of folded mountain ranges is not definitely established in the case of the groups of the outer zone, the parallelism is sufficiently striking to argue a unity of origin, and that the simplest explanation is that which attributes this to folding. The conformity of the island chains with the older mountain systems to the west, which recalls other examples in various parts of the world, points in the same direction. Thus we have a regular succession in time and place from the West Australian tableland through the Australian cordillera to the inner zone of islands, and it is only natural to extend the sequence to the outer zone also. If this is justified, that zone may perhaps represent the most recent fold-system on the face of the Earth, as it would also have the greatest longitudinal extension. This might be explained by the absence of checks to the forces in play in the case of so large an extent of ocean.

POLAR REGIONS.

Mr. Harrison's Expedition to Arctic Canada.—Writing from Herschel island on August 26, Mr. A. H. Harrison gives particulars of the work he has been able to accomplish since the beginning of March, the date of his previous letter (see *Journal*, vol. 27, p. 635). Survey work and geographical studies of various descriptions had continued fully to occupy Mr. Harrison's time. The greater part of the spring and summer months was spent on Herschel island, but in July Mr. Harrison took advantage of an opportunity which offered to secure a passage on board a whaler to Banks Land, and went up the coast as far as Cape Kellett. During the cruise, which occupied six weeks, useful information was obtained as to the character of the Arctic ice, on which Mr. Harrison often went out from the ship. He had hoped to obtain supplies from the whalers who had wintered at Baillie island, in the neighbourhood of Cape Bathurst, but found that they themselves had barely sufficient provisions for their own requirements. Consequently Mr. Harrison's idea of wintering on Banks Land had to be abandoned, and at the end of the cruise he returned to Herschel island. Among the fruits of the six months' work are maps of Baillie island (which, Mr. Harrison states, is wrongly located on the charts) and Herschel island, together with a series of soundings between the two islands, which are important as providing the only two safe harbours along that part of the coast. Much time has also been devoted to observations of the drift of the ice in the neighbourhood of Herschel island. A south-east or north-east wind always drove the ice off in the direction of Point Barrow, and a south-west or north-west wind brought it back again. But there was almost always open water, or what appeared to be an open-water sky, to the north, and hence Mr. Harrison does not think it practicable to undertake a journey north over the ice in search of the land which he is confident exists in that direction. The conclusion at which he has arrived is that there is a drift to the north-east from Point Barrow, which meets the waters of the Mackenzie river somewhere to the north of Herschel island, whence, having no outlet to the north or east, the current is ultimately deflected into the line of drift of the *Jeannette* and the *Fram*. As regards his plans for the future, Mr. Harrison proposes to winter at the mouth of the Mackenzie river, and in the spring to undertake a journey eastwards, returning along the coast over the Arctic ice. Then in the summer the whalers will bring him fresh supplies from San Francisco, and carry him to Banks Land. Mr. Harrison has engaged the services of two Eskimo families, who will accompany him north, women as well as men. The former are not only a necessary adjunct to the expedition—since the men will not go without them—but are expected to be of the greatest assistance; not inferior to the men in endurance, they are far superior to them in industry. Mr. Harrison is acquiring a speaking knowledge of the Eskimo language, which will, no doubt, stand him in good stead in his ethnographical investigations.

The Flora of Ellesmere Land and its Affinities.—The second part of the report of the second Norwegian Arctic Expedition in the *Fram* consists of a memoir by Mr. H. G. Simmons, the botanist of the expedition, on the Vascular Plants in the flora of Ellesmere Land (Christiania: A. W. Brøgger, 1906). The writer has not been content to study his own collections only, but has made himself thoroughly acquainted with all the data previously brought together on the subject, having spent some time in London for the purpose of studying the collections made by British expeditions. The memoir consists of scientific descriptions of the species represented, with careful definition of the localities and range of each. A short introduction discusses, however, the general questions of the composition and affinities of the flora, besides sketching the history of botanical research in the area studied. The sixty-nine species known to Sir Joseph Hooker when discussing the botany of the Nares Expedition, have now been increased to a hundred and fifteen, not including ten which Mr. Simmons regards as doubtful, the orders represented by the greatest number of species being *Gramineæ*, *Cyperaceæ*, *Cruciferæ*, *Saxifragaceæ*, and *Caryophyllaceæ*. Only two of the genera are not present in Greenland, and only two species of other genera, so that Hooker's opinion that the flora of Ellesmere Land is entirely Greenlandic would seem to be fully borne out. But Mr. Simmons points out that a further examination is necessary before concluding that the dividing line (if such exists) between a European flora in Greenland and an American one further west is deflected so as to include Ellesmere Land with the former and separate it from the other Arctic islands. He shows that, apart from the circumpolar species, the character of the flora is as decidedly American as Greenlandic, and that there are definite indications that certain of the species have entered from the south-west. The explanation is that the affinity noted is with the flora of *north-west* Greenland, which itself shows clearly the influence of the near neighbourhood of the American flora, many species having evidently made their way in from Ellesmere Land. The Greenland flora is, in fact, no unity, but consists of several diverse elements.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Incised Meandering Valleys.—In the Bulletin of the Geographical Society of Philadelphia (vol. 4, No. 4), Prof. W. M. Davis contributes some further investigation on the formation of meandering valleys where a serpentine river has been impelled by regional uplift to erode a new valley above the level of its earlier valley floor. Beginning with a symmetrical diagram of an incised meandering valley, in which the meanders are considered as stationary, he points out that, under natural conditions, the meanders tend to migrate down the valley, with the result that the spurs have a steeper undercut slope on the up-valley side, and a slip off gravel-strewn slope on the down-valley side. This he further illustrates by a diagram of the successive positions of a meandering stream. He points out that the rates of corrasion (vertical, lateral outward, and lateral down-valley-ward) vary absolutely and in relation to one another. An important point is that in the earlier stages of valley erosion it is the down-valley-ward corrasion that is largely responsible for the trimming and gradual removal of the spurs, whereby a narrow, incised, meandering valley is converted into an open flood-plain valley. Several diagrams which follow illustrate the combined action of outward and down-valley-ward corrasion. Prof. Davis urges the further study of rivers from these points of view in the field, pointing out that topographical maps are rarely accurate enough to exhibit all the significant features. At present the student of meandering valleys must go into the field for facts. He instances certain rivers which are especially interesting in this connection, such as the Potomac, the Juncata, the Chatanqua creek, the north branch of the Susquehanna, and the river valleys of the High Eifel and Ardennes.

GENERAL.

Queensland Geographical Society.—In the last week of June the Queensland branch of the Royal Geographical Society of Australia celebrated the twenty-first anniversary of its foundation. The celebrations extended over four days, and comprised a series of meetings of the society at Brisbane, interspersed with a variety of social functions. To judge from the reports in the *Brisbane Courier*, the meetings and festivities not only aroused much public interest, but were of a character to give a worthy stimulus and inspiration to geographical workers in Queensland. The proceedings commenced on Tuesday, June 26, with a reception and luncheon by the Mayor of Brisbane, and terminated on Friday evening with a conversazione. On intermediate days members and delegates were entertained at a river-picnic on board the Government yacht by the council of the society, and at a garden-party given by the governor, Lord Chelmsford, who has accepted the office of President in succession to the late Sir Hugh Nelson, whose death was recorded in the April number of the *Journal*. The first meeting in connection with the celebrations was held on Tuesday evening, when the honorary secretary, Dr. J. P. Thomson, who took a leading part in founding the society, and who has been largely responsible for its successful working, read a number of congratulatory messages from geographical societies and other learned bodies all over the world, including one from our own society. Subsequently Dr. Thomson read a paper reviewing at considerable length the activities of the society during the twenty-one years of its existence. He emphasized the fact that "from the first the cardinal principles of universal geography were set up for the guidance of the society, and a broad and comprehensive policy in the acquisition and dissemination of geographical knowledge was adopted;" and was able to show that, in spite of initial difficulties, much good work has been accomplished. The principal feature of the meeting on the following evening was the presentation to the consideration of the society of the valuable paper on the "Present Problems of Geography," which Dr. H. R. Mill read before the Eighth International Geographical Congress; while on Thursday evening there was read, again in the absence of the author, a paper discussing the question of geographical education in schools and colleges, by Dr. Richard Elwood Dodge, Professor of Geography in the Teachers' College, Columbia University, New York. Finally, on Friday there was presented to the society a paper by Sir John Murray, written specially for the anniversary celebrations, dealing with the observations as to the depth of the ocean lying to the east of Australia, the temperature of the waters of the ocean, the marine deposits which cover the floor of the ocean, and the percentage of carbonate of lime which is contained in these deposits. One of the conclusions reached by Sir John Murray is that in the region under consideration—namely, that portion of the South Pacific bounded on the west by the coasts of Tasmania, Australia, and New Guinea, on the north by the equator, on the east by the meridian of 160° W. long., and on the south by the parallel of 50° S. lat.—it may be roughly estimated that of the total water area, about 25 per cent. is under 1000 fathoms in depth, about 20 per cent. between 1000 and 2000 fathoms in depth, about 40 per cent. between 2000 and 3000 fathoms in depth, and about 15 per cent. over 3000 fathoms in depth.

OBITUARY.

H. W. Cadoux.

We regret to record the death of Mr. H. W. Cadoux, a young traveller of much promise, who had already gained a close knowledge of considerable portions of Western Asia, and at the time of his death was hoping to do further geographical work in the same region. He had also resided for some time in Rhodesia, and had carried out surveys in Manicaland and along the Portuguese frontier. His principal work had, however, been done in Trans-Caucasia and Asiatic Turkey. In the former he had resided some seven years, travelling extensively in the eastern portion, and studying in particular the Mohammedan populations and their languages, including one of the old Persian colonies on the southern slopes of the main chain. In June, 1892, he ascended to the summit of Mount Ararat, his visit falling between those of Markoff and Pastukhoff, the latter of whom alluded to it while describing his own ascent. Mr. Cadoux also travelled in Mesopotamia, and his interesting paper on changes in the course of the lower Euphrates, in the September number of the *Journal*, shows him to have been a keen and capable observer.

Dr. Karl Futterer.

The well-known traveller in Central Asia, Dr. Karl Futterer, died in February last at the early age of thirty-nine years, having for some time past suffered from serious ill health. The important journey which he carried out in 1897–99, in company with Dr. Holderer, across the whole length of Asia, was alluded to at the time in the *Journal* (see especially vol. 12, p. 520; vol. 13, p. 430). It was particularly fruitful in scientific observations, Dr. Futterer being a trained geographer and geologist, while he paid attention also to the botanical, zoological, and meteorological characters of the countries passed through. Besides a number of papers in scientific periodicals, he had brought out a portion of a large work on the results of his expedition (*Journal*, vol. 18, p. 525), though his ill health had, unfortunately, delayed the issue of the remainder. It is hoped, however, that this may still be made available, Dr. F. Noetling having undertaken to prepare it for publication. A portrait of the traveller is given in the *Deutsche Rundschau für Geographie* for July last.

CORRESPONDENCE.

African Languages.

The importance of language in relation to political and social aspects of the native question in Africa seems liable to be overlooked. The possibility of large groups of tribes, hitherto distinct and mutually antagonistic, becoming rapidly able and eager to understand each other in some common form of speech, has apparently to be taken into account. Twenty-six years' contact with Swahili and various dialects of Eastern and Central Africa points so far to the conclusion that there is a remarkable degree of similarity, amounting in many important respects to substantial identity, in the grammatical structure of language over the whole vast area occupied by the Bantu races of Africa, from the Sudan to the Cape. And the stock of words common to all Bantu tribes, when recognized under their various dialectic disguises, will probably prove very considerable.

The officials, missionaries, traders, settlers, and travellers of various nationalities who are qualified to give help in testing this conclusion by personal and first-hand study of a Bantu dialect are naturally difficult to reach, scattered in remote and often isolated spheres of work. It is, therefore, perhaps justifiable to ask publicity for the request, that persons so qualified and willing to accept and reply to a brief communication on the subject would send me their addresses at Fort Jameson, North-Eastern Rhodesia.

I should be grateful if foreign journals and local papers in Africa, general and official, would assist by calling attention to my invitation.

A. C. Madan,
Student of Christ's Church, Oxford.

c/o The British South Africa Company,
Fort Jameson, North-Eastern Rhodesia,
July 12, 1906.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *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.
Col. = Colonies.
Com. = Commerce.
C. R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological, etc.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
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—Glaciers. **Forel, Lugeon, and Muret.**
Jahrb. Schweiz. Alpenclub 41, 1905 (1906): 268-287.
Les variations périodiques des glaciers des Alpes. Par Dr. F. A. Forel, Dr. M. Lugeon, E. Muret. 26^me rapport, 1905.

Alps—Meteorology. *Met. Z.* 23 (1906): 193–200. **Ficker.**
Der Föhn vom 4. bis 6. November 1905 in den Ostalpen. Von H. von Ficker.

Alps—Simplon. *Mouvement G.* 23 (1906): 259–262. **[Wauters.]**
Le Simplon. Par A. J. W. *With Maps.*

Alps—Vegetation. **Pampanini.**
Essai sur la géographie botanique des Alpes et en particulier des Alpes sud-orientales. Par R. Pampanini. (Mém. Soc. Fribourgeoise Sci. Nat. Géologie et Géographie, 3, Fasc. I.) Fribourg: Imp. Fragnière Frères, 1903. Size 9½ × 6½, pp. 216. *Maps. Presented by the Société Fribourgeoise des Sciences Naturelles.*

Alps—Vegetation. **Schroeter.**
Das Pflanzenleben der Alpen. Eine Schilderung der Hochgebirgsflora von Dr. C. Schroeter. Dritte Lieferung. Zürich: A. Raustein, 1906. Size 9½ × 6½, pp. 249–344. *Illustrations. Price* 3*s*.
This important work will be reviewed on its completion by the issue of part 4.

Austria—Dalmatia and Herzegovina. **Daneš.**
Úvodí delní Neretvy. Geomorfologická studie. Napsal Dr. J. V. Daneš. V Praze, 1905. Size 10 × 6½, pp. 108. *Maps and Illustrations. Presented by the Author.*

Austria—Meteorology. **Margules.**
Jahrb. K.K. Zentral-Anstalt Met. 41, 1904 (1906): *Anhang*, 1-12.
Revision der Luftdruck-Jahresmittel österreichischer Stationen 1886 bis 1904. Von Dr. M. Margules.

Austria—Meteorology. ———
Jahrbücher der K.K. Zentral-Anstalt für Meteorologie und Geodynamik. Jahrg. 1904. N. F. xli. Band, and Anhang. Wien: W. Braumüller, 1906. Size 12 × 9½, pp. xxx., 132, 106, 32, and 24; Anhang, 42.

Belgium—Schelde. *B.S.G. Lille* 45 (1906): 237-244. **Blanchard.**
A propos les inondations récentes dans les Polders du Bas-Escaut. Par Raoul Blanchard. *With Illustrations.*

Carpathians. *C. Rd.* 142 (1906): 1583–1585. **Martonne.**
Sur deux plans en relief du Paringu et de Soarbele (Karpates méridionales) exécutés d'après des levés topographiques inédits. Note de E. de Martonne.

Carpathians. *Jahrbuch des Ungarischen Karpathen V.* 23 (1906): 1–19. **Siegmeth.**
Streifzüge in den Liptóer Karpathen. Von Karl Siegmeth.

Denmark. *J.R. Statistical S.* 69 (1906): 374–419. **Thompson.**
The Development of Agriculture in Denmark. By R. J. Thompson.

France. *C. Rd.* 142 (1906): 1103–1105. **Lamothe.**
Les terrasses de la vallée du Rhône en aval de Lyon. Note de M. de Lamothe.

France—Communications. *A travers le Monde* 12 (1906): 61–63. ———
Le Nord et l'Est de la France et les Voies d'accès au Simplon. *Map.*

France—Durance. *B.S.G. Marseille* 29 (1905): 257–264. **Repelin.**
Les Sources de la Durance. Par J. Repelin. *With Sketch-map.*
The author holds, with Reclus and others, that the Clarée is the true upper course of the Durance.

France—Nord. *Suppl. B.S.G. Lille* (1906): pp. 80. **Blanchard.**
La densité de Population du Département du Nord au XIX[e] siècle. Étude de dix recensements de population. Par R. Blanchard. *With Diagrams.*

France—Ports. *B.S.G. Lille* **45** (1906): 221–233. **Cloarec.**
Les grands ports de guerre et de commerce de la France. Par P. Cloarec. *With Illustrations.*

Germany—Bavaria. *M.G. Ges. München* 1 (1906): 501–560. **Reindl.**
Dörfer, Weiler und Einzelhöfe in Südbayern. Eine anthropogeographische Studie zur Kenntnis der Siedelungsverhältnisse in Südbayern. Von Dr. J. Reindl.

Germany—Bavaria. *M.G. Ges. München* 1 (1906): 561–624. **Ule.**
Studien am Ammersee in Oberbayern. Von W. Ule. *With Map.*

Germany—Rhine Province. **Koenig.**
Agriculture in the Rhenish Province. Foreign Office, Miscellaneous, No. 652, 1906. Size 10 × 6½, pp. 50. *Price* 3*d.*

Hungary—Lake Balaton. ——
Resultate der wissenschaftlichen Erforschung des Balatonsees. . . . Herausgegeben von der Balatonsee-Commission der Ung. Geographischen Gesellschaft. Erster Band. Physische Geographie des Balatonsees und seiner Umgebung. Vierter Theil. Dritte Section. Resultate der Phytophänologischen Beobachtungen in der Umgebung des Balatonsees. Aus dem Nachlasse des weil. Dr. Moriz Staub in druck gelegt von Dr. J. Bernátsky.—Fünfter Theil . . . Zweite und Dritte Section. Die Farbenerscheinungen des Balatonsees, von Dr. E. v. Cholnoky und die Reflexionserscheinungen an bewegten Wasserflächen, von Dr. Baron Béla Harkányi.—Zweiter Band. Die Biologie des Balatonsees und seiner Umgebung. Erster Theil . . . Anhang: Beiträge zur Kenntniss des Planktons, von Dr. Géza Entz, jun.; und I. und II. Nachtrag zur Aufzählung der Weichthiere, von Dr. A. Weiss und T. Kormos.—Zweiter Theil . . . 1 Section. Anhang: Die Bacillarien des Balatonsees, von Dr. J. Pantocsek.—Dritter Band. Social- und Anthropogeographie des Balatonsees. Erster Teil. Archæologie der Balatonsee-Umgebung. Erster Section. Archæologische Spuren aus der Urzeit und dem Altertum bei Veszprém, von G. Rhé.—Zweiter Theil. Ethnographie der Umwohner des Balatongestades, Dr. J. Jankó. Nach dem Tode des Verfassers deutsch bearbeitet, von Dr. W. Semayer.—Fünfter Theil: Bibliographie des Balatonsees, von Dr. J. v. Sziklay. Wien: E. Hölzel, 1902–1906. Size 11½ × 8½. *Maps and Illustrations.* Topographischer und geologischer Atlas. I. Theil. . . . Entworfen von Ludwig von Lóczy, 1903. Size 21½ × 28½. *Presented by the Société Hongroise de Géographie.*

Hungary—Lake Balaton. **Cholnoky.**
Die farbenerscheinungen des Balatonsees, von Dr. Eugen v. Cholnoky. (Separatabdruck aus dem Werke: "Resultate der wissenschaftlichen Erforschung des Balatonsees." 1 Band, V. Theil. 2 Section.) Budapest: V. Hornyánszky, 1905. Size 11½ × 8½, pp. 68. *Illustrations. Presented by the Author.*

Iceland. *J. Geology* **14** (1906): 122–133. **Ferguson.**
Tertiary and Recent Glaciation of an Icelandic Valley. By H. G. Ferguson. *With Map and Illustrations.*

Italy. *J. United Service I. India* **35** (1906): 105–115. **Noel.**
The Battlefields of North Italy. By Lieut.-Colonel the Hon. E. Noel. *With Map.*

Italy—Calabria. *B.S.G. Italiana* 7 (1906): 432–459. **Baratta.**
I terremoti di Calabria. Conferenza del dott. M. Baratta. *With Maps and Diagram.*

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Les produits laviques de la récente éruption du Vésuve. Note de A. Lacroix.

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Sur les relations tectoniques et stratigraphiques de la Sicile et de la Tunisie. Note de É. Haug.

Northern Europe—Zoogeography. **Ekman.**
Die Phyllopoden, Cladoceren und freilebenden Copepoden der nordschwedischen Hochgebirge. Ein Beitrag zur Tiergeographie, Biologie und Systematik der arktischen, nord- und mittel-europäischen Arten. Inaugural-Dissertation zur Erlangung der Doktorwürde . . . von Sven Ekman. Naumburg a. S., 1904. Size 9 × 6½, pp. 170. *Plates.*

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On the geographic races of red deer in Scandinavia. By Einar Lönnberg. *With Illustrations.*

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Peuples et Langues de la Russie d'après les données du premier recensement russe exécuté en 1897. Par D. Aïtoff. *With Map.*

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Le peuplement de la Suisse. (Étude de géographie humaine.) Par Pierre Clerget.
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Switzerland—Lakes. **Bourcart.**
Les lacs Alpins Suisses. Étude chimique et physique. Par le Dr. F. E. Bourcart. Genève: Georg & Co., 1906. Size 12½ × 9½, pp. 130. *Illustrations. Presented by the Author.*

Turkey—Macedonia. **Cvijić.**
Remarks on the Ethnography of the Macedonian Slavs. By Dr. J. Cvijić. (Translated from the Second Revised Edition.) London: Horace Cox, 1906. Size 10 × 6½, pp. 38. *Two copies. Presented by the Author.*

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Old Lamps or New? Another Contribution to Devonshire Controversial Geology. By Harford J. Lowe. [Extracted from the *Geological Magazine*, Decade v. vol. 2, No. 492, June, 1905.] London, 1905. Size 8½ × 5½, pp. [9]. *Presented by the Author.*
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The Botanical Geography of a Penine Stream. By C. E. Moss. *With Illustrations.*

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Memoirs of the Geological Survey, England and Wales. Explanation of Sheets 326 and 340. The Geology of the country near Sidmouth and Lyme Regis. By H. B. Woodward and W. A. E. Ussher. With Contributions by A. J. Jukes-Browne. London: E. Stanford, 1906. Size 10 × 6, pp. vi. and 96. *Illustrations. Price 1s. Presented by the Geological Survey.*

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The British Academy. The Romanization of Roman Britain. By F. J. Haverfield. (From the *Proceedings of the British Academy*, vol. 2.) London: H. Frowde, [*not dated*]. Size 10 × 6½, pp. 34. *Illustrations. Price 2s. 6d. net. Presented by the Publisher.*

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Notes on the Corries of the Comeragh Mountains, Co. Waterford. By F. R. Cowper-Reed. *With Maps and Plate.*

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Memorandum on the Industries of Leeds. [By James Graham.] [Leeds, 1905.] Size $10\frac{1}{2} \times 8\frac{1}{2}$, pp. 8. *Map. Presented by the Higher Education Committee, Leeds.*

The maps show the space-distribution of the chief industries according to number of workers.

United Kingdom—London. **Prideaux.**
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Notes on Salway's Plan of the Road from Hyde Park Corner to Counter's Bridge. By Colonel W. F. Prideaux.

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The Southern Highlands from Dumgoyn. By J. Frew and F. Mort. *With Illustrations.*

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The History of the Scottish Peat Mosses and their relation to the Glacial Period. By F. J. Lewis. *With Diagram and Illustrations.*

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The Kingussie District: a geographical Study. By Marion I. Newbigin, D.SC. *With Map and Illustrations.*

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The Pendleton Earth-shake of November 25, 1905. By Dr. C. Davison. *With Diagrams.*

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Memoirs of the Geological Survey. England and Wales. The Water Supply of Suffolk from underground sources; with records of sinkings and borings. By William Whitaker, F.R.S., with Contributions by Dr. H. F. Parsons, Dr. H. R. Mill,

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Minutes P.I. Civil Engineers 163 (1906): 21-161.
On Waterways in Great Britain. By J. A. Saner. *With Maps and Sections.*

United Kingdom—Yorkshire. *Trans. Hull Geol. S.* 6 (1901-05): 58-64. **Crofts.**
Notes on the indications of a Raised Beach at Hessle. By W. H. Crofts. *With Plates.*

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List of Papers, Maps, etc., relating to the Erosion of the Holderness Coast, and to Changes in the Humber Estuary. Compiled by T. Sheppard.

United Kingdom—Yorkshire. *P. Yorkshire Geol. S.* 15 (1905): 388-410. **Carter.**
The Evolution of the Don River-system. By W. Lower Carter. *With Maps and Illustration.*

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The Glaciation of the Don and Dearne Valleys. By W. Lower Carter. *With Maps and Illustrations.*

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Notes on the "Overflow Channel" in Newton Dale between Lake Wheeldale and Lake Pickering. By J. T. Sewell. *With Map.*

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China. *Z. Ges. E. Berlin* (1906): 356-365. **Tafel.**
Dr. Tafel's weitere Reisen in Nord-China.

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Eastern Asia. **Doflein.**
Ostasienfahrt. Erlebnisse und Beobachtungen eines Naturforschers in China, Japan, und Ceylon. Von Dr. Franz Doflein. Leipzig und Berlin: B. G. Teubner, 1906. Size 10 × 7, pp. xiv. and 512. *Illustrations. Price 13s.*

Dr. Doflein's expedition was undertaken chiefly for the study of the marine fauna of Eastern Asiatic waters, to the life-conditions and distribution of which he frequently refers in the present narrative.

Eastern Asia. **Maidel.**
Physico-Geographical Sketch of the China and Yellow Sea. By Major-General Baron E. Maidel . . . Edited by T. B. von Spindler. [In Russian.] St. Petersburg, 1904. Size 10 × 6½, pp. viii. and 122. *Charts and Illustrations.*

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L'Œuvre Française sur le Haut-Mékong de 1893 à 1905. Par le Lieutenant de Vaisseau Georges-E. Simon. *With Illustrations.*

French Indo-China—Cartography. *Ann. de G.* 15 (1906): 26-42. **Rouget.**
Étude sur la cartographie de l'Indo-Chine française. Par le Capitaine Rouget.

French Indo-China—Tongking. *B.S.G. Marseille* 29 (1905): 279-294. **Gérard.**
L'Industrie des Pêches maritimes au Tonkin. Par André Gérard.

India. *J. and P. Asiatic S. Bengal* 1 (1905): 230-235. **Molony.**
Some remarks on the Geology of the Gangetic Plain. By E. Molony. *With Map.*

India—Bombay. ———
Gazetteer of the Bombay Presidency. Vols. 2 B-6 B, 10 B-13 B, and 15 B-24 B. Bombay, 1904-1905. Size 10 × 6. *Presented by the India Office.*

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Note on the Natural Bridge in the Gokteik Gorge. By T. D. La Touche. *With Plan and Illustrations.*

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Pleistocene Movement as indicated by Irregularities of Gradient of the Nardaba and other Rivers in the Indian Peninsula. By E Vredenburg. *With Map, Illustration, and Diagrams.*

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India—Himalayas. *Jahrb. Schweiz. Alpenclub* **41**, 1905 (1906): 190-205. **Guillarmod.**
Vers le Kangchinjunga (8585^m), Himalaya népalais. Par le Dr. J. Jacot Guillarmod. *With Plates.*

India—United Provinces. **Nevill.**
District Gazetteers of the United Provinces of Agra and Oudh. Vol. **42**, Kheri (pp. 252, xxxviii, and viii.); vol. **43**, Fyzabad (pp. 282, xlii., and viii.); vol. **44**, Gonda (pp 276, xlii., and viii.). Compiled and edited by H. R. Nevill. Allahabad and Naini Tal, 1905. Size 9 × 6. *Maps. Presented by the India Office.*

Malay Archipelago—Java. **Klerck.**
De Java-Oorlog van 1825–30, door E. S. de Klerck. Vierde Deel. Batavia: 's Hage, M. Nijhoff, 1905. Size 11 × 7½, pp. xxvi. and 898. *Maps. Presented by the Bataviaasch Genootschap van Kunsten en Wetenschappen.*

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The Philippine Islands, 1493–1898. Edited by E. H. Blair and J. A. Robertson, with . . . notes by E. G. Bourne. Vols. **26–35** (1519–1649). Cleveland, Ohio: The A. H. Clark Co., 1905-1906. Size 9½ × 6. *Facsimile Maps and Illustrations. Price $4 net per volume.*

Philippine Islands. *Vierteljahrs. Naturf. Ges. Zürich* **50**, 1905 (1906): 321–488. **Usteri.**
Beiträge zur Kenntnis der Philippinen und ihrer Vegetation, mit Ausblicken auf Nachbargebiete. Von A. Usteri. *With Map and Illustrations.*

Russia—Caucasus. **Bush.**
Mem. Imp. Russ. G.S., Gen. G. **32** (1905): No. 4 (pp. ii. and 136).
The Glaciers of the Western Caucasus. By N. A. Bush. [In Russian.] *With Plates.*

Russia—Caucasus. *Jahrb. Schweiz. Alpenclub* **41**, 1905 (1906): 206-227. **Weber.**
Im Zentralen Kaukasus. Von A. Weber. *With Illustrations.*

Russia—Siberia. *G.Z.* **12** (1906): 155-161. **Sieroszewski.**
Die jakutischen Küsten des nördlichen Eismeeres. Von W. Sieroszewski.

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La grande Voie fluviale de Russie en Extrême-Orient. *With Map.*

Describes steps and proposals for improving communication by means of the great Siberian rivers.

Russia—Siberia—Communications. *Rev. Française* **31** (1906): 207–216. **Servigny.**
Le Transsibérien et l'Expedition Russe de l'Iénisséi. Par J. Servigny. *With Map.*

Turkey—Arabia. *Z. Ges. E. Berlin* (1906): 305-322. **Burchardt.**
Ost-Arabien von Basra bis Maskat auf Grund eigener Reisen. Von H. Burchardt. *With Illustrations.*

Turkey—Asia Minor. *G.Z.* **12** (1906): 185–193. **Braun.**
Von der anatolischen Riviera. Von F. Braun. *With Illustrations.*

Western Asia—Seistan. *J S. Arts* **54** (1906): 657–666. **McMahon.**
Seistan: Past and Present. By Sir Henry McMahon.

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Les chemins de fer africains. Par E. Salesses.

Cape Colony—Geology. *Rep. Brit. Ass., South Africa*, 1905 (1906): 394–396. **Du Toit.**
The Stormberg Formation in the Cape Colony. By Alex. L. du Toit.

Congo State—Katanga. *B.S. Belge d'Etudes Col.* 13 (1906): 329–352. **Buttgenbach.**
L'Avenir Industriel du Katanga. Par H. Buttgenbach. *With Map and Illustrations.*

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Die petrographische Ausbeute der Expeditionen O. Neumann—v. Erlanger nach Ostafrika und Abessynien 1900–1901. Von M. Weber. *With Map.*

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The Meteorological Report for the year 1903. The Survey Department, Finance Ministry, Cairo. Cairo, 1905. Size 7½ × 11, pp. 212. *Diagrams.*

Egypt—Sinai Peninsula. ——
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Egyptian Sudan. *National G. Mag.* 17 (1906): 241–267. **Bridgman.**
The New British Empire of the Sudan. By H. L. Bridgman. *With Map and Illustrations. Also separate copy, presented by the Author.*

German East Africa—Meteorology. **Heidke.**
Mitt. a.d. Deuts. Schutzgeb. 19 (1906): 40–106.
Meteorologische Beobachtungen aus Deutsch-Ostafrika. Zusammenstellungen von Monats- und Jahresmitteln aus den Jahren 1899 bis 1902 von 22 Beobachtungsstationen. Von Dr. P. Heidke.

German South-West Africa. *Globus* 89 (1906): 207–209. **Gessert.**
Die Tafelgebirge des Hanami-Plateaus. Von F. Gessert.

Ivory Coast. *B.S.G. Com. Paris* 28 (1906): 289–312. ——
Notes sur la Haute Côte d'Ivoire. Par Capitaine E. A. S.

Kamerun and French Congo. *Mitt. a.d. Deuts. Schutzgeb.* 19 (1906): 1–30. **Kund.**
Bericht über eine Bereisung der deutsch-französischen Grenze zwischen Schari-Logone-Tuburi. Von Leutnant Kund. *With Map.*

Madagascar. *C. Rd.* 142 (1906): 1139–1141. **Colin.**
Travaux géodésiques et magnétiques aux environs de Tananarive. Note de É. É. Colin.

Morocco. **Lemoine.**
Paul Lemoine. Mission dans le Maroc Occidental (Automme, 1904). Rapport au Comité du Maroc. Paris, 1905. Size 8½ × 5½, pp. 224. *Maps, Sections, and Illustrations. Price* 3 *fr. Presented by the late Budgett Meakin, Esq.*

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Il valore economico del Sahara e i risultati della missione Foureau-Lamy. Comunicazione del dott. G. Jaja.

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Ueber eine Fahrt durch Südafrika. Von Richard Beck. *With Illustrations.*

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The Geological History of South Africa. By Dr. F. H. Hatch.

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Dongas: their effect and treatment. By C. D. H. Braine. *With Illustrations.*

Dongas are deep trenches cut by floods, which do great damage by draining all the moisture out of adjacent lands. Their formation has been largely due to reckless destruction of trees. The illustrations give some excellent examples of surface denudation.

South Africa—Geodesy. *Rep. Brit. Ass., South Africa*, 1905 (1906): 228–248. **Gill.**
On the Origin and Progress of Geodetic Survey in South Africa, and of the African Arc of Meridian. By Sir David Gill. *With Map. Also separate copy.*

South Africa—Kalahari. *Ann. de G.* 15 (1906): 43–58. **Demangeon.**
Le Kalahari, d'après le livre de M. Siegfried Passarge. Par A. Demangeon.

South Africa—Zambesi. **Lamplugh.**
Rep. Brit. Ass., South Africa, 1905 (1906): 292–301.
Report on the Investigation of the Batoka Gorge and adjacent portions of the Zambesi Valley. By G. W. Lamplugh. *With Sketch-map. Also separate copy, presented by the Author.*

South-East Africa—Historical. **Theal.**
Records of South-Eastern Africa, collected in various Libraries and Archive Departments in Europe by George McCall Theal, LL.D. Vols. 1–9. [Vol. 7 includes "Eastern Ethiopia," by Friar João dos Santos, in Portuguese and English.] Printed for the Government of the Cape Colony, 1898–1903. Size 9 × 6. *Chart and Plan. Presented by the Government of Cape Colony.*

Sudan—Geology. *C. Rd.* 142 (1906): 668–669. **Petit and Courtet.**
Les sédiments à Diatomées de la région du Tchad. Note de P. Petit et H. Courtet.

Togo—Rainfall. **Danckelman.**
Die Niederschlagsverhältnisse des Schutzgebietes Togo. Von Dr. von Danckelman. (*Meteorologische Zeitschrift*, Hann-Band, pp. 145–151.) Braunschweig: F Vieweg und Sohn, 1906. Size 12 × 8. *Map.*

Transvaal. **Hall.**
Mines Department. Geological Survey of the Transvaal. The Geology of Pretoria and Neighbourhood: an Explanation of the Geological Map of the Environs of Pretoria. By A. L. Hall. Pretoria, 1905. Size 10 × 6, pp. viii. and 56. *Illustrations. Presented by the Mines Department, Geological Survey of the Transvaal.*

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Transvaal Department of Agriculture. Annual Report of the Director of Agriculture. 1904–1905. Pretoria, 1906. Size 10 × 6½, pp. 486. *Maps and Illustrations.*

Transvaal—Geology. **Kynaston.**
The Geology of the Komati Poort Coal-field. By H. Kynaston. (Transvaal Mines Department, Geological Survey, Memoir No. 2.) Pretoria, 1906. Size 9½ × 6, pp. 56. *Maps, Sections, and Illustrations.*

Transvaal—Swaziland. *Transvaal Agricultural J.* 4 (1906): 515–524. **Miller.**
Swaziland. Its Agricultural and Pastoral Future. By A. M. Miller. *With Illustrations.*

Tripoli. *Tour du Monde* 12 (1906): 49–84. **Mathuisieulx.**
Le Djebel Tripolitain et le Soff-ed-Jinn. Por M. de Mathuisieulx. *With Map and Illustrations.*

Tunis. *A travers le Monde* 12 (1906): 97–100, 105–108. **Violard.**
Les Territoires de l'Administration militaire de l'Extrême-Sud Tunisien. Par Émile Violard. *With Map and Illustrations.*

Uganda. **Dawe.**
Report on a Botanical Mission through the Forest Districts of Buddu and the Western and Nile Provinces of the Uganda Protectorate. By Mr. M. S. Dawe. London, 1906. Size 13 × 8½, pp. 64. *Map and Illustrations. Price 1s. 5d. Presented by the Author.*

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Uganda—Railway. **Kaiser.**
Die Uganda-Bahn in ihrem Einflusse auf die Eingeborenen. Von Alfred Kaiser. (Sonderabdruck aus den "Mitteilungen der Ostschweiz. Geograph.-Commerc. Gesellschaft" in St. Gallen.) Size 9 × 6, pp. 16. *Presented by the Author.*

West Africa. *La G., B.S.G. Paris* 13 (1906): 332–336. **Tilho.**
Délimitation franco-anglaise entre Niger et Tchad (Mission Moll). Par le Capitaine Tilho.

West Africa. *La G., B.S.G. Paris* 13 (1906): 244–247. **Chevalier.**
Une mission économique dans l'ouest Africain. Par Auguste Chevalier.

West Africa. *Globus* 89 (1906): 316–317. ——
Wo starb Friedrich Hornemann?

See note in the Monthly Record (*ante*, p. 509).

NORTH AMERICA.

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Transportation Methods in Alaska. By Captain G. S. Gibbs. *With Illustrations.*

Alaska. *B. American G.S.* 38 (1906): 145–167. **Tarr and Martin.**
Glaciers and Glaciation of Yakutat Bay, Alaska. By Ralph S. Tarr and Lawrence Martin. *With Map and Illustrations.*

Alaska—Yukon. *National G. Mag.* 17 (1906): 268–272. **Gibbs.**
The "Breaking up" of the Yukon. By Captain G. S. Gibbs. *With Illustrations.*

Aleutian Islands. **Egbert.**
Report on the Natural History of Kiska Island. By Dr. J. Hobart Egbert. (Reprinted from *Forest and Stream*, April 29, May 20, 1905.) Size 8 × 5, pp. 14. *With Illustration.*
The Flora and Fauna of Kiska Island. By the same. [Newspaper cutting.] *Presented by the Author.*

Canada. ———
Report of the Surveyor-General of Dominion Lands for the year ending June 30, 1904. Ottawa, 1905. Size 10 × 6½, pp. 334.

Canada—British Columbia. *Alpine J.* 23 (1906): 119-124. **Bainbridge.**
Six Weeks in the Lillouet District, B.C. By O. J. Bainbridge. *With Illustrations.*

Canada—Tides. **Dawson.**
Tide Levels and Datum Planes on the Pacific Coast of Canada. By Dr. W. Bell Dawson. (Supplement No. 1 to the Thirty-Eighth Annual Report of the Department of Marine and Fisheries.) Ottawa, 1906. Size 10 × 6½, pp. 22.
Referred to in the Monthly Record (October, p. 402).

Lake Michigan. *J. Geology* 14 (1906): 134–137. **Case.**
A peculiar formation of Shore Ice. By E. C. Case. *With Illustrations.*

Newfoundland—Labrador. **MacGregor.**
Report of an Official Visit to the Coast of Labrador. By His Excellency the Governor of Newfoundland, during the month of August, 1905. 1906. Size 13½ × 8½, pp. 85.

North America—Currents. **Davidson.**
North-West Currents. The Inshore Eddy Current along the North-West Coast of America. (By George Davidson.) (From the Daily Commercial News of January 27, 1906.) Size 8½ × 5½, pp. [4]. *Presented by the Author.*

Rocky Mountains. *American J. Sc.* 21 (1906): 296-300. **Keyes.**
Orotaxial Significance of Certain Unconformities. By Charles R. Keyes. *With Diagrams.*

United States. *G.Z.* 12 (1906): 135–145. **Heiderich.**
Veränderungen in der Bevölkerung der Vereinigten Staaten von Nordamerika. Von H. Heiderich.

United States—Arizona. *J. Geology* 14 (1906): 138-146. **Atwood.**
Red Mountain, Arizona: a dissected volcanic cone. By W. W. Atwood. *With Illustrations.*

United States—Arizona. *Science* 23 (1906): 721-730. **McGee.**
Climatology of Tinajas Altas, Arizona: Preliminary Report. By W J McGee.

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On the Rainfall of Central Queensland and Floods in the Fitzroy River. By H. E. Bellamy. *With Maps and Sections.*

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Report of the Second Norwegian Arctic Expedition in the *Fram*, 1898-1902.

No. 2. The Vascular Plants in the Flora of Ellesmere Land. By H. G. Simmons. Kristiania, 1906. Size 10 × 7, pp. 198. *Map and Plates. Presented by the Author.*

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Arctic—Wellman Expedition. *National G. Mag.* 17 (1906): 206–228. **Wellman.**
Walter Wellman's Expedition to the North Pole. The Polar Airship. By Walter Wellman. *With Diagrams. Also separate copy, presented by the author.*

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La région de Jakobshavn (Groenland). Par M. C. Engell.

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Plan der "Danmark"-Expedition nach der Nordostküste von Grönland, Juni 1906 bis Sept. 1908. Von L. Mylius-Erichsen.

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A Modified Polar Projection adapted to studies in Dynamic Meteorology. By Cleveland Abbe. *With Sketch-maps.*

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A useful guide to surveying in mountain regions.

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Solifluction, a component of Subaërial Denudation. By J. G. Andersson. *With Illustrations.*

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Floodplains produced without Floods. By N. M. Fenneman.

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Some Peculiarities of Rock-weathering and Soil Formation in the Arid and Humid Regions. By E. W. Hilgard.

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Die Veränderungen der Erdoberfläche. Ein Mahnwort von Oberlehrer Richard Tronnier.

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De la minéralisation des eaux souterraines et des causes de sa variation. Note de F. Dienert.

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Beobachtungsergebnisse von sechs Ballonfahrten der Schwedischen Aeronautischen Gesellschaft. Zusammengestellt von J. Westman. *With Maps.*

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Détermination de la hauteur des rayons d'aurores boréales. Par V. Kousnetzow. *With Diagrams.*

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Sur les récentes théories de l'aurore polaire. Résumé et critique des théories de MM. Birkeland, Arrhenius et Nordmann. Idées personelles. Par Adam Paulsen. *With Plate.*

Meteorology—Trade-winds. *B. American G.S.* 38 (1906): 128-130. **Rotch.**
Proof of the existence of the Upper Anti-Trade and the Meteorological Conditions at Lesser Heights in the Northern Tropics. By A. Lawrence Rotch.

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The Life History of Surface Air-currents. A Study of the Surface Trajectories of Moving Air. By W. N. Shaw and R. G. K. Lempfert. London, 1906. Size 12 × 10, pp. 108. *Charts, Diagrams, etc. Price 7s. 6d. Presented by the Meteorological Office.*

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Die Vorgeschichte des barischen Windgesetzes. Von S. Günther und S. Dannbeck. *With Diagrams.*

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Il primo scritto italiano di Oceanografia. Nota del dott. R. Almagià.
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Sur la septième campagne scientifique de la Princesse Alice. Note de S.A.S. le Prince Albert de Monaco. (Bull. Musée Océanographique de Monaco, No. 69 (1906), pp. 6.)

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Recent Advances in Seismology. By John Milne, F.R.S. *With Diagrams.*

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Les Tremblements de Terre et les systèmes de déformation tetraédrique de l'écorce terrestre. Par F. de Montessus de Ballore.

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Ein Kulturhistorischer Beitrag zur Erdbebenlehre. Von S. Günther.

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Entwickelung und gegenwärtiger Stand der Gezeitenforschung. Von W. Abendroth.

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Wasserbewegung in Wanderwellen. Von Prof. Dr. Philipp Forchheimer. (Sonder-Abdruck aus Zeitschrift für Gewässerkunde, 6 Band, Heft 6) Size 10 × 7, pp. [19]. *Illustrations and Diagrams. Presented by the Author.*

Zoogeography. **Gough.**
On the Distribution and the Migrations of *Muggiæa Atlantica*, Cunningham, in the English Channel, the Irish Sea, and off the South and West Coasts of Ireland, in 1904. By Lewis Henry Gough. (Conseil Permanent International pour l'Exploration de la Mer: Publications de Circonstance, No. 29.) Copenhagen, 1905. Size 10 × 7, pp. 14. *Charts.*

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Die tiergeographischen Reiche und Regionen. Von T. Arldt.

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The Tarpan and its Relationship with Wild and Domestic Horses. By Dr. J. C. Ewart. *With Illustrations.*

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Commercial—Pacific Ocean. *Izvestia Imp. Russ. G.S.* **40** (1904): 481–556. **Woeikoff.**
Will the Pacific Ocean be the chief commercial Highway of the World? By A. I. Woeikoff. [In Russian.] *With Map.*

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Bibliografia della polemica concernante Paolo Toscanelli e Cristoforo Colombo

originata dalle communicazioni di Gonzalez de la Rosa e di Enrico Vignaud al Congresso degli Americanisti tenuto o Parigi nel settembre del 1900. Saggio compilato da Enrico Vignaud, tradotto con Introduzione e aggiunte da Gustavo Uzielli. Napoli, 1905. Size 10½ × 7¼, pp. 36. *Presented by the Author.*

History of Cartography. *B.R.S.G. Madrid* 48 (1906): 190-237. **Blazquez.**
Estudio acerca de la cartografia española en la Edad media. Por A. Blazquez. *With Facsimile Maps.*

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Barton. ———
Alfred Bowyer Barton, M.D., F.R.C.S., F.R.G.S. Memoir and extracts from his diary. A Fragment. London: Printed for Private Circulation, 1906. Size 7½ × 5, pp. 154. *Presented by Mrs. Barton.*

Dr. Barton is best known to geographers as the companion of Colonel Sarel and Captain Blakiston during the ascent of the Yangtse in 1861. He died in July, 1905.

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Don Giovanni Beltrame, necrologia di G. Biadego.

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The influence of the scientific works of I. V. Mushketoff on the increase of geographical knowledge of Asia. By K. I. Bogdanovitch. [In Russian.]

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Die Schriften Ferdinand Freiherr von Richthofens. Zusammengestellt von Dr. E. Tiessen. (Separatabdruck aus "Männer der Wissenschaft," Heft 4: Ferdinand Freiherr von Richthofen. Gedächtnisrede von Prof. Dr. E. von Drygalski.) Leipzig, 1906. Size 9 × 6, pp. 18. *Presented by Frau F. von Richthofen.*

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Bibliotheca Geographica. Herausgegeben von der Gesellschaft für Erdkunde zu Berlin. Bearbeitet von Otto Baschin. Band xi. 1902. Berlin: W. H. Kühl, 1905. Size 9½ × 6, pp. xvi. and 532. *Presented by the Gesellschaft für Erdkunde, Berlin.*

This volume includes over 10,000 titles, and the periodicals dealt with number about 1000, so that the work may well claim to be the most complete geographical bibliography in existence.

Bibliography. ———
Katalog I. enthaltend wertvolle und seltene Buecher und Manuscripte jeder Art, Handzeichnungen, u.s.w. Vorraetig bei Martin Breslauer, Buchhaendler und Antiquar in Berlin. Size 9 × 6, pp. viii. and 236. *Facsimile Illustrations, etc. Price* 4 *marks. Presented by the Compiler.*

Includes a number of rarities from the early days of printing, a few being of geographical interest.

Climate and Disease. *P.R. Irish A.* 26 (1906): *Section B.*, 46-49. **Marsden.**
Sixteen Years' Observations on the relation between temperature and rainfall and the spread of Scarlatina, Measles, and Typhoid Fever. By R. Sydney Marsden, D.SC.

Educational. **Burrows.**
Geographical Gleanings. Part i. "On Some Methods of Teaching Geography." Part ii. "On the Preparation and Teaching of the Subject." By the Rev. F. R. Burrows. London: G. Philip & Son, 1906. Size 9 × 6, pp. 76. *Price* 1*s.* 6*d. net. Presented by the Publishers.*

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Geography in Schools. By H. C. Martin.

French Colonies—Statistics. ———
Ministère des Colonies: Office Colonial. Statistiques Coloniales pour l'année 1903. Publiées sous l'administration de M. Clémentel. Navigation-Melun, 1905. Size 9½ × 6, pp. 152.

Geography. *J.G.* 5 (1906): 145-160. **Davis.**
An Inductive Study of the Content of Geography. By W. M. Davis.

Noticed in the August number (p. 184).

Place-names. **Knox.**

Rules for the Transliteration of Place-names occurring on Foreign Maps. Compiled by A. Knox. 1905. London: Printed by Harrison & Sons, 1905. Size 6½ × 4¼, pp. iv. and 82.

These rules are drawn up for use in the War Office, Intelligence Division. The R.G.S. system of spelling is not altered, but guidance is given as to the way in which it is to be applied in transliteration from foreign systems.

Year-Book. **Wagner.**

Geographisches Jahrbuch . . . xxviii. Band, 1905 . . . herausgegeben von Hermann Wagner. Zweite kleinere Hälfte. Gotha, 1906. Size 9 × 6, pp. 289–456 and x. *Price* 6 *marks.*

Deals with recent progress in magnetism, and the various methods of determining position.

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

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England and Wales. **Ordnance Survey.**

Sheets published by the Director-General of the Ordnance Survey, Southampton, from September 1 to 30, 1906.

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Carte de la France dressée par ordre der Ministre de l'Intérieur. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Sheets: XIX.–16, Aix-en-Othe; XXIV.–25, Annecy. Paris: Ministère de l'Intérieur, Service Vicinal, 1906. *Price* 0.80 *fr. each sheet.*

Germany. **Dan.**

Deutsches Reich. Uebersichtskarte der relativen Verbreitung der Berufsgruppe: Chemische Industrie nach der Zählung vom 14 Juni 1895. Von Dr. Walter Dan. Scale 1 : 3,700,000 or 1 inch to 58·4 stat. miles. *Petermanns Mitteilungen,* Jahrgang 1906, Tafel 14. Gotha: Justus Perthes, 1906. *Presented by the Publisher.*

Germany. **K. Preussische Landesaufnahme.**

Karte des Deutschen Reiches. Herausgegeben von der Kartogr. Abteilung der Kgl. Preuss Landesaufnahme. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Sheet: 366, Torgau. Berlin: K. Preussische Landesaufnahme, 1906. *Price* 1.50*m. each sheet.*

ASIA.

China. **Topographical Section, General Staff.**

Province of Shan-tung. Compiled in the Topographical Section, General Staff. Scale 1 : 1,000,000 or 1 inch to 15·8 stat. miles. London: Topographical Section, General Staff, War Office, 1905. *Price* 2*s.* 6*d. Presented by the Director of Military Operations.*

A useful map of the province of Shantung compiled from all the most reliable route sketches and surveys up to date, a list of which is given on the map. It is clearly executed and printed in colours.

India. **Eliot.**

Climatological Atlas of India. Published by the authority of the Government of India under the direction of Sir John Eliot, K.C.I.E., F.R.S., late Meteorological Reporter to the Government of India, and Director-General of Indian Observations. Issued by the Indian Meteorological Department, 1906. *Price per copy, 27 rupees in India and* 36*s. in the United Kingdom. Presented by the Secretary of State for India.*

This atlas will be specially noticed.

Yunnan. **Davies.**

Map of Yün-nan. Scale 1 : 1,267,200 or 1 inch to 20 stat. miles. Compiled by Major H. R. Davies. London: Topographical Section, General Staff, War Office, 1906. *Price* 3*s.* 6*d. Presented by the Director of Military Operations.*

The remarkable progress in the exploration and survey of South-West China in recent years will be clearly seen by a comparison of this map with one of thirty years ago, when Mr. E. C. Baber and Captain W. J. Gill made their famous journeys through these regions. At that time, with the exception of the excellent route surveys by these two explorers, practically nothing but the roughest sketches of the region existed; now, however, a great deal of really good work has been done, both by British and French officers and explorers, of which Major H. R. Davies has taken full advantage in the compilation of this excellent map. The map has been drawn under Major H. R. Davies' personal supervision and direction from the Survey of India sheets on 4 miles to an inch, which, besides the standard sheets of Burma and the frontier, include the extensive surveys by Major Davies himself in 1895 and 1898–1900, together with those of Captain C. H. D. Ryder, Captain E. C. Pottinger, Captain W. A. Watts-Jones, Captain C. G. W. Hunter, and many others whose names are mentioned on the maps, as are also those of other travellers from whose work additions and corrections have been made which are not included on the Survey of India sheets. Although the title states that this is a map of Yünnan, the area embraced is considerably greater, and extends from lat. 21° to 30° 15′ N., and from long. 97° to 106° E. The map measures 29 by 33 inches, and is printed in colours.

AFRICA.

Egypt. **Egyptian Survey Department.**

Provisional map of a portion of the Eastern Desert of Egypt. Scale 1 : 1,000,000 or 1 inch to 15·8 stat. miles. Sheets: 12 G, 13 E, 13 F, 14 F, 14 G. **Giza**: Survey Department, 1906. *Presented by the Director-General, Survey Department, Giza.*

Additional sheets of the map referred to in the last number of the *Geographical Journal*. They include the greater part of the region extending from lat. 24° 25′ to 25° 35′ N., and long. 33° to 34° 30′ E., and, like the others, are only provisional issues not finally adjusted to the points fixed by triangulation.

Egypt. **Egyptian Survey Department.**

Topographical map of Giza Province. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Sheet: N.E., 4-5. Giza: Survey Department, 1905. *Presented by the Director-General, Survey Department, Giza.*

AMERICA.

Canada. **Department of the Interior.**

Sectional map of Canada Scale 1 : 190,080 or 1 inch to 3 stat. miles. **Sheets**: 71, Brandon, revised to July 16, 1906; 72, Portage en Prairie, revised to July 16, 1906; 74, Cross Lake, revised to August 7, 1906. **Ottawa**: Department of the Interior, Topographical Surveys Branch, 1906. *Presented by the Canadian Department of the Interior.*

Rio de Janeiro. **Greiner.**

Planta da Cidade do Rio de Janeiro e Suburbios organisado e desenhado pelo Engº Ulrik Greiner. Scale 1 : 12,500 or 5·06 inches to 1 stat. mile. Rio de Janeiro: Laemmert & Co.

GENERAL.

Ancient Atlas. **Kiepert.**

Formae Orbis Antiqui. 36 Karten in Format von 52 : 64 cm. mit kritischem Text und Quellenangabe zu jeder Karte. No. xiii. Peloponnesus cum Attica. Mit 6 Seiten Text. No. xiv. Phocis, Bœotia, Attica, Athenæ, mit 8 Seiten Text. Bearbeitet und herausgegeben von Richard Kiepert. Berlin: Dietrich Reimer (Ernest Vohsen), 1906. *Price* 3*m. each sheet.*

Of the thirty-six maps, of which this atlas will consist, only fourteen are yet published, including the two mentioned above, although the first appeared twelve years ago. The style in which they are produced is extremely good, and each map is accompanied by explanatory and critical text, giving also the sources of information.

World. **Bartholomew.**

Atlas of the World's Commerce. A new series of maps, with descriptive text and diagrams, showing products, imports, exports, commercial conditions, and economic statistics of the countries of the world. Compiled from the latest official returns at the Edinburgh Geographical Institute, and edited by J. G. Bartholomew, F.R.G.S., F.R.S.E. Part x. London: George Newnes, Limited, [1904] *Price* 6*d. each part. Presented by the Publisher.*

This part is of exceptional interest, and contains, in addition to smaller charts and diagrams, two general commercial maps, one of Europe and the Near East, and the other of the Far East, which includes the whole of Asia from Tobolsk to the Indian ocean, and from the Aral sea to the Pacific ocean. Each of these maps is coloured to show vegetation, in addition to which principal railways, canals, navigable rivers, telegraphs, British consular stations, and other information of a commercial character are given. There is the usual continuation of the alphabetical list of commodities of commerce, and a most instructive diagram showing the relative values and importance of the imports and exports of the United Kingdom in the year 1905.

World. **Stieler.**

Neunten, von Grund aus neubearbeitcten und neugestochenen Auflage von Stielers

Hand Atlas 100 Karten auf 200 Seiten mit 162 Nebenkarten in Kupferstich und einem alphabetischen Verzeichnis aller im Atlas vorkommenden Namen (ungefähr 240,000 Namen enthaltend) herausgegeben von Justus Perthes' Geographischer Anstalt in Gotha. Lieferungen 19, 20, 21 und 22. Gotha: Justus Perthes, 1906. *Price* 60 *pf. each part.*

CHARTS.

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

Charts and Plans published by the Hydrographic Department, Admiralty, during August, 1906. *Presented by the Hydrographer, Admiralty.*

No.	Inches.	
1914 m	= 17·8	England, south coast:—Looe harbour. 2*s.*
3563 m	= 1·41	Norway, western approaches to Vigten islands:—Giaeslingerne light to Kalvö. 3*s.*
3562 m	= 1·42	Baltic, Little Belt:—Apenrade and Flensburger Fiords, including Alsen Fiord and sund. 3*s.*
3344 m	= 1·2	Fort Liberté, Manzanillo, and Monte Cristi Bays. 3*s.*
3590 m	= var.	South America, Magellan Strait. Plans in the neighbourhood of Beagle channel.—Port Langlois and Port Edwards, Sholl bay, Port Estrecho, Port Fanny, Port Almeida, Port Soffia, Port Huemul, Port Fortuna, Port Quo-Vadis, Port Barrow, Port Engano, Port Util. 2*s.*
1156 m	= 1·3	Mexico, south-west coast:—Gulf of California, Topolombampo harbour. 2*s.*
3595 m	= 10·0	Red sea, Gulf of Akaba:—Jezirat Faraun. 2*s.*
3599 m	= 4·0	Plans and anchorages in the Persian Gulf. Henjam island anchorage. 2*s.*
3586 m	= 1·2	Malacca strait, Sumatra, north-east coast. Aru bay. 2*s.*
3577 m	= 0·5	Borneo island:—Sesajap and Bulungan rivers. 3*s.*
3548 m	= 1·8	Japan:—Yokohama to Uraga. 3*s.*

New Plans and Plans added.

1304 m	= {1·08, 2·35, 2·35}	Plans on the coast of Chile. New plan:—Tictoc bay. Plans added:—Port Auchemo, Port Velcho
1508 m	= 7·1	Anchorages in the New Hebrides islands. Plans added:—Betarara anchorage.

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

Charts Cancelled.

No.		Cancelled by	No.
1914	England, south coast: Looe harbour.	New chart. Looe harbour	1914
3344	San Domingo:—Monte Cristi bay and approaches.	New Chart. For Liberté, Manzanillo, and Monte Cristi bays	3344
471	San Domingo:—Manzanillo bay.		

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

Charts that have received Important Corrections.

No. 1607, England, east coast:—River Thames, North Foreland to the Nore. 847, Cyprus:—Famagusta and Salamis, Famagusta harbour. 2478, Africa, west coast:—Manna river to Junk river. 7, Gulf of Aden:—Aden and adjacent bays. 2195, Celebes sea:—Plans in east part of Celebes. 976, Philippine islands:—Manila bay. 1798, China, north coast:—Kwang tung peninsula, including Ta lien kwan and the approaches to Port Arthur. 1270, Korea:—Approaches to Chemulpo anchorage.

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

Chile. **Chilian Hydrographic Office.**

Chilian Hydrographic Charts. Nos.: 116, Puertos de las Islas Guaitecas; 135, Tierra del Fuego. Bahia allen Gardner, Seno Tekenica. Valparaiso: Oficiana Hidrografica, 1906. *Presented by the Chilian Hydrographic Office.*

Indian Ocean and Red Sea. **Meteorological Office.**

Meteorological Chart of the Indian Ocean north of 15° S. lat., and Red Sea for

October, 1906. London: Meteorological Office, 1906. *Price 6d. Presented by the Meteorological Office.*

North Atlantic. **U.S. Hydrographic Office.**

Pilot Chart of the North Atlantic Ocean for Washington, 1906. Washington: U.S. Hydrographic Office, 1906. *Presented by the U.S. Hydrographic Office.*

North Atlantic and Mediterranean. **Meteorological Office.**

Meteorological Chart of the North Atlantic and Mediterranean for October, 1906. London: Meteorological Office, 1906. *Price 6d. Presented by the Meteorological Office.*

North Pacific. **U.S. Hydrographic Office.**

Pilot Chart of the North Pacific Ocean for October, 1906. Washington: U.S. Hydrographic Office, 1906. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Northern Nigeria. **Home.**

Fifty photographs of Northern Nigeria, taken by Douglas R. Home, Esq. *Presented by Douglas R. Home, Esq.*

A set of quarter-plate silver prints. As will be seen from the titles, some of the subjects, such as native salt-fields, smelting furnaces, markets, and others, are of special interest.

(1) The High Commissioner's yacht on the Niger near Lokoja; (2) Typical bungalow as provided for European officers. Lokoja; (3) Road to the native market, Lokoja; (4 and 5) In Lokoja market; (6) The Wase rock; (7) Part of our column crossing the sands bordering on the river Benue; (8) Crossing the Ankwe river; (9) A halt on the banks of the Ankwe river; (10 and 11) Native salt-fields, Azara; (12) Native Hausa salt-fields, Akiri; (13) Making camp outside Awe; (14) Landing at Ibi; (15) Embarking at Ibi; (16 and 17) In the market at Ibi; (18) Clearing ground for camp Okeli; (19) Outside the king's house at Little Eboni; (20) Native bridge, Kabba Province; (21) Kukuruku country; (22) Northern Nigeria police at Dekina; (23) Two sections of B Company, 2nd Batt. Northern Nigeria Regiment, Dekina; (24) Good-bye, Dekina; (25) Starting the carriers, Dekina; (26) In the village of Aguatcha; (27) Stream in the town of Bida; (28) The exterior of the Emir of Bida's compound; (29 and 30) Lampai; (31 and 32) Types of Nupes, Lampai; (33) Inside view of roof of native Nupe house; (34) The Niger Company's compound near Tilde; (35–37) Native iron smelting furnaces, Panguru; (38) In the Joss country; (39) Stern-wheeler, "Karonga," river Benue; (40) A political officer and staff; (41) Some of the officers of the Munshee Expedition; (42) Native soldiers saying good-bye to their wives at Lokoja, Munshee Expedition; (43) Men of the 2nd Batt. marching down to the Niger for embarkation, Munshee Expedition; (44) Embarking men and stores of 2nd Batt., Lokoja, Munshee Expedition; (45) The first section embarked off Lokaja, Munshee Expedition; (46) Hausa fiddler and Yoruba headman; (17) Hausa boy; (48 and 49) Pelicans on the Niger.

Vegetation Types. **Karsten and Schenck.**

Vegetationsbilder herausgegeben von Dr. G. Karsten und Dr. H Schenck. Vierte Reihe, Heft 2. Das südliche Togo. Von Dr. Walter Busse. Jena: Gustav Fischer, 1906. *Price 2.50m. each part.*

Yorkshire. **Wigram.**

Three Photographs of the Obelisks known as the "Devil's Arrows" at Boroughbridge, Yorkshire, taken by Major H. H. Wigram, late Scots Guards. *Presented by Major H. H. Wigram.*

These obelisks consist of three rude masses of millstone grit, and are situated about a quarter of a mile from Boroughbridge, on the Wetherby road. They stand N.–S., the northern stone being about 129 feet from the central one, which is 360 feet from the southern. They are 18 to 22½ feet in height, and there was formerly a fourth stone. In spite of many conjectures, little or nothing is known as to the origin of these remarkable pillars.

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.

The

Geographical Journal.

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THE ALPINE RACES IN EUROPE.*

By JOHN L. MYRES.

This paper is an attempt to interpret the admitted distribution of human types in Central and Eastern Europe, both in modern times and in successive periods of antiquity, partly in connection with similar though scantier evidence from adjacent regions of Western Asia, partly as conditioned by changes in the distribution of land and water, and of climate and vegetation, which are indicated by recent work in palæogeography, as far back as the Ice Age and the period immediately preceding it.

For convenience of reference, I propose to limit myself almost exclusively to data which are accessible in a few standard works and fairly well-known papers: for anthropology, to Deniker's 'Races de l'Europe,' 1897; 'The Races of Man' (E. T.), 1900; and his Huxley Memorial Lecture (1904) in *Journ. Anthr. Inst.*, **34**, 1810; and to Ripley's 'Races of Europe,' 1900: in palæogeography, to Suess, 'The Face of the Earth,' 1 (E. T. Oxford, 1904); and to Ratzel's papers, "Die Ursprung und Wanderung der Völker geographisch betrachtet," in *Ber. ü Verh. d. k. Sachs. Ges. Wiss. Leipzig*, **50** (1898), **52** (1900). It is to the last named that I owe the suggestive treatment of the conditions in Eastern Europe, which started me on the present inquiry.

On the statical aspect of the matter there is practical unanimity, though the evidence is still incomplete here and there, and in detail. Presentations of the anthropology of Europe as different superficially as those of Ripley and Deniker agree on closer analysis in recognizing three main types: (1) the long-headed dark *Homo Mediterraneus*, bounded northwards by the Alpine barrier, but with littoral offshoots along the Atlantic seaboard; (2) the long-headed blonde *H. borealis*, disposed

* Research Department, March 9, 1906.

round the Baltic and North sea, in an oval of about 1500 by 2000 miles; commingling westward with the littoral extension of *H. Mediterraneus*, and showing traces of a large south-eastward extension also in comparatively recent times; and (3) a rather variable but broad-headed type, generally brunette, which from its wedge-like distribution westward from a base between the Adriatic and the Dnieper to an apex in Brittany, and from its general coincidence of distribution with the main mountain zone of Central Europe, has acquired, rightly or wrongly, the name of *H. alpinus*. Between *H. Mediterraneus* and *H. borealis* a general affinity is commonly admitted; the evidence of palæanthropology supports this relationship strongly; and that of the palæogeography of quaternary Europe makes it practically certain that both types may be traced back to an Eur-African origin.

There is general agreement, also, that the broad-headed *H. Alpinus* is of incomparably remoter relationship to these long-headed types. Keane, indeed, argues recently for a North African origin for *H. alpinus* also, quoting a broad-headed strain among the ancient Guanches, and a similar patch still between Tunis and Tripoli. But the common beliefs are either that *H. alpinus* originated locally in his Alpine habitat by some physiological response to climate, altitude, or other geographical circumstance, or that his origin must be sought further east in some part of Asia. The latter view is supported by the enormous preponderance, over Asia, north of the Himalayan chain, of excessively broad-headed peoples, and by the extension of such types, in their modern statical distribution, over the whole of the Eurasian steppe, and sporadically over most of Irania, Caucasia, and Anatolia. But the evident expansion of these Asiatic broad-heads from centres of distribution which are exclusively in very high altitudes, gives new weight to the former contention that in the European highlands also broad-headedness *may* be a feature acquired both locally and recently.

This former hypothesis is clearly not a matter of geography, but of physiology, and I do not propose to consider it further, except to remark that the present state of our knowledge as to the rate of alterability of a deep-seated structure like the human cranial skeleton offers very little encouragement to believe either that the area of highland in Europe is large enough to permit the local evolution of a marked human variety of this kind, or that the time which has elapsed, since the retreat of glacial conditions made this highland habitable, has been at all long enough to allow of so considerable a change of head-form, even if the area available eventually had been large enough or secluded enough for the purpose.

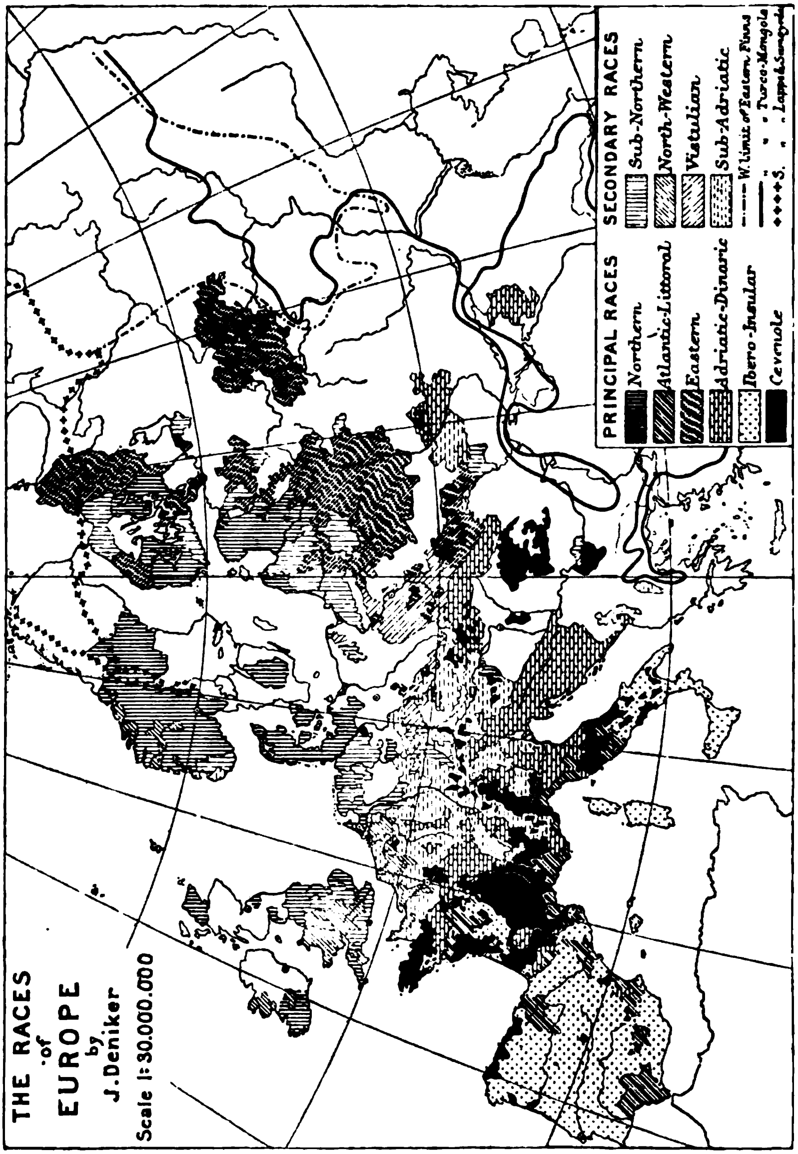
I propose, therefore, to assume that *H. alpinus* in Central Europe has come from somewhere; that, like the long-headed types, he has reached the greater part of his present European habitat within post-glacial times; and that, except on an hypothesis of spontaneous generation such as we have already seen reason to reject for Europe, it is difficult to accept Keane's view * that his original home was in North Africa. Keane's instances of survival of broad-headed man in this direction will, moreover, be found susceptible later on of adequate explanation on a quite different Alpine hypothesis. A glance at the general distribution of types of head-form, and even of pigmentation, over the land-surface of the Old World reveals a *primâ facie* case for the hypothesis that the sallow dark-haired broad-heads of the West stand in some not very distant relation to the broad-heads of Central Asia; distinct as the latter are in their almost hairless face, exceedingly yellow skin, and peculiar conformation of eye and brow. But if "somewhere in Asia" is the ultimate home of the western broad-heads, what was the line of their route, and what were the geographical conditions during the period of their transit?

The plateau core of Asia is connected now with the mountain core of peninsular Europe by two distinct lines of communication; the Eurasian steppe, and the Anatolian and Iranian section of the Alpine-Himalayan fold system. From the point where they leave the western limits of Inner Asia, these two lines of communication lie for a while conterminous; but about midway in their course they are held apart by the Caspian depression, and then again, after another brief interval of Caucasian contiguity, by the sea of Azov and the Black sea.

Both routes have served in historic times as lines of immigration from Inner Asia to Eastern Europe; and both are marked now (quite apart from spasmodic incursions) by a graduated transition of racial type among their permanent if not sedentary inhabitants. The northern series passes by gradual changes from the typically Mongoloid peoples of the Kirghiz and Turkoman steppes to the Finns and Slavs who border respectively the Baltic and the Pontic shores of the isthmus into peninsular Europe; and whose physical types, as they are traced westward, betray respectively the growing proximity of the Baltic and the Carpathian citadels—of *H. borealis*, that is, and of *H. alpinus*. The southern series passes likewise from the Tajik and Galcha peoples on the western fringe of Highland Asia, through the Armenoid types of Caucasia and Anatolia to the Albanians and other "Dinaric" broad-heads of Deniker's classification, and so on to the short-heads of the Alpine region and their westward colonies in Central France and Brittany.

* 'Man Past and Present,' p. 457: "Here again we see how unnecessary it is to go to Asia for the early European roundheads, who are generally introduced from the east in the Bronze Age, although it is clear that large numbers had already established themselves in Central and West Europe during the New Stone Age." And again, p. 458, he speaks of "great invasions of dark or brown roundheads of average size (probably from the Iranian uplands). But all of these had themselves first been specialized in North Africa, the true centre of evolution and of dispersion of all the main branches of the Caucasic family."

Throughout historic times the northern route has had, for European peoples, an overwhelmingly greater importance politically, and has worked also an incomparably greater change in the recent ethnography



of Europe than the southern; and it is probably this practical necessity of taking political account of this northern route which has permitted its predominance in anthropological theory also. When a people, or a language, or an idea, not demonstrably "Mesopotamian" or "Semitic," is claimed as having migrated into Europe from "somewhere in Asia," it has been presumed almost invariably that it arrived in peninsular Europe from the north-east; and conversely, when attempts have been made to derive "Aryan" phenomena in India or Persia from an ultimate source in Europe, it is usually north of the Caspian that their course is traced.

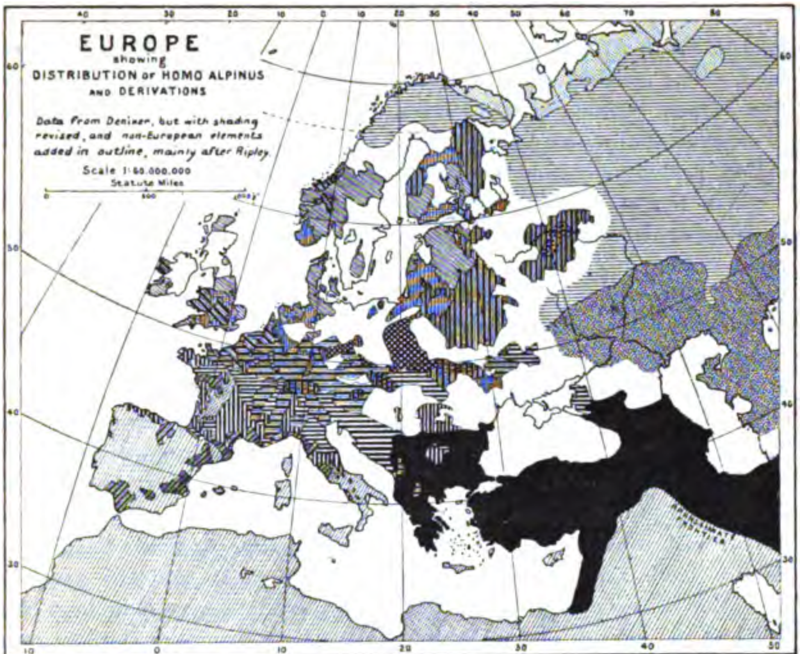
It is to Ratzel, I think, that the credit belongs of demonstrating, in the paper already quoted, the relative modernity of this northern line of communication. The steppe route was, in fact, non-existent until two conditions were fulfilled: (1) the retreat of the glacial ice-cap from the basin of the upper Dnieper, upper Don, and upper Volga; and (2) the restriction of the Sarmatian, or Ponto-Caspian sea, to its modern Caspian limits, so as to connect the European steppe, from Carpathians to Volga, with the Asiatic steppe from Altai to the foot of the Urals.

Ratzel used his reconstruction of the geography of Eastern Europe during and since the Ice Age, to explain how Europe became isolated sufficiently, and long enough, to permit of the evolution of *H. borealis* as a gigantic blanched variety of the precursor of *H. Mediterraneus.* But he has not indicated clearly whether he realized that another corollary follows from his geographical conclusions; and it is this other corollary which I hope to develop in what follows. Meanwhile it is important to note, also, that even in regard to the northern route Ratzel does not state the case against early Asiatic immigration at all so strongly as the facts seem to justify. Not merely was it possible, long after the stage of European history when broad-headed man is traceable in the neolithic lake-dwellings of western Switzerland and Austria, for the overwhelmingly long-headed folk of the *kurgans* to range nomadically over a secluded steppe from the Carpathians to the west bank of the Volga, and to lay the foundations of the ethnography of the north-western Caucasus, but, as soon as the shrinkage of the Caspian had gone on long enough to open a steppe-route into Asia, it was the European long-headed steppe-people which carried its *kurgan* interments north-eastward as far as Tobolsk, and distributed those patches of relatively long-headed blondes which survive even further afield. There is, in fact, no positive evidence of any but long-headed nomads on the European steppe until a period which is far on in the Bronze Age of this region; and probably not until the so-called "Scythic" movements at the beginning of the Age of Iron. Now, if the steppe route was thus securely closed until this late date, as the ethnography and the geography of the region combine to prove that it was, we are thrown back upon an examination of the parts south of the Caspian for a possible means of access of broad-headed people to Europe.

At first sight we are met by a precisely similar obstacle, geographical and ethnographical. The highlands, which are continuous from the Pamirs to Phrygia, are divided from the Balkan and Dinaric highlands by the Hellespontine depression and the Ægean sea; and though the former, in its present state, has never been a barrier to man, it was certainly somewhat more deeply submerged—at least up to the 150-feet line—in late Quaternary time, just when the broad-headed peoples, if they were of Anatolian origin, ought to have been free to enter the Alpine region. Moreover, from the later Stone Age onwards the activity of the blonde long-headed nomads of the European steppes can be traced very clearly south-westwards also, intruding by way of the lower Danube upon the Balkan lands, and establishing themselves with their characteristic *kurgan* tumuli all over Thrace, over a large area on the karst plateau of Bosnia, and even over a considerable part of Western Asia Minor, from the Hellespont southwards to Lydia and Caria, and eastwards up the Sangarius into plateau Phrygia. In Bosnia this long-headed population lasted on until the early Iron Age, or somewhere about 800 B.C.; in Thrace, fair-hair and tumulus-burial could be seen still, about 450 B.C.; and from the Danube mouth to Varna a markedly blonde and long-headed population survives to the present day. At this point, therefore, it would seem as if northern and Mediterranean long-heads met once more and nipped off our Alpine broad-heads from their nearest Anatolian affinities. Here, however, the earlier history of the people and of the area throws a different light on the matter.

In regard to the geographical factors, Ratzel and Suess are only summing up a consensus of recent inquiry when they emphasize the very recent date and summary character of the subsidences which let down certain areas adjacent to Asia Minor to their present level. These areas are (1) the whole south lobe of the Caspian, south of Baku and Krasnovodsk in lat. 40°; (2) the whole Black Sea basin south of a line joining the Caucasus with the Crimean Yaila, and this with the Balkans behind Varna; * (3) the whole Ægean basin, from the submerged Cycladic ranges northwards, and therewith the sea of Marmora; (5) the whole (probably, and certainly the south-eastern part) of the foreshore of Syria on which Cyprus stands, as far west as a line drawn from Adalia to Alexandria. Suess quotes one rather doubtful case of the discovery of a human implement in Hellespontine shore-deposits of the period of greatest subsidence, approximately at the culmination of the Ice Age; and thinks that "it is even possible that these events were witnessed by man;" and certainly the anthropology of Cyprus gives the strong impression that the island was already inhabited by

* It is a matter of detail when and how the Mediterranean came to receive the drainage of this area, and of the far older Sarmatian sea which survives in the gulf of Odessa and the sea of Azov.



EXPLANATORY DIAGRAM

FIG. A DENIKER'S NOMENCLATURE	PHYSICAL CHARACTERISTICS Head Form	Colouring	Stature	GROUPING NOW PROPOSED FIG. B
				MEDITERRANEUS
Ibero-Insular	Dolicho	Dark	Short	Ibero-Insular
Atlantic-Littoral	Meso	..	Tall	Littoral
Adriatic-Dinaric	Brachy	..	..	ALPINUS Adriatic-Dinaric
Sub-Adriatic	..	Less Dark	Less Tall	Sub-Adriatic
Cevenole	..	Dark	Short	Cevenole
Eastern	..	Fair	..	Eastern
Vistulian	Meso	..	..	Vistulian
Sub-Northern	..	..	Tall	Sub-Northern
Northern	Dolicho	..	..	BOREALIS Northern
North-Western	Sub-Dolicho	Brown	..	North-Western
	Brachy	Dark	..	Adriatic & Sub-Adriatic (v. above)
"Turco-Mongol" (Turkish half)	..	..	..	Balkan-Anatolian "Armenoid" area
" " (Cossack-Tatar half)	..			Mongoloids of Steppe
"Eastern Finns"	..			" " Forest
"Lapps & Samoyedes"	..			" " Tundra

man of North African type, before it was cut off finally from the mainland. The problem, also, of the introduction of *H. Mediterraneus* into the Ægean would be considerably simplified if it were permissible to suppose that, down to the glacial submergence, it had land communication, past Rhodes and Lycia, with the lost Syrian foreshore.

Whether we admit for our present purpose a larger or smaller width of isthmus between Anatolia and the Balkan lands, the conclusion remains that in immediately pre-glacial times, and far on into the period which corresponds with the Ice Age of Northern Europe, we must presume the existence of a promontory of Asia, much broader, but not much more elevated than the present Asia Minor, barred southward, as at present, by the Eastern Mediterranean as far east as Lycia; further east by a prolongation of the Persian gulf far up the present Mesopotamian "Lombardy;" and in the intervening section by the abrupt south face of Taurus. Internally this great promontory consisted of alternate mountain ridges and intermont plateaux, more or less uniformly dotted with considerable lakes; for the Sarmatian or Ponto-Caspian sea on the north, the Mesopotamian gulf on the south, and the excessive humidity of the glacial "penumbra" combined to give abundant rainfall, and the modern river gorges of Halys, Sangarius, and the like, were far less completely excavated than now.

By an isthmus, if it can be called so, at least as broad as from the Bosphorus to Eubœa, and not improbably from Varna to Attica, this great Anatolia extended west as far as the Iron Gates and Montenegro. Beyond this only two things are clear: (1) that continuous highland, broken, if at all, only by an early stage of the Danube gorge, ran northwards, and then westwards along the Carpathians, enclosing a Hungarian lake; (2) that west of the Hungarian lake a long highland promontory ran out almost to nothing where it made touch with the Eastern Alps. It is not certain, however, exactly at what point in the break up of this continental *régimé* the upper Adriatic collapsed; and we have to be prepared for the possibility that a foreshore like that of Syria connected the Dalmatian highland with the foot of the Apennines. All this Balkan section of the Anatolian region repeated on a smaller-featured scale the tangle of ridge and lake-land which we have seen to be characteristic of Asia Minor. We must also remember that further east, in what is now northern and central Irania, far more favourable conditions prevailed, so long as the Aral-Caspian sea was in existence; and that the configuration of this land also offers just the same foundation for a *régimé* of lake-basins as does Anatolia itself.

We have, therefore, all the conditions for the development, in immediately pre-glacial time, of a distinct type of man—a great expanse of uniformly diversified country, adequate rainfall, moderate climate, ample forest on the highlands, grasslands, with good evidence of the presence of domesticable cattle, round the lakes; and, in particular, a peculiar abundance of edible fruits—quince, mulberry, olive—especially its characteristic stone fruits, from cherry and plum to apricot and peach; and nuts, such as chestnut and walnut. The last point is of importance, because, if current speculations as to the influence of jaw-power on skull-form, and of diet upon the need for jaw-power, are leading to valid results, as I think they are, a diet of masticable fruits may well have been one of the conditions for the development of Anatolian short-headedness, even before the domestication of cattle and the acquisition of a milk and cheese diet like that of the Mongolian peoples.

We have next to consider the effect of glacial conditions on this Quaternary Anatolia. First, though in the latter part of the Ice Age the great subsidences were beginning, there is nothing to show that the general submergence of the Mediterranean coasts extended more than about 150 feet above the present sea-level; so that the gravels of the Hellespont and of Salonica, for example, need not mark more than the course of comparatively narrow gulfs or flooded valleys. Second, so long as the Sarmatian sea remained continuous and wide, as Ratzel shows—and, still more, so soon as the Pontic depression began to take place—the climate of Anatolia must have been comparatively little affected by the pressure of the European ice-sheet; and, in fact, definite traces of glaciation are absent, not only from Anatolia (apart from its present snow-peaks), but from almost all its Balkan continuation as well, though the evidence here is not at all so clear, especially as to Bulgaria or the southern Carpathians. But the open Adriatic and the Hungarian lake probably exercised a certain mitigating effect on all this western section. Further west, however, the Alpine region was certainly very heavily ice-capped; and this ice-cap, together with the Hungarian lake and the snow-clad Carpathians, remained a very serious obstacle to the intrusion of European man from the north-west, when the ice-sheet intermittently retired and gave him access to a strip of tundra country between itself and the Alpine glaciers.

Now, under these conditions two things may reasonably be inferred: First, that in Anatolia and Irania, which were more than ever isolated from Africa and Arabia by the subsidence of the Syrian foreshore and the deeper submergence of Mesopotamia, but were preserved in comparative comfort by southerly latitude and peninsular character, Anatolian man continued to develop favourably and emphatically into a well-marked and well-grown variety. Second, that in so far as Balkan Asia was affected by the Ice Age at all, it was in the direction of partial isolation and relative climatic rigour. And it seems to be admitted (1) that one of the first physiological effects of climatic rigour upon man is to dwarf his stature; (2) that exposure to "alpine" conditions tends to diminish pigmentation, and eventually to lighten the hair-tint. This, at all events, is the current explanation of the blondeness of

H. borealis, and of the prevalence of blonde types among the highlanders of brunette North Africa.

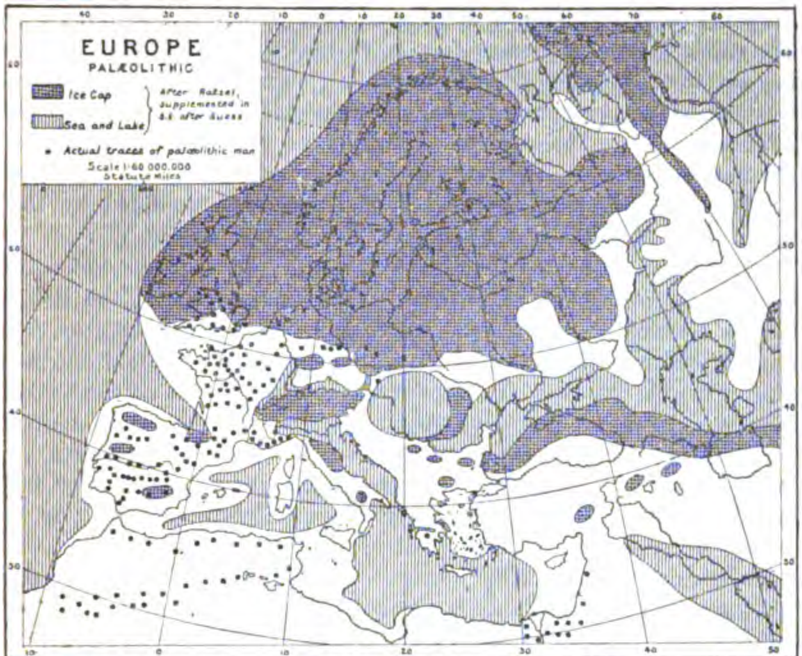
Now, one of the stumbling-blocks of the student of *H. alpinus* has always been the extraordinary distinctness of the gigantic "Dinaric," or Albanian variety, and the dwarf short-limbed "Cevenole race" of Deniker, as we find it in Central France, in Savoy, in Bohemia, and in certain parts of the south-eastern Carpathians, and again sporadically even further north-east in Galicia and beyond Dnieper. And it has long been clear that the "Dinaric race" shares its giantism, as well as its general physique of head and face, with the members of the Armenoid and Caucasian groups of short-heads. But clearly, if our analysis of the Ice Age geography is correct, this difference of stature among broad-headed peoples in Europe is exactly what we ought to expect; and analysis of the circumstances of the succeeding phase of geography and climate will show further how this original distribution, with dwarfs to the west, and giants to the east of the incipient Ægean, is postulated exactly by what happens next.

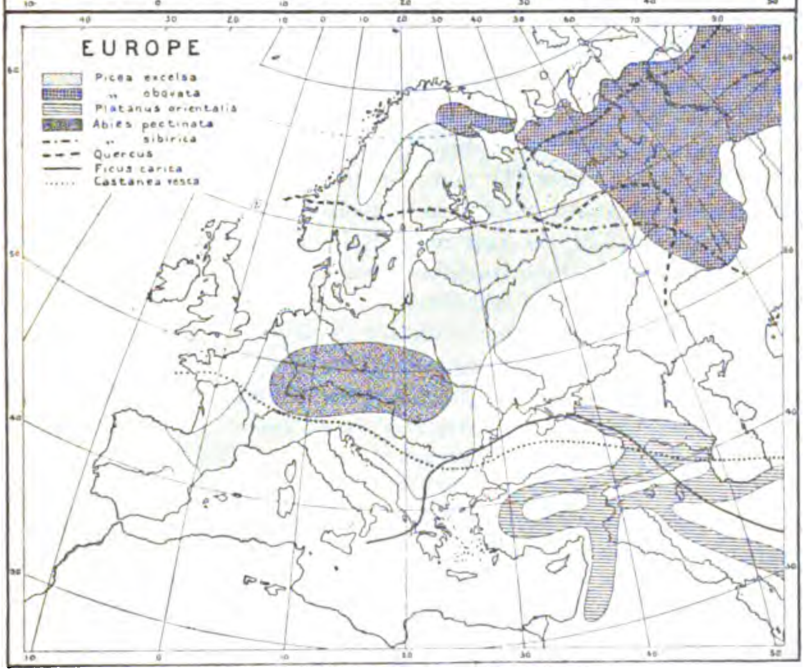
There seems no reason to doubt that the first repopulation of post-glacial Europe took effect from the west eastward. The Atlantic seaboard had always been preserved by its littoral climate from excessive glaciation; and West Europe had far better communication with the then temperate zone of North Africa than Central Europe had with Balkan Anatolia; thanks to the way in which the Alpine and Carpathian snow-caps, and the Hungarian lake, barred the road from the south-east. Moreover, palæolithic man, of the long-headed types which eventually spread into Bohemia and Northern Hungary, had already a long interglacial training in *tundra* life, and experience of the ways of the large fauna, which he seems now to have followed on their return to the north-east.

After the tundra, the steppe; and throughout all the period of steppe-formation in Europe, and also as long as any exclusively European steppe remained, along either the Baltic or the Ponto-Caspian foreshore, blonde long-headed man remained in secure possession of it.

Such gradual changes of head-form as are shown in the later palæolithic stages in France, as in the race of Laugerie-Chancelade, with its cephalic index of about 74, are more than accounted for by the arrival of an improved strain of Eurafrican man; for the modern Berber index rises as high as 76·5. And against this is to be set the arrival also of the race of Cromagnon, with its index reduced to 73 or less. It is only, therefore, in such very exceptional cases as the two late palæolithic skulls from L'Homme Mort in Lozère, with indices of 78·53 and 78·85, that it becomes necessary to look in any new direction for a source of fresh blood.

By the close of the palæolithic age in Western Europè, however, the whole width of the Alpine foothills was disengaged from its ice-

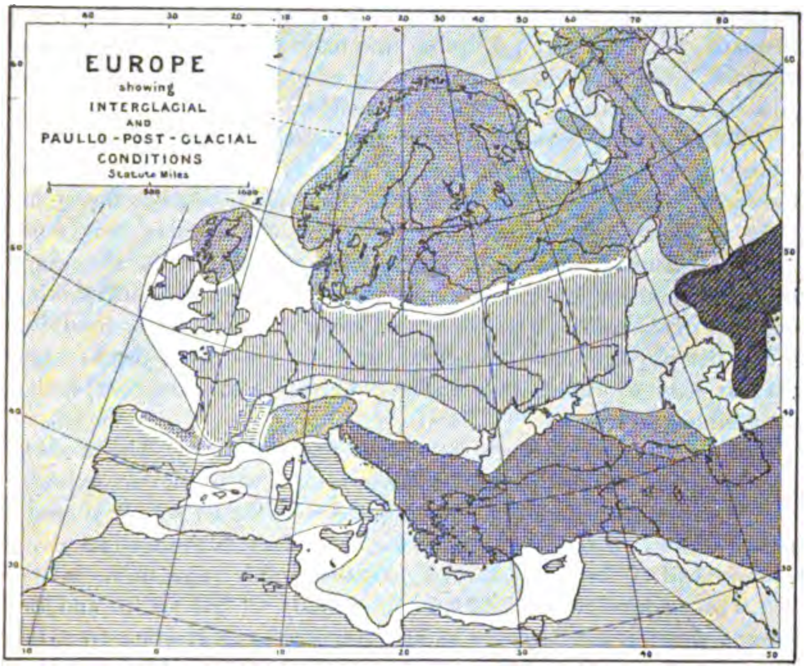

EUROPE
PALÆOLITHIC
Ice Cap
Sea and Lake
After Ratzel, supplemented in S.E. after Suess
Actual traces of palæolithic man
Scale 1:60 000.000
Statute Miles


EUROPE
Picea excelsa
" obovata
Platanus orientalis
Abies pectinata
" sibirica
Quercus
Ficus carica
Castanea vesca

cap; the Hungarian lake was largely transformed to steppe, and the Carpathians and Balkans had assumed nearly their recent appearance. The Adriatic had its present form, save that the Po shore-line was less far advanced, and that all as far west as Piacenza, if not even further, was impassable swamp, bordered by dense forest from the base of the Alpine foothills. Under these circumstances the whole north front of the Balkan lands was thrown open for an advance from the south-east, provided only that the dwarfed short-heads were qualified by their recent mode of life to take advantage of the new situation.

And this is exactly what had happened. Subsequent desiccation has greatly altered the surface-covering of large parts of the Balkan lands; restricting the forests, filling the lakes with detritus from unmitigated rainfall, and so reducing still further the available surfaces of water in the interior. This desiccation naturally affected the interior earliest, driving out trees and water-supplies from the *Axylon* towards the coast-line. But the recent appearance of the Alpine lakelands, and even of parts of Anatolia, recalls what once was general. Now in a heavily forested lake-land practically no mode of civilized life is possible except on the margins of the lakes; and as soon as the process of obstruction of the lakes by detritus sets in, expansion becomes easy lakewards; here alone, also, is there safety at all times from forest dangers, and sooner or later a "lake-dwelling" culture emerges. Now, it can hardly be an accident that it is round the periphery of old Anatolia that we have in classical authors the majority of the descriptions of this type of culture, surviving into historic times; namely, round the Armenian Phasis, the North-Syrian Orontes, the Thracian Strymon, and locally on the lower Danube. And it can hardly be an accident either (1) that the first purely broad-headed population of which traces remain in Central Europe is that of the Swiss lake-dwellers, which is first recognizable in a fairly early neolithic stage; (2) that the first traceable invasion of Italy from the north is effected by broad-headed lake-dwellers, whose mode of life is the only one which enabled them to circumvent the triple frontier of the Alpine and Apennine forests, and the swamps of the Po valley; (3) that the area over which the lake-dwelling culture spreads—more or less modified by circumstances as it goes—is very nearly coincident with that over which the first well-marked intrusions of broad-headed peoples can be traced; (4) that, together with the Alpine lake-dwellings, comes the earliest positive record of a number of characteristic Anatolian fruits, particularly peach, plum, cherry, and chestnut. The actual distribution of the last three is particularly instructive in this respect.

While the Alpine front of the Balkan lands was thus thrown open for the expansion of the dwarf broad-heads of what was now South-Eastern Europe, the disappearance of the large Pontic area, and the desiccation of the rest of Anatolia, are sufficient causes for an exodus of the giant broad-heads thence; and at this point we have to remember that after the great submergence and the close of the Ice Age came a period of appreciable elevation, which, while it carved out finally the deep *rias* coasts of the Ægean, and gave the Hellespont and Bosphorus their present depth, provided a broad-fronted Hellespontine bridge,



Reference

Sea and lake basins during phases of maximum land-elevation

Shrunken ice-caps: N.B. fringed with debris and tundra

Probable distribution of Palæolithic predecessors of H. borealis

" " " predecessors of H. mediterraneus, pressing N.W. from an African home in succession to H. borealis, and N.E. as far as the barrier of Taurus

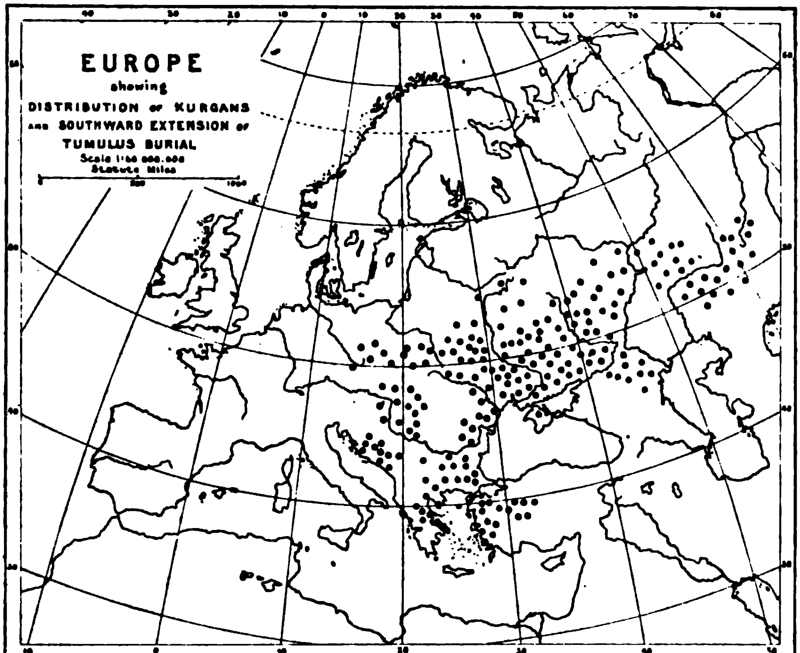
The isolated "Balkan-Anatolian" region suggested as the breed-home of H. alpinus

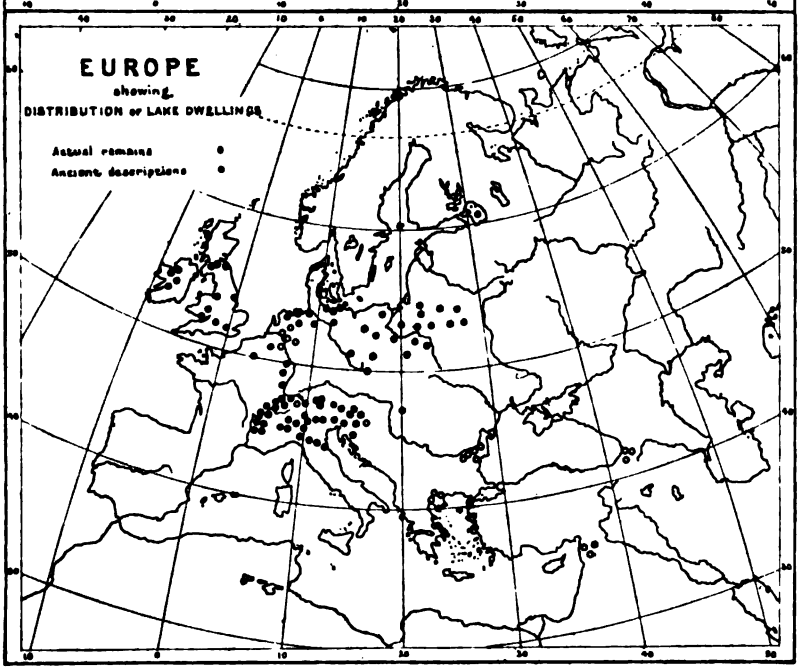
First area of advancing mongoloids

once more, between Anatolia and the Balkan lands. It is not surprising, therefore, to find distributed thickly along the westward road, pioneered by the "Cevenole" broad-heads, a copious "Dinaric" population, flooding round and beyond the isolated remnants of the older strain, which lie on either side of its path. Nor is it surprising to find Deniker marking an independent patch of "Dinaric" peoples east of the sea of Azov; for the Caucasus was by this time at least as passable or circumventable as it is now, and a Caucasian—that is, North-East Anatolian—population overlies in this region the early long-heads from the European steppe, while itself underlying the yellow beardless round-heads from the steppes of Asia. It would be tempting to bring into the same connection the strikingly Albanian-looking Tatars of the Yaila, as an early patch of people isolated here since the break-up of the Pontic edge of Anatolia; but the historical intrusion of European Albanians into the Crimea quite recently makes this comparison dangerous, and there is at present no adequate record, I think, of skulls from pre-Hellenic tombs in this quarter.

There is general agreement as to the subsequent course of events in Central and Western Europe. Generally speaking, the stunted "Cevenole" broad-heads have preserved their individuality—for, if our theory is right, they arrived earlier, when the country was more densely obstructed, and more sparsely populated; while the giant "Dinaric" stock, arriving later, penetrating further, and intermixing more with *H. borealis*, has taken on a blonde exterior, while retaining much of its physique and head form; and has thus given rise to many local varieties of rufous half-breeds ("Celts") and much perplexity among ethnographers.

North-eastward the course of events was different. The modern race-map gives us Deniker's "Eastern race," with blonde exterior allied to low stature and broad-headedness, distributed widely through the zone of swamp and forest from the outer foothills of Galicia along the watershed of European Russia. Eastward this type, in its earlier days, was bounded by the blonde long-heads of the steppe and the *kurgans;* westward it has been always exposed to infiltration from the side of the blonde long-heads of the Baltic; only at its Carpathian starting-point, and towards its north-eastern extremity, does it betray its composition and its origin, by the persistence in its midst of a larger percentage of short broad-heads, who are also dark, whom Deniker identifies, probably rightly, as genuine "Cevenoles." What has happened, clearly, is this: along the Carpathians the short Cevenole type spread early, and was only partially swept aside by a "Dinaric" after-flood. For in a region of more rigorous climate, of great swamps, and of forest beyond, between steppe on one side and tundra on the other, this hardier and more truly "Alpine" type was in its element still; and here, in more obstructed country, its "Dinaric" kinsmen could not follow when the time for inter-mixture came. Consequently, here alone we are confronted with a type which is at the same time blonde and broad-headed and short; and, consequently, also, further north, where neither the blonde Baltic-man nor the blonde *kurgan*-man could keep pace, we recover these distant colonies of "Cevenoles" in the great forest, like the Finisterre Bretons, the Walloons, and the Zeelanders in the recesses of the Far West.


EUROPE
showing
DISTRIBUTION of KURGANS
and SOUTHWARD EXTENSION of
TUMULUS BURIAL
Statute Miles


EUROPE
showing
DISTRIBUTION of LAKE DWELLINGS
Actual remains
Ancient descriptions

Two other problems remain. At an earlier stage we traced the *kurgan*-people as early as late Neolithic times south-westward into Balkan lands, as far as Bosnia and Thrace, and even into western Asia Minor. How does this agree with the hypothesis of an Anatolian origin for the Dinaric type? And, further, how are we to account for the presence, again since late Neolithic times at least, of a pure population of *H. Mediterraneus* in the Ægean? The answer in both cases is the same. As in Switzerland, for example, it is quite possible, within a comminuted highland once partly cleared of its forest, for many invasions to take place from steppe to the north, or from an island fringe to the south: in the latter case, without affecting the population of the interior; in the former, without touching, at all, whole districts which retained adequate natural frontiers of mountain or forest. In the case of Thrace or Phrygia, the broad river-valleys —Danube, Axius, Hebrus, and Sangarius—were occupied permanently, and so was the *Axylon*, in the heart of Asia Minor, and the bare karst plateau in Bosnia. But in Albania a broad-headed population of very pure type, and apparently of immemorial antiquity, remains; in the swamps of the Strymon, lake-dwellers lived on into the fifth century B.C., and alongside the patriarchal pastoral Phrygians, the western mountains, and even some retired lowland districts of Anatolia, remained devoted to matriarchal institutions and cults, such as would better fit the more agricultural parts of Africa. It should also be added that, while we have copious legends of migration from Thrace to Phrygia, we have also more than one tradition of "Amazonian" invasions of Thrace, of the conquests of Sesostris in Europe, and of a mysterious migration of Mysians and Teucrians from Anatolia into Thrace, among whose colonists were the lake-dwelling Pæonians round Lake Prasias. Is this also possibly one of the senses in which "Pelops" was a "Phrygian"?

The case of the Ægean peoples of "Mediterranean" origin is similar. All we really know at present about the earliest population of the Ægean is this: first, that the islands were purely long-headed down to the early Iron Age; second, that the fringe of Eastern Greece, Argolis, or Attica were long-headed also; third, that in Lycia there are long-headed and broad-headed people side by side now, uncombined after all these centuries; fourth, that splendid as the cultural superiority of the South Ægean peoples were in their long Bronze Age, they never set permanent foot out of reach of the sea either in Asia Minor or in Greece itself; fifth, that at Troy, if we may use the evidence which exists, the broad-headed type underlies the long-headed type, and the latter only makes itself felt either as a northerly intrusion of the *kurgan*-folk, as in Hissarlik III., or as a temporary annexation of the Troad to a south Ægean sea-power, as in Hissarlik VI.

Thus far we have a situation analogous rather to the activity of

Malays or Vikings, or to the present proceedings of the Japanese or ourselves; the phenomenon of a group of coastal islands influencing, from without, the adjacent mainlands, but not penetrating them or occupying them permanently, except under the occasional leadership of an Agamemnon or an Alexander, whose activity is from beyond the hills, and whose instincts are still pastoral mainly. How these "Mediterraneans" reached the Ægean is a further question. My own impression is that they are, as they themselves believed, indigenous, even if that has eventually to mean *pre-glacial;* analogous to the population of Cyprus or of Sicily, but brought thither possibly by sea; and, if by land, then by ways which postulate either a land-bridge over the Adriatic, or a prolongation westward of the basal plateau of Cyprus.

In any case, the actual distribution of the Ægean long-heads, apart from that of their culture, is no more obstacle to the view here stated of the relationship of the European and Anatolian broad-heads, than is the episode of the Thraco-Phrygian blondes.

The CHAIRMAN (Mr. D. G. HOGARTH): Mr. Myres has presented us with a problem of very great range and very great complexity. He himself represents a rare combination of the geologist, the palæogeographer, and ethnologist. He deprecates, as those who have read his paper will see, the introduction of the physiological question; but at the same time, if there is any one present who would wish to speak upon that, I am sure he would not object. I always feel that in all these craniological questions there lurks a certain physiological factor of very great importance, but of quite unascertained value—that is to say, the problem as to what conditions bring about change of skull-form, and whether the skulls of a race can alter and the race remain the same. The question has arisen with regard to the present peoples who claim to be Greeks. I think it will probably be better if, to some extent, we keep the different sides of this question apart, and I should therefore propose, first of all, to call on those who can speak to it more particularly upon the geological side, and deal with the question whether the glacial and preglacial conditions really render the northern route as impossible as Mr. Myres holds. I should like to know how far they agree with the view of Suess as regards the configuration of the east Mediterranean at a rather later age.

Mr. ARTHUR EVANS: I was not fortunate enough to be present during the first part of Mr. Myres' interesting communication. In any case, it would be difficult to deal with the whole of the questions raised by him. I understand that he wishes to make out that the round-headed "Alpine" race came into Europe by way of Asia Minor, and not, as has been hitherto generally supposed, from Central Asia. In support of this contention he has raised a great water-barrier on the Central Asian side, and thrown a land bridge over the Ægean. It seems to me—not speaking as a geologist, but as one to a certain extent familiar with the subject of Quaternary man—that a good deal of this argument would have been pertinent to the case of the remains of the older Palæolithic population in the European area, and might indeed be applicable in a comparatively late Quaternary period. But we can hardly suppose that, within the limits of any reasonable number of millennia—within the limits, at any rate, of the Neolithic Age—the Ægean was not much as it is at present, and I imagine, in the same way, that the shrinkage of the water-barrier on the side of Russia was of extremely gradual consummation.

We do know, of course, that the remains of human settlements in the Ægean country under its present geographical aspect go back to early Neolithic times, and so far as the evidence goes—so far, at least, as I have been able to follow it—there were at a very early period two main lines of connection with the Ægean area, one of them following the Russian coast of the Black sea, the other going very far north. Particular forms of "idols," which on the Ægean shores belong to the close of the Neolithic period and the earliest age of metal, can be traced by means of intermediate types to the Danubian countries, and again, through the remains in Polish caves, to the Neolithic settlements of the Baltic Amber coast, and even as far north as the interesting settlement on the shore of Lake Ladoga, to which Mr. Myres has referred. And on the other hand, the Neolithic remains of Southern Russia, recently described by Dr. Stern, of Odessa, have brought out very interesting connections between the Neolithic settlements in that region and those of the Danubian basin, and have shown that these extended through the Balkan countries as far as Thessaly. One important point, as it seems to me, is, when do you find this round-headed race making its first appearance in the Alpine regions? So far as I know, the earliest Neolithic remains on that side are all of the dolichocephalic type, and in the Balkan countries, at any rate, the round-headed element begins to appear at a period when metal culture was fairly advanced. I do not deny the possibility of the round-headed Alpine race coming from Asia Minor, but their first appearance in the Alpine regions—which hardly goes back even to the earliest Neolithic stage—certainly seems to date from a time when the Ægean was already in existence. This, indeed, in itself is no bar to Mr. Myres' theory, because there are such obvious facilities of access across the Dardanelles and the Bosphorus, as well as by the island stepping-stones of the Ægean. There is, however, a physiological question that has not been touched.

The theory that has been brought forward by Prof. Arthur Thompson, and experimentally illustrated by him, makes the development of the round-headed type dependent on cranial expansion, due either to the muscular action of the jaw or to increase in cerebral volume. According to this view, it is quite conceivable that there may have been centres of brachicephalic development, radiating from more than one point within a dolichocephalic area, and we need no longer look for distant avenues of immigration to explain the existence of a round-headed race in a given region.

Dr. Haddon: I am very sorry no geographer has spoken, as it is mainly a geological and geographical problem that Mr. Myres has raised. It seems to me that the anthropologists will have to consider very carefully the data supplied to them by geólogists and geographers. For a long time I have felt the need of reconstructions of past geographical conditions, and when ethnologists have these they will probably be able to understand the differentiation and migration of races and peoples far better than they could from the material supplied only by their own science. In Asia there seem to be two well-marked groups of brachycephals—the beardless yellow stock, or *Homo mongolicus*, and the bearded white stock, or *Homo alpinus*. I hope Mr. Myres does not propose to introduce into literature, as he did in his discourse, the term "Anatolian" man for the latter group, since the older name is sufficiently explicit, and at any time it can be divided into varieties, such as Cevenole, Dinaric, and Anatolian. It has long been my view that this race originated somewhere on the western plateaus of Asia, and immigrants crossed into Europe, worked their way up the Danube, and entered France, perhaps by the pass of Belfort, in the Neolithic age. I do not at all see how the "diet of masticable fruits" could have materially assisted in inducing brachycephaly, as the people could not have continuously eaten soft food for a long space of time; fruit is ripe for so short a period, and there must of necessity have been other kinds of food of harder or tougher quality, and why should not these, according to this method of explanation, have elongated their heads? Also I do not quite follow the connection, indicated on one or two of the lantern slides, between certain trees and races of men. I have been greatly interested in this paper of Mr. Myres, and it appears to me that his main conclusions are likely to stand.

Mr. Arthur Evans: I was speaking of the Balkan peninsula. The early appearance of dolichocephaly in the West might possibly be explained by Thompson's theory. My point was in relation to Mr. Myres' theory of trans-Ægean immigration—namely, that, in that case, you ought to find this Alpine type at a very early period in the Balkan regions. Of course, the exploration of the prehistoric remains through a large part of that peninsula is still very imperfect.

Dr. Shrubsall congratulated Mr. Myres on a brilliant and interesting interpretation of the present-day distribution of the Alpine races of mankind in the light of palæography. The chief difficulty seemed to him to be to prove the existence of the broad-headed type at the period under consideration. No remains of the broad-headed type have been found which could be ascribed to an earlier period than the Neolithic, and not to the earlier part even, of that cultural stage; whereas an enormous period of time must have elapsed since the various glacial and interglacial epochs. In the earlier of these epochs there was, even, no quite satisfactory evidence of the very presence of man in the western section of the Eur-Asian continent, so that the development of the special features of *Homo alpinus* at this time in an elevated and isolated Anatolia could be but an ingenious speculation. Another difficulty, on Mr. Myres' hypothesis, which had not been quite cleared up, was to explain the presence of broad-headed man in the Danish islands, the Canaries, and on the Tunisian coast. Lastly, Dr. Shrubsall desired to emphasize the insufficiency of the present data for anything more than an outline hypothesis such as Mr. Myres had propounded; until more was known, any such suggestion was as difficult to controvert as to formulate, but this paper served a most valuable purpose in summarizing the present knowledge of the subject.

The Chairman: Perhaps Mr. Hudleston will say a few words now.

Mr. Hudleston: Of course, it is open to any geologist to make any sort of map he likes, and I am bound to say a great many geologists make maps just in order to suit their own particular views. On the whole, I'd rather not attempt to criticize anything I saw on the screen; although those plans shown by Mr. Myres were most beautiful, yet at the same time I fail to see their connection with the subject, and that being so, I certainly am not competent to discuss it.

Mr. Gray: For the most part, I should be inclined to agree with Mr. Myres. I think in one point, however, he does not take quite the right view: I mean on the question of the influence of environment in changing the physique of a race. I think that anthropologists hitherto have made far too little allowance for the comparatively rapid changes that can be made upon the physique of a race by change of environment. Quite recently there has been a great deal of evidence cropping up which shows that these changes may be very rapid indeed. For instance, some skulls, measured by Dr. Macdonell, which were found in Whitechapel, and pretty certainly date from the time of the plague, belong to a type quite different from any found in the British Isles at the present time. They belong to a race which we can only parallel by going back to Neolithic times. At the present day we cannot find in any region of Great Britain a population corresponding to this Whitechapel population of two to three hundred years ago, and the conclusion that appears to be forced upon us is that the great change of environment produced by modern industrial conditions has actually changed the type of the race. It has also been found in recent investigations that in large industrial towns the pigmentation of the population is so completely changed that, judging the race from this particular feature, we can only say it is a race entirely different from the average of the whole country, the probability against its being the same race being very high. So that here we have an industrial environment changing a population in a hundred years so completely that anthropologists would be compelled to say that the resulting population was a different race. Now, I think that, in view of these facts, we would have to very seriously consider the possibility of these round-headed types being the result of their environment, and it appears to me to be much more probable that the Cevenole type was really evolved from the surrounding long-headed races than that it was an offshoot of the Dinaric race. It corresponds much more nearly to these long-headed races of the Neolithic type in stature. It seems highly probable, from their present geographical distribution, that broad-headed races are better adapted to mountainous countries than are long-headed races; and if that is so, a Neolithic race inhabiting the European Alps would have plenty of time to develop into a broad-headed race. Mr. Myres seemed to think that it was difficult to change the shape of the skull of a race. But it is quite conceivable that such a change may take place in the course of many generations under the influence of a moderate selective action always acting in the same direction. The longer-headed members of a group would be eliminated by a suitable environment, and in the course of time only the broader heads would be left. It is quite possible that by selection the Cevenole group was produced from the previous long-headed Neolithic races. I agree entirely with Mr. Myres that the Dinaric type came from Asia Minor, but I am inclined to think that it is a different type from the Cevenole type, and of quite different origin.

Dr. Wright: I should like, first of all, to congratulate Mr. Myres upon his very interesting paper. I think that by very great ingenuity he has harmonized the facts which we have; my only quarrel would be that the facts are rather too few, and many of them are probably not very correct. I think, too, that the division of the skulls into round-headed skulls and long-headed skulls is altogether too crude. I think it is quite likely many round-headed skulls might be easily developed in a long-headed community. I found, in some skulls I examined in the East Riding of Yorkshire, that one got all intermediate types between extreme dolichocephalic and extreme brachycephalic skulls; but a brachycephalic skull with an index of 82, and a brachycephalic skull from South Germany with an index of 82 might be totally different skulls. I always regard the South German skulls, with that characteristic occipital decline which they have, as very sharply distinguished thereby from other brachycephalic races, and as furnishing really the strongest argument that can be brought forward, that certain round-headed races are racially round-headed, and not produced from long-headed races merely by environment. I was extremely interested, too, in the diagrams which Mr. Myres showed of the vegetation in certain parts of Europe. I think it is very important to bear in mind the vegetation accompanying the different races, and I think one should also consider more the funeral rites which are practised. And then there is another point, and I think Dr. Sturer of Berne is the only man who has taken it into consideration, and that is the domestic animals. I wish Mr. Myres had considered these associations more fully. As regards the origin of this peculiar round-headed people, I imagine them to be of the type of the South Germans of to-day, and not of the type which was found in France and England in Neolithic times, and I think they came comparatively late into Europe, because they are still extremely pure, and I think they came almost certainly from the

East. I think there is no evidence of their coming from Africa. Whether they came north of the Caspian, or whether they came south of the Caspian, I do not think I could offer any opinion of the slightest value whatever. I think Mr. Myres' paper is a very useful one, in that it summarizes the facts and gives us a useful theory upon which to work. I believe, with Prof. Haddon and Mr. Shrubsall, that the geographers and the geologists should come in and give us more facts, and then we might take up the line from them.

The CHAIRMAN: If no one else wishes to say anything, I shall in a moment ask Mr. Myres to reply to the various criticisms brought forward. I can only repeat my regret, and it is evidently the regret of the committee, that we have not been addressed upon the conditions which seem to underlie all these problems—that is to say, particularly, the geological and palæogeographical conditions. The paper deals so exclusively with palæogeography that one feels that one's own personal knowledge of the geography of some parts of this area is of no value whatever. We are really asked to consider this part of the world under conditions totally different from those which obtain at present. But, so far as I know the geography of Asia Minor and of the Balkan lands, Mr. Myres has stated the modern conditions where he brings them in, with very great accuracy. There are one or two minor points in his paper which I should like a little more information about. One of those is with regard to a remark he makes at the end of the paper about the prevalence of the long-headed *Homo* Mediterraneus in the Ægean islands up to quite the end of the Bronze Age. He mentions it as being absolutely exclusive. Of course he would admit that the data at our disposal are very few. There has been a certain amount of anthropometric investigation in Crete, but so far as I know not more than about 70 skulls have been examined, and those, as it happens, belong to one period of the Ægean civilization, and that an early one. We have practically no information about the latter periods, and it is just in one of those that a rather curious contradiction seems to be suggested by the type which is represented upon one of the Knossian frescoes which Mr. Arthur Evans first discovered, the fresco since known as the "cupbearer," which reminded him of the Albanian type; that is to say, we have a broad-headed type represented. That possibly may imply the entrance of a new race such as there is some other evidence to show may have come in about that period. At any rate, it seems to me to impair the general statement which Mr. Myres has made in his paper, that the long-headed race prevailed exclusively in the Ægean lands down to the end of the Bronze Age. Then again, though perhaps it might take us too far afield, I always feel I want my doubts about some palæoliths removed; that is to say, how far the presence of man can be assumed simply from these so-called stone weapons. I noticed, in one sketch-map which Mr. Myres put upon the screen, that he indicated these palæolithic remains extending in a kind of crescent round as far as Egypt. I believe there is more doubt about Egyptian palæoliths than perhaps about any others. There you have a country where peculiarly dry conditions have prevailed for many centuries, conditions in which sand can exercise its greatest power, and these supposed flint implements could have been produced by natural action, and not human action. However, Mr. Myres did not rest any part of his argument upon the distribution of palæolithic remains. With regard to what Dr. Haddon said about the introduction of the name "Anatolian man," I would join with him in deprecating the bringing in of such a name. I think it would be peculiarly inappropriate, because "Anatolian" is not only a modern name, but also describes purely modern conditions; that is to say, it is applied to the eastern part of an area which, according to the theory of Suess, had no distinct existence in geological time; therefore we had better not have a peculiar type of man introduced as "Anatolian man." I am rather glad to see that those authorities who have spoken with peculiar knowledge of craniology all seem to echo my doubts about the physical factor in craniological questions. They all seem to imply that there is little reason to suppose broad-heads need always have come from a common origin, and that they may have developed quite independently. And I must say that I feel a little doubt about the great superiority of this enlarged south-eastern Balkan area over the Balkan area as it is at present, for the development of a special type of man, and I feel still greater doubt about the conditions of isolation which Mr. Myres seems to postulate as necessary for the evolution of a distinct type. Then, again, there is the difficulty which has been brought forward about the presence of small patches of broad-headed men at a considerable distance from any centre of broad-heads, and cut off from them at present by very considerable geographical boundaries. But the time is getting late, and I think there are a great many things about which Mr. Myres has been asked, and if no one else wishes to say anything I will ask Mr. Myres to reply.

Mr. Myres: No one could be more sorry than I am that we have not been fortunate enough to draw the geographers and the geologists. It is precisely because it seemed to me worth while to do even very imperfectly what Dr. Haddon insisted on the importance of—re-construct the palæogeography of this region—that I ventured to submit this paper to the committee at all. One or two points of geology have, however, been raised. Mr. Shrubsall, in particular, raised points which I admit were very natural interpretations of the maps which I put on the screen. I used a map labelled "interglacial conditions" to illustrate also a point in post-glacial times. I ought to have explained—and if I had not been cutting things down I should have explained—that upheaval at one period of comparatively mild climate does not, of course, mean that upheaval occurred in a similar way at the next subsequent period of mild climate. I ought really to have produced a map which would show the retreat of the ice-sheet when it was retreating finally, and not have economized by showing over again a map which showed the retreat of the ice-sheet under what seem to be regarded, at all events by some geographers, as having been conditions of upheaval in the north-west.

There is a further point. If I understand the geological evidence, upheaval in the north-west does not necessarily mean upheaval in the south-east also. One of the things, upon which apparently geological speculators seem to be fairly agreed, is that one gets evidence of differential upheaval. And, in particular, in regard to the Ice Age, one of the things that seems to have happened is that the whole of the sub-structures of what is now Europe swung to a certain extent upon an axis: sometimes that axis is sufficiently central to cause an upheaval of the south-east when there is a depression of the north-west; sometimes the whole thing moved more like the lid of a box, and then you have only differential upheavals. One's own experiences in the Ægean teach one sufficiently well the extent to which, in a small area like that, very marked swings occur. Take the island of Crete. In the west, you have an upheaval of 80 feet since classical times, and in the east you have a depression of 30 feet.

In regard to the question of environment and physique, I do not think Mr. Gray took account, in his criticism, of quite all the cases that one has to deal with. When you have got ancient and modern stages of the population of an area, in some cases you find it is perfectly true that an absolute change of type has taken place in time without any obvious change of population, historically recorded or evidenced by changes of culture and so forth. But it seems to me that that is only one of three groups of cases. For instance, in the Ægean you can trace definitely the intrusion of fresh people out of an adjacent area, and *pari passu* with that a gradual change of the skull form. That is to say, it is roughly in proportion to the exposure to incursions which the Ægean had undergone, that you find the Greek physical type altering. There you seem to have a case of what one was taught in one's youth was "concomitant variation." Then take the case of Sicily and Italy; there you have a population which has undergone all sorts of conditions; you have periods of great prosperity, and periods of starvation; the country has such an enormous seaboard, it is liable to have all sorts of things happen to it. But in spite of that, there is practically no difference at all in the population of South Italy and Sicily since Neolithic times onward. Here you have all sorts of conditions apparently changing, and the physical type simply sticking where it was. So that I am not sure that the case is by any means made out at present for anything like habitual variation of type. No doubt in this, as in other respects, some types of mankind are much more stable than others; and probably where a type has been once mixed, a certain swing of the pendulum goes on while it adjusts itself.

With regard to the particular piece of evidence upon which Mr. Gray laid most stress, one has to remember modern conditions are modern, and it will be a very dangerous thing to argue, because in the east of London artificial stress has produced certain effects in a couple of centuries, that even in two thousand years comparatively small results would be effected when you are dealing with mankind in the state of nature. That meets also a point Dr. Haddon raised, as to the hardness and softness of skulls. I doubt whether Neolithic skulls were much softer than modern skulls; I think they would be harder; but the period of time is infinitely longer.

There was another point with regard to food and trees. I am bound to say, in passing, that the evidence in regard to the animals is to my mind so very difficult that I left them out. I have been into the case of animals as far as I have had the opportunity, but the illustrations of "spread" in a particular direction—I confess I am looking for "spread"—the particular illustrations all happened to come from the plant world. Besides which, the animal is much more migratory than the plant, especially in association with man. Man can take his animals with him; the plants by no means follow so well; they are, therefore, better test cases of the lines of least resistance, climatic and geographical. I, perhaps, ought to explain more clearly than I did before, that the reason why I laid stress upon the chestnut in particular is because it still remains, over the area where it will grow, a very considerable article of food, especially among the least civilized classes. One sees this very markedly in Crete, and all round the fringe of the Ægean; one sees it again in north Italy, and pretty well wherever the chestnut has gone. The case of the chestnut is the clearest, but in the case of stone-fruit particularly there does seem to have been concomitant intrusion of certain edible fruits along with the arrival of broad-headed men. Of course, our evidence with regard to that is from the things found in settlements. We cannot tell that they had them for food or simply for toys, but it looks as though the way they got at the peach-stone was that they ate the peach.

One point more Mr. Shrubsall raised with regard to the route of influence from north-west into Russia. One has to draw distinctions between a route of intercourse and a route of migration, and I am not at present satisfied that we have any evidence of a route of migration—of bodily transference of masses of people—from the Ægean north-westward so as to complete the circle, which he mentions, of broad-headed man. Where one can trace broad-headed man in the area between (say) the mouth of the Danube and the Ægean islands, he has the appearance of being intrusive and comparatively recent, and not earlier than Neolithic, at either end, so far as one can interpret the evidence at present.

I am afraid I did not make myself quite clear about the question of the long-headed people in the Balkans. I had to mention them, and the thing would have borne considerable expansion; but the difficulty which Dr. Evans feels, and we all feel, is this: How is it that you have a well-marked and very persistent patch —we do not know that it is more than a patch—of long-headed people among the Bosnian tombs at a period so very much later than that at which we have well-marked broad-headed people so much further west? Either the broad-headed people came by way of the north route out of Asia, or they came by way of the south route. I hope that I have satisfied others besides myself that the north route was closed. If they came by the south route, how is it that they have left this patch, or that this patch of broad-headed peoples in Balkan lands has survived? My suggestion for dealing with that difficulty is to suppose that the tomb-type is of significance; and that, thanks to their tomb-type, one is justified provisionally in regarding these Bosnian long-heads as an intrusion (of a kind which has frequently happened since) of pastoral people out of the steppes into the Balkan peninsula who have pushed considerably far afield into an area where broad-headed man did not follow, and where possibly he never had been. I suggest that the reason is, that (so far as we know) the geology and geography of that area are such as to make it neither forest nor lake-land.

Dr. Shrubsall's point about the Guanches is explained, I think, if one interprets Deniker's "Atlantic-Littoral" type as the result of the intrusion of "Dinaric" tall short-headed folk among a "Mediterranean" population, long-headed and short. Thus interpreted, the distribution of the "Atlantic-Littoral" type reveals itself as a series of stepping-stones between the south-western fringe of "Dinaric" man and the Guanche and other short-headed outliers in north-west Africa. That is why I have included the "Atlantic-Littoral" people in my map-analysis of Deniker's conclusions: it is the south-western counterpart of his "Eastern" race in central Russia, and his Russian patches of "Cevenoles" are the analogue of the Guanches.

Dr. Wright's suggestion as to the comparative study of funeral rites leads to very instructive results already; but one of the points still in suspense is, how far funeral rites can be regarded as really deep-seated characters of human groups. One can learn to bury one's dead a fresh way; one cannot learn a fresh shape for one's head. In the case of the southern analogues of the *Kurgans*, even, I only venture to adduce them in this argument because I think there is sufficient evidence on the physical side to justify the assumption of early long-headed intrusion southwards from the *Kurgan* area proper.

A FIFTH JOURNEY IN PERSIA.*

By Major P. MOLESWORTH SYKES, C.M.G.

After leaving Rizáb we rose steadily to the watershed, which was almost level for about 2 miles. We then descended close under a red and yellow hill, where the steep ravine was almost too much for the labouring team; but at last that obstacle too was left behind, and, finally, after a march of 37 miles, Sághand was reached. Late at night

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* Read at the Royal Geographical Society, June 18, 1906. Map, p. 429. Continued from p. 453.

one or two beggars who had not been worth "trussing" arrived, from whom we learned the fate of our fellow-travellers, and were amused to hear that we had been cursed freely by the bandits for interfering with the exercise of their profession on the advanced caravan, which we had, quite unwittingly, protected by our presence.

The crux of this section of the journey was a 33-mile waterless stage from Robat-i-Khán to Chashma-i-Shuturán, with a belt of sandhills which commenced at the twenty-second mile. To give our horses every chance, water and forage were left by the advanced camp at the waterless caravanserai of Robát-i-Sirka, situated close to two red-brick obelisks, said—and probably with truth—to date from Safavi times. There, after five hours' rest, the carriage, drawn by four horses abreast, started to cross the dreaded sandhills, which rise to a considerable height and form a fitting boundary between the deserts of Yezd and Tabas. Thanks to the precautions taken, and to the fact that the carriage was almost empty, the horses were just able to master the steep gradients, and at sunset, wearily enough but without a break-down, the whole party had reached camp, accompanied by two travellers whom we had rescued, inarticulate from thirst, in the middle of these shifting sands, which during a gale must indeed be dangerous. Beyond Robat-i-Khán, the carriage, as apart from the horses, underwent its most severe trial. The route was quite impracticable, as being too narrow for wheels, and the river-bed constituted the only possible route; but this in parts was so narrow, owing to the huge boulders, that it is marvellous how the carriage passed. In places rushes were made, in which we all aided; but elsewhere the horses were driven up until the wheels touched the obstacles, when judicious slewing round of the back portion of the carriage had the desired effect. Throughout one admired the resource shown by the coachman, who was an Azerbaiján Turk, and differed as much from the voluble Persian as an Englishman does from an inhabitant of Tarascon.

Eleven stages, or 220 miles, were at last accomplished, and our interest was excited to the full when we looked down upon Tabas, one of the most remote towns of Irán. To appreciate the oasis, it should be approached, as on this occasion, after many days of wearisome and monotonous travel across the Lut, during which no greenery had been seen, and the daily provision of water and forage had ever been the prevailing question. The surroundings of the town, too, are arid, the terrible desert stretching to the south for hundreds of miles, its white glistening surface being broken in the far distance by the Naiband range, which I had explored twelve years previously. With our eyes filled to repletion with this blighting, palsying waste, the sight of Tabas was indeed refreshing, and when, skirting the town wall, we drove for more than a mile up an avenue bordered on both sides by mulberries, elms, willows, and palms, we revelled in this wealth of fresh greenery, which was accentuated by the murmur of running water and the smell of beans in flower, surely one of the most delightful of odours.

Tabas, known as "the Gate of Khorasán," was termed Tabas-at-Tamr, or "Tabas of the Date Palm," by the Arab geographers, to distinguish it from Tabas-al-Unnab, or "Tabas of the Jujube Tree," which I described in a former journey * as being situated some three stages to the east of Birjand, and which is now known as Tabas Sunnikhána. The date of its foundation is unknown, but it is connected by place-names with Parthian times. This dynasty is termed Ashkáni by the Persians, a word represented by the classical Arsaces, which was the title of the royal family. I may incidentally remark that the Chinese envoys of the second century B.C., who were the first to open up communications between the Far and Middle East, refer to the King of An-Sih, which fact is of considerable interest.† In the Tabas district is Deh Ashk, and also Darra Ashkán, which names corroborate the above theory. Tabas was conquered by the Caliph Osman, as were also Káin and Kuhistán, in A.H. 31 (651). Later on it became a centre of the famous Ismaili sect, whose extraordinary tenets are responsible for the word "assassin," and for the true story of the "Old Man of the Mountains." Marco Polo did not, I think, visit Tabas; but I have recently dealt with this question in the *Geographical Journal*.‡ Here it suffices to state that the great traveller describes his route as far as Kubanán, some five stages to the north of Kermán. Thence I originally thought that he crossed the Lut to Tabas, but my inquiries have tended to prove that Ser Marco, in all probability, travelled *viá* Naiband to Tun by a route which keeps to the east of Tabas. Tabas, in the eleventh century, became known as Tabas Gílaki, after a chief who conquered it, whereas Tabas to the east of Birjand was termed Tabas Masinán. But I must not allow myself to be led away into an historical dissertation, and will pass on to the eighteenth century A.D., when Nádir Sháh, in return for services rendered when lost in the Lut, conferred the district on Ali Morád Khán, an Arab of the Zangui tribe, which is connected with the Khuzái tribe, to which the amirs of Káin belong. The same family still governs the district, although their position is far different from that held by them after Nádir Sháh's death, when the ruling chief made a bid for the throne of Persia.

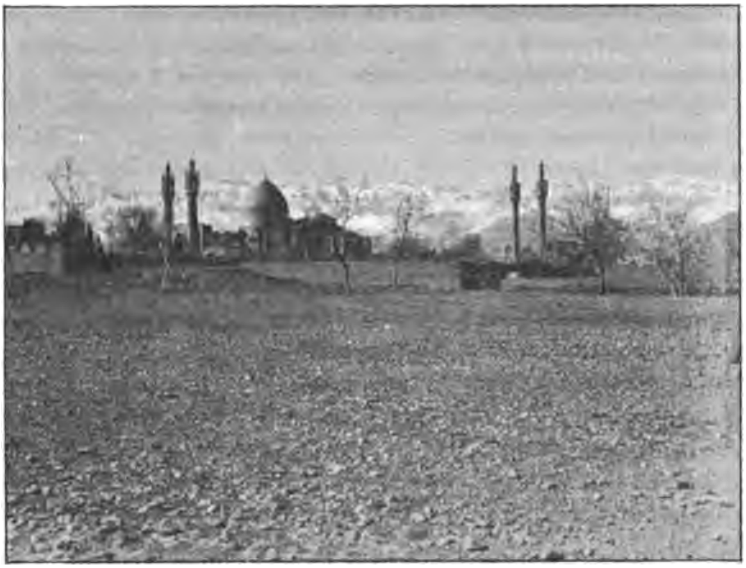
Before describing the little town, I propose to make a short reference to the district. Tabas and Tun, the division to the east, together with Gunabád to the north-east, unite to form the governorship, Tabas being the poorest of the three divisions, the latter two of which I have

* *Vide Geographical Journal* for February, 1902.

† *Vide* 'Chinese Knowledge of Early Persia,' by E. H. Parker. *Asiatic Quarterly*, January, 1903.

‡ *Vide Geographical Journal*, vol. 26 (1905), p. 462.

previously described. Situated on the edge of the Lut, and growing but scanty crops, which do not provide more than six months' food for its population, Tabas depends mainly on its date palms and orange groves, the produce of which is highly prized in upland Khorasán. As is general in Persia, the population is divided into dwellers in villages and nomads. The latter are all of Arab extraction, and possess enormous flocks of sheep and camels.* The town of Tabas, which is situated at an altitude of about 2000 feet, is walled, and contains various bazaars. But the chief, if not the only, object of interest is a fine column which rises to a height of some 200 feet, and is known as the Minár Kabír, or the "Great Minaret." It is constructed of brick set in various patterns,



THE MÁHUN SHRINE.

and has two bands of a Kufic inscription running round it: apparently it dates from Seljuk times. The origin of these columns has been much discussed by travellers in Persia, but as they all possess a staircase, it is, I think, extremely probable that they served as watch-towers primarily, and also as beacons. In the wide plains of Persia, where surprises were the one thing to be especially guarded against, the utility of the watch-towers is evident. Modern Tabas, owing to the cessation of the Turkoman and Baluch forays, has partly deserted the cramped bazaars and spread east on both sides of the avenue

* The nomads are: Chubdári, 200 families; Khanjari, 250 families; Arab, 200 families. In the winter they graze near Tabas, and in the salt country to the north. In the summer they move to the hills in the Tun and Gunabad districts.

referred to above, where the population, estimated at 8000, occupies gardens. Two miles to the west is the shrine of Musab ibn Jafar, who is locally known as *Shahzáda* Sultán Husein. This was, I believe, the site of a still more ancient Tabas, it being comparatively easy to change the position of a town situated in a plain which is served by irrigation streams. The dome of this shrine is said to have been built by *Mir* Ali Shir Khán, Sheibáni in A.H. 950. To conclude this brief sketch, Tun and Tabas are regarded as the least delectable of the districts of Khorasán, and "Go to Tun and Tabas" is by no means a polite remark.

The evening of our arrival I was welcomed by the Imád-ul-Mulk, who is not only a lineal descendant of the old chiefs of Tabas, but, on the distaff side, can boast that the blood of Nádir Sháh runs in his veins. He gave me a good deal of information about his district, and I also heard that when his father died, some wonderful old jewellery—the loot of Delhi—had disappeared. One of these pieces, my informant stated, was an ornament with four enormous diamonds, on which were incribed the names of Akbar the Great and his three successors. Tabas struck me as very much out of the world; but there is now a weekly post with Meshed, and I am agitating for it to be continued to Yezd, as in Eastern and Central Persia there is no south-to-north postal service, so deadly a barrier is the Lut.

We had now accomplished about two-thirds of our long journey, and as we were not only marching north-east, but also were approaching districts less low-lying than Tabas, we started, after two days' rest, with the feeling that the worst had been left behind. We crossed the low range bounding the plain of Tabas to the north, and descended into a district of great *Kavir*, by the side of which the Tabas nomads were grazing flocks of sheep much larger than any we had seen in South-east Persia. Indeed, everything was by comparison green and fertile, although only practised eyes would perhaps have noticed the great difference. At Yunsi we joined the direct Kermán-Meshed route. Lying in the midst of a level salt plain and on the banks of a salt *kál*, or river, this village is one of the most depressing places in Persia; it is referred to by Sir F. Goldsmid * in connection with a legend that the prophet Jonah was thrown up at this spot, and took refuge under a gourd. A few stages later we traversed the last of the salt plains and reached the fertile district of Mahavalát, which is the centre of a thriving silk industry, and is famous for its melons. It lies on the skirt of the high central range of Khorasán, and from it as far as Turbat-i-Heideri, which was reached on May 3, there was a steady rise throughout. The district of Turbat-i-Heideri was originally known as Záva, of which the chief town was termed Bishak. To-day

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* *Vide* 'Eastern Persia,' p. 250.

Záva is the name of a flourishing village one stage to the east of the town of Turbat-i-Heideri, but has ceased to give its name to the district. Rukhh, by which name the northern portion of the district was known in mediæval times, is also no longer used. The nomenclature of the capital town of the district is derived from Heider, who was the founder of the sect bearing his name. This holy personage, in the seventh (thirteenth) century, became famous for his endurance, inasmuch as during the summer he walked about in fire and dressed in felt, whereas in midwinter he lived in the snow. Heider, who is generally better known by the title of Kutb-u-Dín, or "Pole of the Religion," is buried in a dome built over his *turbat*, or tomb, and this is the origin of the name. Less than a century ago, Ishak Khán, a Karái chief, seized the district, and for many years the town was termed Turbat-i-Isá-Khan. To-day, however, the original name is almost entirely used, and Ishak is forgotten. At Turbat-i-Heideri I joined the route followed by me in 1893. At that date I put up at a caravanserai, but on the present occasion we were welcomed to a comfortable consulate, and thoroughly enjoyed the hospitality of Captain J. Watson. The little town has grown considerably of late years. It possesses remarkable nodality, as roads from Meshed, Herát, Seistán, Kermán, Yezd, and Turshiz all unite in the little walled bazaar, which is estimated to possess 8000 inhabitants, and is the centre of the silk and Baluch * carpet trade. To resume, the last section of rather less than 90 miles brought us to Meshed of the golden dome, where our march of over 700 miles, accomplished at a rate slightly exceeding 16½ miles per diem, was brought to a successful termination.

V.

For some months after reaching Meshed the press of official work prevented me from examining the surrounding country; but late in the summer I made a flying trip to the district of Kuhpaia to the west, across which runs the direct route to Nishapur. This district is extremely historical, and among other claims to interest is the fact that in it is situated one of the original fire temples founded by Zoroaster, which has never been identified. Of this, one of the most important sites in Khorasán, I have some information, and I hope, during the course of the next few years, to prove my information correct, but on the present occasion there was not sufficient time at my disposal. To resume, in the first place we drove to Gulistán, at the entrance of the Nishapur range. This village is composed of houses running to three storeys, with windows cut in the main wall, and

* There are 1700 families of Baluchis in the Turbat-i-Heideri district. So far as they themselves can tell, they have come north from the confines of Baluchistán during the last century.

presents a most curious and picturesque aspect. Below runs a river, across which is constructed one of the very fine old dams which abound in Khorasán. The legend runs that its builder buried enough gold in its foundations to reconstruct the entire work should a flood sweep it away. Passing Gulistán, we continued our journey up the valley to Turgabeh, a corruption of Turuk Oba, or "the Settlement of the Turks," where we found our horses awaiting our arrival. Thence the river-bed was struck, and our senses were charmed by a valley with glades, trees, and greenery, the like of which I have never seen on the Irán plateau; and yet all was northern in character, from the elder bush to the poplar, and from the sweet-savoured thyme to the wild rose. In short, one felt in surroundings such as would befit the "Midsummer Night's Dream." Six miles above Turgabeh is the large village of Jágbark,* which is a typical hill village. Lining both sides of the precipitous valley, the houses, constructed of the rounded stones from the river-bed, rise to a considerable height, and are remarkable for their overhanging eaves, which are carved and painted, and for their rough windows of wooden latticework. The lower storey contained the farmyard, and the dwelling-rooms were perched above. Trees were everywhere, and often formed part of the wall, and might even be seen growing up through a roof. The setting of these truly charming villages is enhanced by little cascades, which tumble down the mountain-side and add to the volume of the murmuring brook. But yet the name of Jágbark is ominous, and signifies "the Place of Drowning," and every now and then a storm in the hills produces a flood with such disastrous rapidity that on one occasion an entire regiment was drowned in the narrow gorge. Jágbark, too, possesses a curious legend, in which reference is made to a ship floating on its waters. These legends are also crystallized in place-names, such as Langar,† signifying an anchorage, and Yunsi, which commemorates the prophet Jonah, and one is tempted to believe that they are the echo of a far-off rumour of the days when there was an inland sea in Persia. Passing through the busy bazaar, and then the tea-shops, consisting of fantastically shaped platforms built on piles over the stream, the ascent became steeper, the atmosphere grew fresher, and the valley narrower, until our guide led us by a tortuous track up through delightful orchards to a spur where the greenery suddenly terminates and gives place to the naked hillside covered with slate *débris*. Below this a little side valley ran up to a stream, and so much impressed was I with its charm and remoteness that I decided to convert it into a hill station for Meshed; and, indeed, no more ideal spot is conceivable, as a cottage perched on this spur overlooks a bend of the valley which forms a sea of greenery, and yet is raised

* *Vide* Yate's 'Khorasan and Sistan,' pp. 348 *et seq.*

† Langar is situated one stage to the north-west of Turbat-i-Sheikh-Jám.

above the unwholesome damp of the valley, and far from the still more baneful mosquito. We spent the night in the champagne air of the hillside, and early dawn saw us on the road bound for the Dar Rud pass. We crossed and recrossed the brook repeatedly and, as we ascended, the sides of the valley became precipitous, and the dense growth of plane and poplar was succeeded by scanty willows. These too in time ceased, and we thenceforward rode up a stony, forbidding valley to a point where the valley bifurcates at a small stone caravanserai. The climb up the pass was long, but easy, and some four hours after leaving camp, we reached the summit at an altitude of 9400 feet, or 4000 feet above our camp, and more than 6000 feet above Meshed. To the south the range was narrower, probably owing to the fact that

KAVIR, OR SALT GROUND IN THE LUT.

the snow melts sooner on the southern slope and cuts a deeper channel, whereas on the northern slope the snow lingers late into the year. We were looking on to the plain of famous Nishapur, but a haze brooded over everything, and nothing was visible in that direction Looking back in the teeth of a furious gale, and following down the wide fertile valley of the Kashaf Rud,* the dark green of the gardens surrounding Meshed was easily discernible. But the golden dome remained invisible, until, gazing intently, a fitful flash as if of summer lightning flickered and again vanished, and it was thus that the glory of the Persian religious world was revealed to us from afar. The summit of the range consisted of rolling downs, with a few elevated mountains.

* Kashaf signifies "a tortoise."

One of these to the north-west is termed the Luk Tarsa, or "the Fearful Camel." Behind it was Pishána Fil, or "the Elephant's Forehead." The return down the valley to our camp and thence back to our home on the following day was speedily accomplished, and we agreed that Meshed compared more than favourably with Kermán in regard to its summer retreats, which are within an easy ride of the city, and would be an acquisition to any capital in the world.

In the autumn of 1905, the British minister, Sir Arthur Hardinge, traversed Khorasán on his way to England *viâ* Trans Caspia and, after the attractions of Meshed had been exhausted, it was arranged that a visit should be paid to the most famous fort of Central Asia, which is known as Kalát-i-Nádiri. Leaving the capital of Khorasán early in September, we marched due north to Rizván, situated on the skirts of the northern mountain barrier of Irán, which has already been referred to in this paper. The actual range is entered by a rocky gorge, which forms a fitting portal to rock scenery of stern and awesome grandeur certainly unsurpassed in any part of Persia I have visited. The track ran up the river-bed, which was subsequently quitted, and rose across some low hills to the upland village of Kardeh. From this village we started off betimes, escorted by some horsemen who belonged to the Chulái, a Turkish tribe, settled in these parts by Tamerlane. They apparently talked Turkish among themselves, but understood Persian. Their dress closely resembled that of the Turkoman, except that their sheepskin bonnet was cut lower. They struck us as fine, hardy men of a manlier type than the Persians. The whole district is called Chulái Khána, the Kara Dagh constituting its northern boundary. Nine miles above Kardeh we halted to photograph and examine an inscription which the late Mr. Ney Elias had had copied. It is situated on the left bank of and well above the river, and consists of ten lines, which measure 5 feet 6 inches by 3 feet 2 inches. The inscription, which is beautifully incised and quite legible, is to the effect that in A.H. 915 Abul Fath Mohamed Sheibáni defeated a Persian force in this neighbourhood.* Several photographs were taken, most of which were successful, and we continued the ascent past a completely round white cliff. It is known as Panj Mana, or "the Five Stones,"† and is connected with a far-fetched story of a courtier who apparently offered to put the weight with it. Eighteen miles from Kardeh we quitted the main valley and scrambled up the very steep and boulder-strewn narrow gorge known as the Zo-Pir-i-Zan, or "Valley of the Old Woman." However, the gorge in question was not so bad as the one

* Mohamed Sheibáni was almost the last warrior of the house of Chengiz, and the founder of the Sheibáni dynasty and of the Uzbeg kingdom, which lasted until Khiva, Khokand, and Bokhára fell before the onslaught of Russia some thirty-five years ago.

† A *man* is of various weights, but the Tabriz man, which is most generally used, weighs about 6½ lbs.

bearing a similar name in South Persia, and, above it, we emerged on to rolling hills, traversing one of the two great parallel spurs into which the Hazár Masjid range divides, the second being known as the Kara Dagh, or "Black Mountain." The descent across this second range was extremely trying, and its name of Diwa Boíni, or "the Camel's Neck,"* struck us as most appropriate. At last we reached Várdeh, only to find that the advanced camp was still trying to find a way round. However, we ultimately obtained all that was necessary, and settled down for the night, after accomplishing a particularly trying march. The following day we crossed yet another range, and descended a valley with superb rock scenery, great ribs of slate rising precipitously from the sullen gorge. A good photo of the rocks in the Darband-i-Gaur, or "the Fortified Gate of the Infidel," as it is termed, was secured, and the journey was resumed down the valley, which gradually opened out, but in front all further progress appeared to be barred by mile upon mile of sheer precipice. This is the southern wall of the Titanic fort of Kalát-i-Nádiri, which runs in an almost unbroken line as far as the eye can reach. Before the visit of Sir Arthur Hardinge to Khorasán, the Governor General had promised to arrange for my entry into this somewhat jealously guarded stronghold, in which no previous consul general had been permitted to set foot, although Sir Charles MacGregor and Colonel A. C. Yate were admitted to it thirty and twenty years ago, and there is no reason for debarring a sight of its wonders to travellers. At the same time, on nearing the historical fortress, I felt considerable anxiety as to whether the governor would obey the *Asaf-u-Dola's* orders, as he is appointed direct from Tehrán, and is thus more or less independent of the Governor General of Khorasán. It was, consequently, with much relief that I sighted a reception party headed by the governor's son, under whose guidance the minister was escorted to the Argawán Shah *darband*, outside which our camp was pitched.

I now propose to give a brief description of the famous fortress which we were to enter on the morrow. Its shape exactly resembles the profile of a wild boar, its general direction running west-north-west. The southern wall, already referred to, is the most uniform in appearance, and some 15 miles in length. It is broken at the Darband-i-Argawán Sháh, which represents the boar's mouth, and again, at the south-east extremity, there is a second entrance known as the Kushtani *darband*. This latter is situated on a long narrow spur in which the fortress terminates to the south-east, thus continuing the extraordinary resemblance referred to above. The whole of this stupendous wall rises almost sheer to an altitude of some 1500 feet. Of this perhaps one-half or two-thirds of the distance is climbable, but the crest is

* The names in this district are mostly Turkish.

composed of a black rock, possibly basalt, resembling in shape a wedge, which is so narrow on its inaccessible summit that it would be almost impossible to walk along it. Continuing in a west-north-westerly direction from the *darband* of Argawán Shah, "the snout" of the fortress is most clearly defined, and the boar's "eye" is the Dehchi entrance on the north. This side rises at least 2000 feet above the valley, but it struck me as less inaccessible. At the same time, it is only fair to mention that I inspected it from the crest only. The boar's "back" is broken by the Deh Nafta darband, and through it the river, which enters Kalát-i-Nádiri by the Argawán Shah *darband*, flows down to water the fertile oasis of Doshakh, the ancient Abivard. It is known as the Nafta river.

On the east side there is the fifth *darband* of Chubbast, and, as stated above, the fortress terminates in a narrow spur to the east. So much for the circumference, which is perhaps 60 miles in perimeter. I now turn to the interior. The life of Kalát centres in the narrow valley, some 12 miles in length, which runs approximately from west to east between the Argawán Shah and Nafta *darband*. Almost throughout there is a narrow strip of cultivation which supports perhaps one thousand inhabitants. Elsewhere, there are three or four small villages dependent on rain crops, the inhabitants of which bring the total up to two thousand. What particularly struck me was the hilly nature of the interior. Hills are everywhere, chief among them being the Kuh-i-Bába-Kumeili, which rises to over 6000 feet, and more or less fills up the south-east corner. Elsewhere, too, once the narrow valley is left, the rough track winds across a maze of low hills, so much so that internal communications are extraordinarily difficult. The altitude of the main valley is about 3000 feet, and, partly owing to its shut-in condition, it is extremely hot in summer. The main water-supply is drawn from the river, but there are a few small springs of good water. The climate is unhealthy, and the mosquito so active that every one sleeps under curtains, the only corner of Persia where I have noted this custom.

The history of Kalát, which I have collected from various Persian chronicles, is, as might be expected, of considerable interest. In Firdausi's great epic, known as the "Sháh Náma," the district is referred to as Kalát and Charam, the latter being the name of an important village, still existing some 6 miles to the west of Kalát. In it a grim tragedy was enacted on the occasion of the invasion of Turán or Central Asia by the forces of Kei Khusru, a semi-historical monarch of Persia. It was inhabited by his half-brother Farud, who was independent, and the Shah enjoined upon Tus, his commander-in-chief, the necessity of avoiding the district. However, it was found that the alternative routes led through deserts, and the Persian army perforce entered the gorges to the south of Kalát. Farud, hearing of the approach of a mighty host, took up his position on a lofty crag and watched the army defile below him. He was accosted by the hero Bahrám, who, on being shown the mole on Farud's arm, which proved him to be of Keiánian stock, reported to Tus that it was the Shah's brother. Tus, however, cherished sinister designs, and, wishing to sack Charam, refused to acknowledge the identity of Farud, who was attacked. After slaying various Persian champions in Homeric style, the hero retreated to the fort, whence he shortly afterwards sallied forth and gave battle until the whole of his force was exterminated and

SLATE FORMATION IN THE DARBAND-I-GIAOUR.

he himself was mortally wounded. Returning to his fastness with difficulty, he was received by his mother, who fired the treasury and hamstrung the horses. The women committed suicide by throwing themselves from the top of the fortress, and finally Farud and his mother killed themselves. Tus burst in the gate, to find nothing living inside, but merely a mass of ashes on which to satiate his thirst for plunder. From the above it does not appear that Kalát was renowned for its natural strength in the tenth century of our era, when Firdausi lived, but in A.H. 682 (1283) Arghun, termed Argawán by the Persians, took refuge in the fastness after suffering defeat at the hands of his uncle, Sultán Ahmad. He was besieged, but without success, and, using the impregnability of Kalát as a lever, he opened negotiations with the nobles of Tabriz, and finally won the throne of Persia. This constitutes the first historical siege of Kalát.

But it was not until blood-drinking Tamerlane strode across the stage of Asia that Kalát won its imperishable fame and the title of the greatest fastness of the Middle East. The "Lord of the Conjuncture of the Planets," as he is termed, found Kalát in the possession of a certain Ali Beg, and attempted its capture by surprise, but in this he failed, although he seized many flocks of camels and sheep. He then formally invested what is now known as the Nafta *darband* in person, his amirs attacking the other entrances. Some Badakshání hillmen discovered a track, up which they climbed the cliff, and matters looked black for the defenders; but Ali Beg proposed a meeting to arrange the terms of surrender, and took advantage of its being granted to break down this track. Fourteen general assaults were then delivered, but were repulsed without difficulty, and the world conqueror was forced to retire defeated. Two years later, *Amir* Sheikh Ali, a nephew of Tamerlane, escaladed the natural barriers, but, once there, found himself caught, and when his arrows were expended was forced to surrender. Shortly afterwards plague broke out, and wrought such havoc among the defenders, that Ali Beg surrendered and was put to death.

Kalát apparently does not again figure large in the history of Khorasán until the star of Nádir Sháh, the last great Persian conqueror, rose on the murky horizon, and in a few years restored to Persia her dignity and prestige, which the Afghan invasion had for a time shattered. Nádir Sháh was a glorified robber who was born in the neighbouring district of Darra Gaz, and throughout his career cherished a strong affection for the fortress which was thenceforward to be known by his name. After his glorious triumphs in Afghanistán, in India, in Bokhara, and in Khiva, the dread Afshár repaired to Kalát in A.D. 1740, and began its fortification by building the works which we saw. He cherished a dream that one day he would retire to spend his closing years in this safe retreat, and it was here that he stored the untold millions of India, with the famous diamond, the Daria-i-Nur, or "Sea of Light." His family, too, was sent to live in the same fastness. Fate, however, never permitted the realization of these idle dreams, and Nádir Sháh was assassinated in A.D. 1747, and fell, cursed for his cruelties by the whole nation. A nephew, Ali Kuli *Khán*, was elected his successor, and his first act was to send a band of Bakhtiári horsemen to extirpate the tyrant's brood and seize the treasure at Kalát. The carelessness of the garrison, a member of which had neglected to pull up the ladder, by which means alone there was communication with the outer world, made everything easy, and in a few hours every male descendant of the conqueror of India was put to the sword, and the treasury was looted. One scion of the house, Sháh Rukh, a grandson of Nádir Sháh and a mere boy, was alone spared, in case the nobles clamoured for a member of the royal house, and with this grim tragedy the description of Kalát-i-Nádiri may fitly be brought to a close, just as grim tragedy ushered it on to the stage of history.

I now return to our journey. We quitted camp at dawn on the following morning, and were soon riding between two precipitous cliffs,

INTERIOR OF KALÁT-I-NÁDIRI, SHOWING SIDE OF NATURAL WALL.

which frowned down upon the sunless shingle of the river bed. The Hebrew writer's "Who will lead me into the strong city? and who will bring me into Edom?" came into my mind as we entered the fort, and I recollected that Edom, like Kalát-i-Nádiri, was a natural fastness of extraordinary strength. The actual *darband* had been recently injured by a flood, and is by no means strong, but at every turn towers or forts supplemented the hand of nature, the whole constituting an impregnable position if held by a resolute force. The *darband* is named after Argawán Sháh, who was referred to above. It is of more than usual interest to recall that it was this monarch who despatched an embassy to China, to the court of Kublei Kaán, and was thus instrumental in procuring the return of Marco Polo to Europe, as he alone was acquainted with the sea route from China to Persia, and was also deemed sufficiently trustworthy to take charge of the lady Kokachin, who, according to the illustrious Venetian, was "moult bele dame et avenant." Arghun Sháh, furthermore, sent embassies to the pope and to the kings of France and England. In return, Edward I., in 1290 A.D., accredited Geoffrey de Langley to visit the Moghul, with a gift of "some gerfalcons and other jewels of our land." We passed the ruined *darband*, and, a short distance beyond it, stopped to examine an inscription, which is cut in the cliff and beautifully incised. As may be imagined, this record was of great interest, and, after failing in the first attempt, I have secured an excellent photograph of it. The inscription is partly in Persian and partly in Turkish, and is not completed. However, the name of Nádir appears on it, and this alone, apart from the character and decoration, proves that it is chiselled in the honour of the great Afshár, and is not connected, as previous travellers have reported from hearsay, with Arghun. Unfortunately, one section of the inscription has been worn away by the action of water; but I have hopes of recovering the defaced lines, as there is an old gentleman of ninety, a resident of Kakha, who is said to possess a copy of it. So far as it is decipherable, the inscription consists of praise of God and Mohamed, with a reference to Nádir Sháh. To resume, we emerged from the gorge at the village of Argawán Shah, which is inhabited by Jaleiir and Gerashlu Turks, and thenceforward there was a continuous strip of cultivation, with numerous gardens. After passing a ruined ice-house, whence a track leads to the Dehchi *darband*, we skirted a hamlet, termed Khwárizm Mahalla, which is peopled by a few families from Khwárizm, or Khiva, planted by Nádir Sháh, who, like the monarchs of Chaldea, transported tribes from one side of Central Asia to another. Finally, 4 miles from our camp, we reached the governor's residence, known as "Kabud Gunbad," or the "Blue Dome," a name derived from its mosque.

We returned the call of the *Jalíl-ul-Mulk* on historical soil, for he received us in the garden, in which is situated the *Imárat-i-Nádir*, or "Building of Nádir." This consists of a central dome some 90 feet in height, constructed of a variety of stone resembling Devonian sandstone. The interior of the dome was some 50 feet in diameter, and there were traces of decoration in gold, blue, and black. This central dome of fluted pillars was surrounded by four sets of rooms, each consisting of an arch with a chamber on either side. The whole was cased externally with marble, which, with the utter disregard to means displayed by Orientals, was quarried in Urmia, near Tabriz, and transported some 1500 miles from the western to the eastern frontier of Persia by forced labour, and, as Sir John Malcolm testifies, at the cost of much human misery. The stone panels are decorated with exquisitely cut trees and birds chiselled in relief, but some of the panels are plain, thus presenting an unfinished appearance. Beneath are extensive vaults. This was the famous treasury of Nádir Sháh, and the cellars, rather more than a century and a half ago, contained more bullion and wealth than any conqueror has perhaps amassed since Alexander the Great rifled the hoards of the Achaemenians. The whole is interesting rather than striking; indeed, the design is mean and betrays no grandiose inspiration, such as would be befitting to a thesaurus which included the Dariá-i-Nur, or the still more famous Peacock Throne. After concluding our inspection, we rode to the northern wall, which, unlike the southern, is hidden from the valley by an interior range. Two hours of steep ascent to an altitude of 4500 feet brought us to

THE TREASURE HOUSE OF NÁDIR SHÁH.

the hamlet of Khist, to the west of which, covering several acres, was the palace in which the family of Nádir Sháh was surprised, in the manner already related. The buildings were of coursed stone, and the ruins of a Persian bath were visible; but here again everything presented the same aspect of incompleteness, and the most interesting remains consisted of elaborate masses of masonry which filled the steep valleys, and were designed to store the water-supply. Indeed, to-day, the villagers depend upon these reservoirs, and their crops are fed by the rainfall, there being no springs or irrigation works on these hills. A second ascent brought us, at an elevation of 6000 feet, to the highest peak of the northern wall. As may be supposed, the view was superb; and, from our point of vantage, we looked down on the great plain of

Asia, which stretches in unrivalled monotony to the arctic tundra of Siberia, and is perhaps the most extensive in the world. Almost at our feet lay Doshákh, and Kakha, with the Trans-caspian railway, and, to add to our pleasure, we descried a train running on the famous line, the sight of which, the Indian sowars vowed, made them feel homesick, and recalled to me the joy some yeomen in South Africa expressed at the sight of a mining chimney at Klerksdorp. Tearing ourselves away with difficulty from gazing across the yellow plain, we turned our eyes to the great fort. As mentioned above, the northern face is less regular, and appeared to be less impracticable; but we only saw it from the crest, which is here an easy slope, and the lower portion is said to consist of sheer cliff. Looking into the valley, we saw a maze of low hills, which to the south-east terminated in flat-topped Kuh-i-Bába-Kumeili. But the day was waning, and we had to hasten back to the valley, where everything felt damp and unwholesome compared with the keen mountain air of Khist.

We camped at Kabud Gunbad, and, making an early start on the following morning, rode east down the valley. The river runs between high cliffs, which are united by a remarkable dam some 90 feet wide and perhaps 250 feet in height. It is constructed of red brick, and is said to date from a period anterior to that of Nádir. A few miles lower down, ruined walls mark the site of the once extensive pleasaunce of the Great Conqueror, and, nearing the natural walls of the fort, we passed Deh Nafta, a village inhabited by Khuzái Arabs, whose ancestors were also brought to this happy valley by the same master mind. Below, the river runs through cliffs which attain to an unrivalled pitch of sullen grandeur. Nowhere have I seen anything to match the impressiveness of this impregnable defile, which repulsed Tamerlane's repeated onslaughts, and fully merits the epithet "awesome" which is applied to it by the Persian historian; and here I bring to a close my description of a visit to Kalát-i-Nádiri, which has stamped ineffaceable recollections on my mind.

We quitted Kalát by the Dehchi *darband*, the descent to which is extremely rough. We then skirted the Russo-Persian frontier in a westerly direction, passing the historical village of Charam, which, as related by Firdausi, nestles in the hills. That night we camped at the charming village of Archingán, and, early the next morning, we accompanied Sir Arthur Hardinge to the Russian frontier post of Sang-i-Divár. Here we were most cordially welcomed by the Russian officer in charge, and said good-bye to the minister, who reached Kahka a few hours later, and London in eight days, so miraculously has science brought these solitudes of Central Asia into touch with the Western world. Turning our backs with some regret on civilization, Captain Watson and myself rode due south to the lovely hill village of Khákistar, where we camped under superb walnuts and shot at wood pigeons as they came in to roost. Khákistar is now the frontier customs post, and there is a great deal of traffic along the route we were to follow back to Meshed, which has, so far as I know, never been followed by any English traveller. The scenery is extremely romantic, being bold though, for once, not forbidding, as the ranges are covered with fine junipers, and in a country like Persia such a sight is refreshing beyond words.

The ascent to the Dalucha pass was extremely steep, but thenceforward we skirted the superb Hazár Masjid range, until we crossed the second of these same mighty spurs, which we had already traversed on the way to Kalát-i-Nádiri; here the junipers ceased and the hillsides became naked. The stage was nearly 30 miles long, and as we had shot for part of the way, we were glad to reach Márishk, a most picturesque village situated at the junction of the two valleys; it is the headquarters of the Chulai tribe. The following day the scenery was still fine, but nothing to what we had left behind, and a short stage brought us back again to Kardeh. Instead of returning to Meshed direct from Kardeh, we rode to inspect the ruins of Tus, which is one of the most historical cities of Khorasán, but is perhaps chiefly famous in Europe as having been the home of Firdausi. Tus is situated in the same fertile valley as Meshed, of which it is the mother city; but apart from the ruined walls and a dome, which is erroneously considered to be the tomb of the great epic poet of Persia, there is little to mark a city which was the theme of the mediæval travellers. But the bridge is of great surpassing interest, as the legend runs that Mahmud of Ghazni regretted his treatment of Firdausi, and sent him camel-loads of gold as a reward for his great poem. The caravan was, however, met by the bier which bore the poet to his grave. Disdaining to accept the monarch's bounty, the money was used by the poet's daughter to build this bridge, and to bring down a stream of water from the hills. To resume, a few hours were quite sufficient for the examination of Tus, and 13 miles more brought us back to Meshed after a ten days' tour, which was one of the most interesting I have ever made.

VI.

In the late autumn of 1905 we started on a tour which was intended to include the chief centres of Eastern Khorasán, a country with which is connected the names of Valentine Baker, MacGregor, Stewart, and Yate. We left Meshed by the Herát road, and traversed the almost level valley of the Kashaf Rud in a south-south-easterly direction to Jimábád, a thriving village of two hundred houses. Thence we rose gradually to the village of Sangbast, where we found a tent pitched for breakfast. The interest of Sangbast centres in a ruined dome and a lofty column, both built of burnt brick. Round the top of the latter, which is in an almost perfect state of preservation, is a Kufic inscription, which was photographed. Eiáz, the vizier of Mahmud of Ghazni, who was contemporary with Alfred the Great, founded these buildings as a college and tomb for a saint named *Mirza* Abdul Kásim, his religious leader. Until the last generation, there were two of these columns. Two miles beyond Sangbast we camped at the village of Bakirábád, which is inhabited by Yezdis and Kermánis. From Bakirábád we rose steadily for some miles, and, crossing a low range, descended on the plain of Farimán, which is famous in Khorasán for its breed of cattle and general fertility. It was also a favourite place for Turkoman raids, to judge by the numerous towers of refuge which were dotted about like so many pepper-pots. The custom was for the cultivators to fly to these little towers, close the entrance with a stone, and then to stand at bay with their matchlock sticking out of the sole aperture, when they were invariably left alone. We were met close to the village by Captain Watson, who had marched across the range from Turbat-i-Heideri, and who accompanied us throughout this tour.

The six hundred families inhabiting Farimán include Jámis, Karáis, Káinis, and Seistánis.* The fact is, that until the Russians drowned the Turkoman terror in the blood of the man-stealers, these fertile lands were never safe. Nowadays, however, there is a stream of emigration from the less-favoured districts of Persia and Afghanistan, with the result that the prosperity of Khorasán is steadily increasing. The fertility of Farimán depends on its dam, which had recently been repaired by the orders of H.H. the Ain-u-Dola, an ex-grand vizier of Persia. Building was still going on at the time of our visit, although it was merely a case of finishing touches, and we were courteously shown over the works by the Persian field marshal who was in charge. The dam is advantageously situated between two hills composed of a hard rock, just below a point where two or three valleys unite. Its dimensions are: Total length, 366 feet, with a length of actual dam, 160 feet. Its height is 80 feet, and the foundations are sunk to a depth of 28 feet. The width of the masonry, which is faced on both sides with brick, and filled in with boulders set in mortar, is 20 feet. There are two sluices for water, which escapes by a single exit; there is also a flood channel. At the back of the dam is a huge buttress. The work struck me as good, and it will be interesting to see how it stands. If it prove to be a success, it will pay handsomely, and encourage the construction of other similar works.

After examining this fine public work, we rode among low hills to the hamlet of Chahár Gao, which is some 18 miles to the south of Farimán by the direct route. Shortly after our arrival at the hill hamlet, we heard a fusilade, which approached nearer and nearer.

* I may note that both at Meshed and at Turbat-i-Heideri, Captains Battye and Watson are taking a number of anthropometrical measurements, which are considered to be of the utmost ethnological importance.

We were much puzzled as to what was happening, when a crowd of villagers came into sight, escorting a bride to her new home. A *mulla* led the procession and read prayers, the crowd joining heartily in the responses, and volleys were fired at the pauses. The little bride, dressed in scarlet, was seated on a pony in front of an aged and wrinkled dame, who was apparently her mother, and the entire population of men, women, and children marched along in great excitement and formed the escort. Altogether it was quite an old-world scene, and carried one back to times which are far removed from the bustle of to-day.

Leaving this charming hamlet, we rode to the Kalla-i-Minár, or "Pillar of Skulls" pass, which we crossed at an altitude of 7100 feet. Upon inquiring the origin of this sinister name, we were informed that about a century ago a Turkoman built a tower, the ruins of which we saw, and levied blackmail on all passers-by. Any one who objected to be fleeced was promptly decapitated, and his skull was built into a column—to encourage future travellers. The pass was not difficult, but the stage to Kala Aga Hasan, situated across the next valley, was a very long one, and it was dark before the camp came in. From Kala Aga Hasan, which was in the district of Turbat-i-Heideri, we changed direction to south-east down the direct route to Herát, and, at the stage of Himatábád, entered the district of Bákharz. It was near this village that the late Sir Charles MacGregor * had a brush with Turkoman in 1875. The following day we marched down a stream, where we secured a bag of teal and duck, and, camping at the picturesque hamlet of Kabchi, entered Shahr-i-No, the chief village of the district, on the following morning. Bákharz of to-day is divided into three divisions of "Upper," "Middle," and "Lower" Bákharz, which word, it may be mentioned, is a contraction of *Bád Harza*, or "Where the wind blows." Down this belt sweeps the famous north-north-west wind † of Herát, which in Seistán is known as the *Búd-i-Sad-va-Bist-Ruz*, or "Wind of 120 days," to which Sir Henry McMahon has paid homage in his recent paper on the delta of the Helmand, it being indeed impossible to ignore it. As a proof of how the wind influences names, we may also cite the neighbouring district to the east of Bákharz, which is termed Bádghis, and is derived from *Bád Khiz*, or "Wind-stirring." Another point of interest is that this unremitting gale has been used from very early times for grinding grain. Indeed, it is quite possible that, in the mill, we have the prototype of all windmills. At any rate, in Masudi ‡ there is a story which proves that windmills were known to the Persians at the time of the Arab conquest, which is anterior by many centuries to their use in Europe.

* *Vide* his 'Journey through Khorasán,' vol. 1, p. 254.

† To be exact, it blows from 30° west of north.

‡ *Vide* his 'Prairies d'Or,' ed. Barbier de Meynard, vol. 4, p. 227.

I have previously referred to the mixture of peoples in Khorasán, and was consequently not surprised when the leader of our reception party stated that his ancestors were Ansari * Arabs from Medina, who had settled in the district seven centuries ago. The present village is surrounded by extensive gardens, and occupies a site near the ancient Málin, which in the fourth (tenth) century was an important centre. Bad times, however, overtook it, and Málin became the utter ruin it is to-day. Rather more than a century ago, a *Hazára* chief, Mohamed Khán by name, founded Shahr-i-No, which itself has now been deserted, the peasants, thanks to a cessation of raiding, being now able to live on their own property outside the walls of the fort. Close by the ruin of Málin, or Málan, which covers a large mound, was a shrine in honour of *Sheikh* Abdulla, son of the famous *Sheikh* Ahmad of Jam, which was sheltered by a solitary but magnificent pine. Bákharz is always considered to be a fertile district of Khorasán. But for seven years locusts have ravaged it, and the population is thoroughly disheartened and is leaving the district, as no organized effort has been made to cope with this terrible curse, which year after year wrecks the happiness and well-being of the industrious sons of Irán. By no means the least evil of the scourge is that it favours the increase of the opium crop, which is not affected by locusts.

From Shahr-i-No we again made for the hills, our objective now being the historical town of Khaf. On our way we visited a large mere, but shooting was a failure, as there was no means of retrieving the birds which fell, owing to the combination of thick weeds and deep water. We consequently turned our backs on the Bákharz valley and marched uphill to the village of Ustá, the inhabitants of which are all Sunnis. Before continuing the march on the following morning, we explored a most interesting fort, known as the Kuh-i-Sangi. In shape it resembles the famous Mil-i-Farhád of Rudbár, which has already been referred to in this paper, and rises some 1500 feet above the plain in the form of a cone. A steep climb brought us to a level summit, oblong in shape, and perhaps 150 feet in length by 40 feet in breadth. There were four tanks, all of them cut in the living rock, the largest being 30 feet square and perhaps 20 feet in depth. It was lined throughout with brick. Below, on the other peaks, were the remains of what is believed to have been stabling and quarters, and the whole much resembled the fort I visited near Duruh in 1899. The march was a series of sharp ascents, with occasional descents to the pass known as the Kotal-i-Khāki, which we reached at 8 miles from Ustá. There is a second pass some 5 miles to the east, known as Kotal-i-Sangi, but it is practically impassable for laden mules. The altitude of the pass is about 5000 feet. The descent was easy, through fine scenery, to a

* These Arabs were descendants of the party which invited Mohamed to Medina, and have ever since borne the title "the Helpers."

small village in the Khaf district, which we had entered after crossing the pass. Only a few miles were now left to accomplish, and, riding across a level plain, we soon caught sight of the pines for which the little town of Khaf is famous. Outside the ruinous walls we were met by the usual reception, and found our camp pitched in the open, close to the ruined fort.

The district of Khwaf, as it is spelt, has been of note for many centuries, and was famous for its grapes and pomegranates, which latter fruit cannot stand the cold of the Meshed winter. Its general elevation is so much lower than that of Bákharz that it is deemed to be *Garmsir*, or "Hot Country." In mediæval times, Salumak, now Salámi, was the capital of the district. To-day *Ru-i-Kháf*, or "the Face of Khaf," situated some 3 miles to the north-west of the ancient Khargird, is the chief centre. It is generally termed Rui. The town has suffered in importance from the cessation of raids, and is now half deserted, with but two thousand Sunni inhabitants, all of whom wear a dress which consists of a long coat of quilted light blue calico, resembling the Turkoman garb; but, instead of the sheepskin bonnet, they twist a white puggari round their heads. Curiously enough, too, there has been a tiny colony of Hindus at Kháf for some generations. Although hailing from Shikárpur in Sind, like the Kermán and Bandar Abbás colonies, they have no connection with these latter. They are well treated nowadays by the Persian authorities, but did not appear to be prosperous. Hindus are, however, accustomed to conceal their affluence. The redeeming feature of Khaf is its fine pines, which are said to have been brought from the Himalayas. It gave one a touch of home to hear them soughing in the wind, and efforts are now being made to grow these splendid trees in the Meshed consulate. In the range which lies to the south-west of Khaf, which is known as Khoja Yar, games are held at the No Ruz, the vernal equinox, just as in Seistán.* It is almost certain that this is a survival from pre-Mohammedan days, and, as such, is particularly interesting.

The following morning we visited the once famous *madressa* of Khargird.† It is a double-storeyed square, with outside measurements of 160 feet by 150 feet. The main gateway is a noble piece of work, inlaid with coloured bricks, and decorated with a blue mosaic inscription. Of this, the right half, consisting of verses from the Koran, was defaced and illegible; but the left half was copied, and is to the effect that Sháh Rukh, aided by Ahmad of Kháf, constructed the *madressa* in A.H. 848 (A.D. 1444). The interior is built in the usual style round a court with four open arches. The coloured bricks are still intact, but the mosaics, which are exquisite, are almost all defaced. Their colours are sapphire-blue, with yellow, green, and

* *Vide*, 'Ten Thousand Miles in Persia,' pp. 379–380.

† Khargird is said to be a corruption of *Khusru Kard*, or "Khusru's Building."

white, the motive of the pattern being conventional Kufic letters. Captain Watson photographed the best-preserved specimens of this art. Fine mosaic tiles, dark blue, with conventional flowers in light blue, white, and gold, originally covered the interior of the arches; but almost all have been removed, and in a very few years none will be left. On both sides of the main entrance is a domed building, which is decorated with beautiful plasterwork, the paneling to match consisting of white marble hexagons, relieved by sapphire-coloured tiles. This, the finest building which I have yet seen in Khorasán outside Meshed, was the work of Ghiás-u-Dín and of Kawám-u-Dín, both of Shiraz. The latter architect also built the Gauhar Shád mosque of Meshed. The photographs of this erstwhile stately college by no means do it justice, but specimens of the tiles which I was able to procure at Meshed show what a superb building it must have been when Sháh Rukh, son of mighty Tamerlane, received it, in all its glory of blue and gold, from the hands of his architect.

One of my objects in visiting the Kháf district was to complete my general acquaintance with Eastern Persia, and I may perhaps here summarize the various basins or depressions, the last of which, after more than twelve years of travel, I was now visiting. North of the east-to-west ranges of Makrán, which are pierced by various torrents making their way to the Arabian Sea, is the depression of the Mashkel, and further north, again, the main basin of the Helmand, which drains Southern Afghanistan and part of Eastern Persia. These two basins I had examined in 1896 and 1899 respectively. In the latter year, too, on my journey from Sistán to the Káin hills, I had looked across the grim Dasht-i-Naumid,* or "Desert of Despair," itself containing a minor depression, and the Khaf Namaksar, or Salt Lake, is the last of these depressions before the Hari Rud basin, which we were now about to enter, is reached. Khaf was the most southerly point of the tour, on quitting which we marched due east across the level plain, obliquely approaching the range which we had crossed four days previously. At 15 miles there was a low pass in the hills, running down from the main range, which terminated a few miles to the south-east of this point. Crossing the pass, which is termed Dar Darrah, we descended to Karát. This hamlet boasts of a *mil*, or column, which was of two sizes. The lower portion, some 80 feet in height, was octagonal, and had a belt of much defaced Kufic inscription, which we copied. The upper portion, some 60 feet in height and round, was leaning considerably out of the perpendicular, and looked too dangerous to ascend. A staircase led to the top, and, as elsewhere, this column was undoubtedly used as a signal and look-out station. It is said to have been built

* Captain Keyes, H.M. Consul at Turbat-i-Heideri, states that the word is now pronounced Dasht-i-Nammad. Possibly it is a corruption of Náumid.

by Sháh Rukh. Close by, are the ruins of a caravanserai and dam. At Karát we were within a few miles of the Afghan frontier, and to reach Kárez we changed our direction from east to north-east, and skirted the western portion of the Hashtadán plain. After crossing a low range of worn-down hills, we reached the little town of Teiobád, which is by far the largest centre of the district of Bákharz, and can boast of 3500 inhabitants. A few miles beyond was Kárez, which is on the main Meshed-Herát road, and the frontier village of Persia.

THE *KAZI* OF TURBAT-I-SHEIKH-JÁM.

Kárez, to judge from the ruins surrounding it, was of importance in the days of yore; and, at any rate, it possesses considerable interest for us, inasmuch it was the birthplace of Hakím Burkai, in whose honour Moore wrote "The Veiled Prophet of Khorasán." I always think that it is interesting to gain touch with these somewhat legendary figures, and to know that in the second (eighth) century the "Veiled Prophet," as the Arabic is rightly translated, gave much trouble to the Caliph Mahdi, but, being eventually defeated, poisoned all his followers, and then threw himself into a cauldron of nitric acid rather than submit.

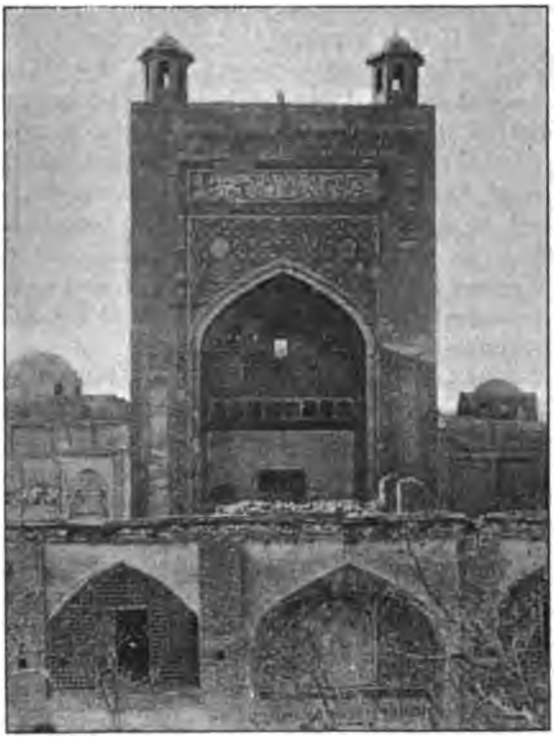
From Kárez we marched north to the Jam river, which, as Sir George Birdwood has pointed out, is the river of Jamshid, "which reveals the present and the future of the world." According to the legend, Jamshid travelled to it every day—here is a form of the Solar myth—and his famous "seven-ringed cup" is, in reality, the Jam Rud reflecting the seven planets, whose revolutions rule the destinies of mankind. For us, among its chief attractions was the hope of some good shooting. Bird-life in Khorasán is scarce compared to what is met with in well-wooded and well-watered England; but, at the same time, there is less of the utter void which is so noticeable in South-east Persia and the terrible Lut. The Jam river, which we struck at Dolatábád, is drawn off to a great extent for purposes of cultivation, but, nevertheless, holds a certain amount of water, and in places is full of reeds. Consequently the shooting for two guns was excellent, as in the marshy sections snipe, redshank, and mallard, teal, widgeon, and pintail ducks, not to mention shovellers, gadwell, and the ruddy sheldrake, abounded, and there were also large flocks of lapwings. As is so often the case, however, we did not enjoy to the full this excellent sport, as we were within a ride of the famous Hari Rud, which, apart from its other attractions, was said to hold pheasants; and, never having shot a pheasant in Persia, we decided to reserve most of our limited number of cartridges for this purpose. We started off down the Jam Rud at an early hour, and, after a ride of some 14 miles, reached the Hari * Rud, the classical Arius. At the point where we struck it, the river flows in a bed, which is from 2 to 3 miles wide, both banks being covered with tamarisk. The river was some 40 yards in width, flowing with a swift current, and difficult to ford except at a few points. The water is very salt in this section, except after a flood. This, then, is the Hari Rud, which, formed by the junction of two streams in the high country to the east of Herát, flows close to the south of that most historical city, and then, curving round due north, forms the boundary between Persia and Afghanistan for some miles. Lower down, it constitutes the Russo-Persian frontier, and, changing its name to the Tejend, is ultimately lost in the all-engulfing sands.

To resume, we beat the tamarisks for about five hours, but only secured partridges and hares, and, as the day was waning, we returned to the Jam Rud, where we enjoyed good sport, and ultimately reached camp several hours after dark. From Dolatábád, we shot our way up the Jam Rud for some miles, and then made across country to the ancient site of Buzján, which, in the fourth (tenth) century was of considerable importance, and the chief town of the district of Jam, which

* Hari, Herat, the classical Arius, Aria, and Aryan are all one and the same word.

we had now entered. There was, however, little to see except a low hill with crumbling walls and bits of pottery, but from it we could descry the lofty gateway of the Jam Shrine, and a few hours later we were camped outside this interesting little town.

Turbat-i-Sheikh-Jam, or "the Tomb of the Sheikh of Jam," to give it its full name, is the first town in Persian territory which was reached by conquerors from the north-east and east; it has consequently borne the brunt of many an invasion. But its fame chiefly depends



THE SHRINE OF *SHEIKH* AHMAD AT TURBAT-I-SHEIKH-JAM.

on its having been the birthplace of *Sheikh* Ahmad, and also of the poet Jámi. The former was of Arab extraction, and flourished in the sixth (twelfth) century; he was famous as a religious teacher, his works being still extant. It was in his honour that the shrine was built, and his descendant, known as the *Kázi*, an old gentleman of ninety, was in charge of this old-world sanctuary when we visited it. The story runs that the shrine was originally built by Sultán Sanjár, the great Seljuk, but that Sháh Abbás destroyed it, on the grounds that the *Sheikh* was a Sunni. However, a document was produced out of the ruins, from which it appeared that the saint was in reality a *Shiá*, and the penitent monarch vowed that, if he captured Kandahár, he would rebuild the shrine in greater splendour than before. In any case, the great arch referred to above is faced with florid arabesque mosaics in blue and white, with bold yellow scrolls which bear a distinctly Safavi appearance. A strip of blue mosaic with white lettering is the chief motive, but everything is falling into irreparable decay. Indeed, it is remarkable that the tiles should have lasted as long as they have. Behind are two insignificant mosques. The tomb of *Sheikh* Ahmad is very rude, and his epitaph runs, "A famous teacher, an honoured *Sheikh*, Ahmad of Jám, a well-known saint. If thou inquirest the year he died, 'Ahmad of Jám, holy is his dust.'" The last line works out at A.H. 536 (1141), each letter having a numerical value. Close by, is a pathetic inscription of the Emperor Humeiun, then a refugee from India, who married a descendant of the *Sheikh*. However, his fortune changed, and his dynasty in the person of Akbar the Great was yet destined to leave an imperishable mark on the history of India. Of the poet Abdur Rahman, known as Jámi, we heard little in his birthplace: but his mystical and romantic poems are still famous in the East, and he is held to be the last great classical poet of Persia. He died in A.H. 893 (1487), at the age of eighty-one.

Leaving Turbat-i-Sheikh-Jam, with its venerable *Kázi*, its crumbling shrine, and its shady garden, we marched north-east across a difficult range for two stages to Khitái, where we again struck the Hari Rud. Soon after leaving camp on the following day, we sighted the remarkable cliffs of *Dahána* Zulfikar, or "Zulfikar Pass." The legend runs that, Ali cleft it with his forked sword, which the name commemorates. Looking across the river, the cliffs, which offer a singularly good example of erosion in their soft surface, rise sheer to a considerable height, and give the impression of a battlemented wall. Underneath, we sighted the squalid village of Zulfikar, which is held by a *sadbáshi* * and a few Afghan frontier guards. Looking up the gorge, our vision was barred by another evenly serrated cliff, closely resembling that of Kalát-i-Nádiri. It was as if a curtain were drawn to prevent the nakedness of Afghanistán being visible to the curious traveller. Perhaps one mile from the gorge, we saw through our field-glasses two white pillars, which are the actual point where the two empires of India and Russia meet, and from our side of the Hari Rud, barren Irán stretched for hundreds of miles to the west and south, and constitutes yet a third empire. We first came opposite the pass in the white glare so well known to frontier officers; but when evening touched it with her magic wand, each sombre crag was lighted up and glorified by colours of every hue, and it was perhaps at this time that the impressiveness of what is, in reality, the north-western

* A *sadbáshi* is the Oriental equivalent of a centurion.

boundary of the Indian Empire was for the first time fully realized by us. We camped opposite Zulfikár pass, to enjoy its stern beauty to the utmost; and a short march on the following day brought us to Zorabád, which is a frontier station, and is garrisoned by a small number of Persian troops. Unfortunately it is unhealthy, about one-half of the population having been prostrate with fever a few days before our arrival. Zorabád is inhabited by fifty families of the Organji tribe, who migrated from Khiva a generation ago.

From Zorabád two short stages brought us to the Kashaf Rud, the water of which was extremely salt, so much so that our horses declined to drink it. At Bágh-i-Bághu, however, we at last secured some pheasants, the *Phasianus principalis*, specimens of which I have given to the Natural History Museum. Here we were within three stages of Meshed, and a few days later returned to our headquarters, after accomplishing yet another tour of great interest, during which I had added considerably to my knowledge of Eastern Khorasán.

In April, 1906, I was granted leave, and, as every hour was precious, I travelled to Kakha in two days, and managed to reach London on the tenth day, after bidding a temporary farewell to the capital of Khorasán.

Before the paper the President: I am dispensed to-night from introducing to you the reader of the paper, Major Sykes, because you all know him. It is now some years since he produced his work on Persia, which was the result of eight years of study there. His name will always be connected with the country of Persia, and I should like, before asking him to read his paper, to indicate the opinion in which he is held by one of the highest authorities in this country on subjects connected with countries in close relation to our great dependency—I mean Lord Curzon of Kedleston, our distinguished Vice-President. Some three weeks ago, speaking at a meeting where Major Sykes was delivering a paper on the Parsees of Persia, Lord Curzon said of Major Sykes, among other complimentary remarks, that there was no living Englishman with a greater knowledge of Persia. Such testimony makes it unnecessary for me to say anything further. I will now call upon Major Sykes to read his paper.

After the paper, the President: I will now call on a member of a profession which is not forbidden to speak to the public. I see here one of its most distinguished representatives, Mr. Chirol, to whom the general public owe a great part of their knowledge of Persian affairs and of the relations of Persia to this country.

Mr. Chirol commented briefly on the terrible state of decay into which Persia had fallen. Every traveller was struck by it, and Major Sykes's paper had afforded fresh evidence of it. The rivalry of Great Britain and Russia had the effect of preventing the Persians from taking the remedy into their own hands, as Nadir Shah and other strong men had done in olden days, who, from time to time, by dint of personal power and measures which we should call revolutionary, pulled the State out of its rut and created a new order of things which continued until another period of decay came, when the process was repeated. "Now," a Persian once remarked to him at Shiraz, "even that resource is taken from us, because the whole effect of the rivalry of the two great powers in Persia is to bolster up a *régime* which we Persians, who have some knowledge of the conditions in other countries, know to be absolutely effete." Undoubtedly that had been one of the most unfortunate results of the rivalry between the two powers; and from that point of view, perhaps, as much as from any other, an Anglo-Russian understanding might help to restore Persia to something of her former position and prosperity.

Sir THOMAS HOLDICH: I should like to say just a few words on the geography of the country about which Major Sykes has spoken to-night, because, interesting as that country is to us now, it is bound to be far more interesting hereafter. He has taken us to the extreme north-west corner of the country called Khorasán, which now includes only a part of Eastern Persia. The time was, and not so long ago, when Khorasán meant the whole of Afghanistan, and extended across the Indian frontier as far as the gates of Lahore. Incidentally, it has been of great interest to me to hear that the two first pillars of that historical boundary between Russia and Afghanistan that we set up with so much care and difficulty, say, twenty years ago, are so well preserved as to be visible from the opposite side of the Hari Rud river. It is a surprise, and I must say a pleasant surprise, to me to learn that these pillars are so well nursed, and that they are whitewashed and polished even as our pillar-boxes may be polished in London. But of far greater interest, I think, is a fact to which Major Sykes has not alluded in his paper, viz. that it took him exactly nine and a half days to get from Meshed to London. Now, this fact opens up a great vista for the future. It is along this line that, in future times, East and West will be chiefly connected, and it is on this route that future generations —generations, perhaps, that I shall not see—will find their way from the shores of England to the plains of India. If you will refer to the map, I should like to point out to you that from Askabád on the Russian line of railway north of the mountains to Herat is about as far as it is from London to Edinburgh. From Herat by Kandahar to Quetta is about twice as far. You may take it, then, that from Quetta to Askabád is about two and a half days' journey, if you could make that journey by rail; about the same length of journey as Major Sykes made from Meshed to Askabád. Consequently, it seems to me that it will be possible in future to bring India, even at the present rate of railway progression, within nine days of London. Of course, I am aware that Quetta is not exactly in India; nevertheless, Quetta may be reckoned nowadays as an Indian station. Well, there are two or three ways of getting to Quetta, and as all these ways more or less touch upon Khorasán, perhaps I may be allowed to tell you a little about the geographical conformation of that country from personal experience. Between the Russian railway and Meshed there lies a band of very difficult mountains. In fact, the whole country is mountainous, and, so far as I know, there is no royal road across it; it would be a matter of immense difficulty to bridge the distance between Askabád and Meshed. From Meshed southwards to about the latitude of Herat there are still considerable difficulties. Again, bands of hills in regular order running from north-west to south-east present themselves transversely to any line which may be carried across that interval. The hills themselves are, perhaps, not great in altitude, but they are close set and the valleys are narrow, and there would be great difficulty in crossing them with any line projected for railway purposes. But from that point level with Herat south-west to Seistan no vast difficulties occur. It is difficult, I admit, all the way, but not so difficult as it is further north. Having reached Seistan, what do you find? I have visited Seistan, and we have heard something about it from Sir Henry McMahon in this room a few days ago. Seistan is a country which might almost be called God-forsaken. There, we are told, the spring is heralded by snakes; there we encounter a terrific wind, which is only tolerable because it sweeps away hoards of pestiferous insects which would make life impossible; there, in the course of a single week of hot weather, you might very well sample all the plagues of Egypt. There should be no mistake about it—Seistan is not a white man's country. Passing Seistan southwards, you must remember you are still in Persia; it is a point which is sometimes overlooked, that if we want to reach Seistan from India we must pass through Persia. Finally, there is that inevitable desert to be crossed between the Persian frontier and Nushki (leading to Quetta), where all the sand and detritus of the Helmand river accumulates by reason of those north-western winds which blow all the year round. It is not a pleasant prospect taken as a whole, and looking at it from a traveller's point of view, one would say that the route generally between Askabád and Quetta, through Seistan, is about as unpleasant a route as you could well choose.

Now about the geography of the Afghan frontier. From Askabád to Merv, and from Merv to Khushk, there is open country which is of no very great interest. From Khushk, as you ascend to the mountains, you pass into a cool atmosphere and a pleasant climate. Crossing those mountains by the Baba, or any other easy pass, you run down the smooth slopes leading to the Herat valley. Once in the Herat valley you are in a sort of oasis, which is not exactly in the middle of a desert as is often represented, but it is distinctly the most fertile and the best developed region in that part of Afghanistan. From Herat again you might expect to meet considerable difficulties in the matter of hill ranges, intervening between itself and Kandahar to the south; but as a matter of fact there is an open way, and no important obstacle. You would pass by several places which are of considerable importance. First there is Sabzawár, which is a very flourishing city. It has always been a green place, as its name denotes, but since the demarcation of the Afghan boundary, Sabzawár has risen to considerable importance. I believe as a centre of trade it now almost rivals Herat itself. Southwards you pass by various places, among others the little hill town of Adraskand, prettily situated, where there is a considerable manufacture of carpets. The carpets turned out there are not equal, either in appearance or in value, to those which Major Sykes has kindly exhibited to-night, but nevertheless they are very passable and very useful. South-west of Adraskand you again tap an agricultural country, of which the capital is Farah; perhaps not an ideal place for residence, for it partakes a little too much of the characteristics of Seistan. You will see that it is about on the same level. Turning eastwards, you run through an open country leading to that great plain of Bakwa, which we are told by Colonel Yate is (according to tradition) the plain on which the final destinies of India are to be fought out between Russia and England. And so to Kandahar, from which point I need follow the Afghan route no further. From Kandahar to Quetta—we all know something of that route. Now, the whole of that Afghan line of approach to India is comparatively easy, so far as gradients and alignment are concerned, and it has certainly the advantage of a magnificent climate. I am only dealing strictly with the geographical aspects of two routes—the Russian and the Afghan; but I may say plainly that between the Afghan route and that running through Seistan, the highland or Afghan route is infinitely preferable from every point of view. It would be interesting to follow this subject further, but I feel I am treading on comparatively thin ice, and I must confine myself to geography. In my own mind I am firmly convinced that the time will come when the great systems of railways which exist in Russia, and those which have been built up by our own energy in India, will be connected by steel links formed by the lines of an international railway.

Colonel C. E. Yate: I will not enter to-night upon any discussion on the subject of a junction between the Indian and Trans-Caspian railways raised by Sir Thomas Holdich. Sir Thomas is in favour of such a junction, and I am against it. We have often discussed the question, and our views are diametrically opposed, and as it happens that my views are fully stated in this month's (June, 1906) *Nineteenth Century*, I will say no more on the matter at present, but turn to the subject before us.

I need not say that I have followed Major Sykes's lecture throughout with great interest. He has carried me back through many of the scenes and to many of the places I visited when I was consul-general at Meshed ten and twelve years ago, and I congratulate him on his description of those places, and I also congratulate Mr. Herbert Sykes on the illustrations he has so kindly provided for our enjoyment this evening. Major Sykes has not had time to give us a half or a quarter of the varied information he has collected and put down in his paper, and for the perusal of that in full we shall have to wait for the publication of the *Geographical Journal*. Meanwhile, I will just touch upon one or two points connected with his various tours.

One thing specially struck me with regret, and that was to hear from him of the destruction of all the beautiful mosaic tilework that adorned the arches and inner walls of the old madrassah or school at Khargird, near Khaf. When I visited this madrassah in 1894 it was still in a fair state of preservation, and the glazed tilework was nearly perfect—so much so that I noted in my book on 'Khurasan and Seistan' that it ought to remain as long as wind and weather permitted. That this beautiful mosaicwork should have been so ruthlessly destroyed by the hand of man is a loss to the world in general. The only other example of this art that I know of in that part of the country was the old Musalla, or place of prayer, at Herat. The remains of that beautiful building were levelled to the ground by the order of the late Amir, Abdur Rahman, of Afghanistan, in 1885, and as I was at Herat at the time I was able to collect a few specimens of the mosaic tilework that adorned the front of it, and these I presented the other day to the new museum that we founded at Quetta shortly before I left. I am now asking that one or two of those specimens may be given to the British Museum, as now that this madrassah has gone as well, the difficulty of getting specimens of this ancient art will become more and more difficult every year.

I must specially congratulate Major Sykes, and also Mrs. Sykes and their infant son, on their journey across the desert from Yezd to Tabas. When one hears of such long waterless marches as those done by Mrs. and Miss Sykes in this journey, and also of those previously done by Miss Sykes, it shows what can be done by ladies in Persia when the spirit is willing and the flesh is not weak.

In Major Sykes's account of his tours in Kerman, the description of the shrine of the famous saint, Shah Niamat Ulla, at Mahun was of special interest to me. This saint was the author of the prophecy, that Major Sykes and Sir Thomas Holdich have referred to, regarding the great battle that is to be fought on the Dasht-i-Bakwa, a plain in Afghanistan about halfway between Kandahar and Herat. This prophecy is interpreted by the Afghans to apply to England and Russia, and I first heard of it somewhere near Balkh in Afghan-Turkestan in 1886. Subsequently I had it quoted to me in various other places in Afghanistan, but none of the Afghans who told me of it could tell me who was the author of the prophecy, and it was not till I got to Meshed in 1893 that I succeeded in tracing it to the particular saint whose resting-place at Mahun has now been so graphically described by Major Sykes. The Afghans firmly believe that the great battle for the supremacy of Asia is to be fought out between the English and the Russians on this Bakwa plain, but none of them could tell me who was to be the victor.

The tradition is that so severe is to be the fight that at the conclusion of the battle 12,000 riderless horses will be found wandering over the plain, and as part of General Skobeloff's scheme for the invasion of India was "to organize hordes of Asiatic horsemen, who, to a cry of blood and plunder, were to be launched against India," I think we may congratulate ourselves, from the numbers of horses referred to in the prophecy, that it is these Asiatic horsemen who are to get the worst of it, and our minds may therefore be at rest on that account. It would be interesting, though, to know the exact words in which the saint recorded this much-talked-of prophecy. I tried my best to get a copy of the saint's writings when I was in Persia, but without success. They are very rare, and exist only in manuscript, and if Major Sykes ever succeeds in finding a copy, I trust he will not fail to let the world know the exact rendering of this passage.

Major Sykes has told us something of the new Central Persian telegraph line that promises in future to form our main line of communication between India and England. This line, taking off from the main Teheran-Bushire line at Kashan, has been laid on the Persian side through Yezd, Kerman, and Bam to Kohi-Malik Siah, that curious rocky hill on the Seistan border that forms the tribeyt of India, Persia, and Afghanistan. Here it has been joined by the Indian telegraph line from Quetta and Nushki, laid along the Quetta-Seistan trade route. This junction at Koh-i-Malik Siah is now to be supplemented by another line from Karachi *viâ* Las Bela, Panjghur and Palantak to Koh-i-Malik Siah, thus giving direct communication from India with Persia and England through both Quetta and Karachi. Now that India has done so much to open up communications and to stimulate trade on her side of the frontier, we can only trust that Persia will see that it is to her interest to do something also. I hope, therefore, that arrangements will now be made with the Persian Government for the linking up of the Persian line from Meshed to Seistan with the other three lines at Koh-i-Malik Siah. The distance from Nasratabad in Seistan to Koh-i-Malik Siah is only 80 miles, and this small extension would give an alternative line of communication in case of any accident on the other lines.

I have never visited Kerman, and I have not seen the Mission hospital there, but I would take the present opportunity of joining Major Sykes in bearing testimony to the good work done in such places by the Church Missionary Society's medical missionaries. I know Dr. Summerhayes, whom Major Sykes has mentioned, well; he and his colleague Dr. Holland had charge of the Church Missionary Society's hospital at Quetta during the four years I was Chief Commissioner of Baluchistan, and I had thus full opportunity of studying their work. Dr. Summerhayes's life is indeed the hard-working, self-sacrificing life that Major Sykes has depicted, and his devoted and unselfish work will, I hope, receive the acknowledgment that is its due.

In conclusion, there is just one more point that I would touch upon, and that is the question of the roads between Bandar Abbas and Kerman. I had hoped to hear something about them to-night, but Major Sykes has only mentioned one of these roads—that by Gulaskhird, which I gather is some 300 miles in length—and nothing has been said as to their practicability for a railway or otherwise. Major Sykes, however, has told us that Bandar Abbas is situated close to natural gates leading into Persia, and that Bandar Abbas will, in his opinion, ultimately become the chief port of Southern Persia. The subject is a specially interesting one at the present time when we have had various articles and discussions on projected Russian railways in Persia, and especially on the proposed Russian railway line from Teheran to Bandar Abbas. I would beg to ask Major Sykes, therefore, before the proceedings close to-night, to tell us something of the different routes leading up from Bandar Abbas to the Kerman plateau, and to say whether he considers any of them practicable for a railway except at prohibitive cost, and, roughly speaking, what the length of such a line would be, and what chance there would be of its paying.

The PRESIDENT: We must close the discussion now, and leave Major Sykes to give us the information for which Colonel Yates asked him. Before we pass a vote of thanks, I would draw your attention to the fact that in the Tea Room there is an extremely interesting collection. There are bronze ornaments, bronze weapons, and vessels which were found to the west of Kerman, and are the only articles of the Bronze Age which have been found on the Iran plateau. The blue tiles, the embroideries, and the copper-work are also interesting. I now propose a hearty vote of thanks to Major Sykes for his most valuable address, and also for having drawn forth such an extremely interesting discussion.

Major SYKES: I would in the first place thank you, sir, for the very kind remarks you have made about me, and I thank the audience for the kind way in which they have listened to my paper. As to the tracks from Bandar Abbas to the interior, I would say that there are four or five, but the one I referred to in my paper is the lowest in altitude, and it is the one by which, I would mention, Krateros, with the elephants returning from Alexander the Great's expedition in India, chose, and I think that it is the easiest pass. In conclusion, I would again thank you for the very kind manner in which you have listened to my paper.

BATHYMETRICAL SURVEY OF THE FRESH-WATER LOCHS OF SCOTLAND.*

Under the Direction of Sir JOHN MURRAY, K.C.B., F.R.S., D.Sc., etc., and LAURENCE PULLAR, F.R.S.E.

PART XII.—THE LOCHS OF THE LOCHY BASIN.

THE Lochy basin is a large and important one, having on its boundary-line and within it some of the highest peaks in Scotland, including the highest—Ben Nevis. It stretches from Sgor nan Coireachan on the west to Meall Cruaidh and Creag Ruadh on the east, a distance of over 40 miles, and from Glas Bheinn and Leim Uilleim on the south to Carn Dearg and Carn Leac on the north, a distance of over 20 miles, the total area of the basin exceeding 400 square miles. Within this basin ten lochs were sounded by the Lake Survey staff, viz. Lochs Lochy, Arkaig, Pattack, na h-Earba (east and west), Laggan, Ossian, Ghuilbinn, Treig, and an Dubh Lochan. Five of the lochs exceed 3 miles in length, and four exceed 5 miles in length, while one of them (Loch Arkaig) is 12 miles in length; five of them exceed 100 feet in depth, and three exceed 300 feet in depth, while one of them (Loch Lochy) exceeds 500 feet in depth. It has been found convenient to include in this paper also two small lochs which drain directly into Loch Linnhe, viz., Lochan Lùnn dà-Bhrà on the east and Loch nan Gabhar on the west. Loch nan Gabhar is in Argyllshire, while all the remaining lochs are situated in Inverness-shire. The relative positions of the lochs and

* Plates, p. 664.

rivers within the area under discussion are shown in the little index map (Fig. 1), from which it will be seen that Loch Arkaig drains into Loch Lochy by the short river Arkaig, while the other lochs within the basin drain into the river Spean, which joins the river Lochy shortly after its exit from Loch Lochy, the junction of the two rivers being marked by the pretty falls of Mucomir.

The Lochy basin, only a small portion of which has been mapped by the Geological Survey, lies wholly within the region of the crystalline schists of the Central Highlands. It is intersected by the powerful north-east and south-west fault that traverses the Great Glen from

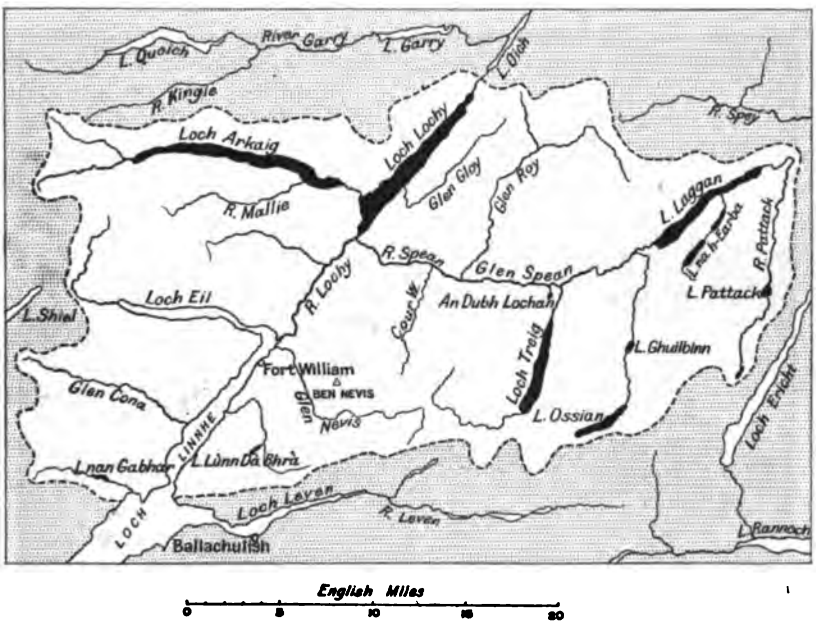


FIG. 1.—INDEX MAP OF THE LOCHY DISTRICT.

Inverness to the shores of Loch Linnhe. In the area west of this dislocation the rocks, so far as known, consist of quartz-biotite granulites and muscovite-biotite schists, which are believed to represent altered sediments. These are traversed by acid and basic intrusions and numerous veins of granite and pegmatite.

East of the Great Glen several of the metamorphic groups of the Eastern Highlands are represented, including the Perthshire quartzite, black schist, limestone, Ardrishaig phyllites, and the associated quartzite, the beds striking generally in a north-east and south-west direction. These schists are pierced by various masses of igneous rock, of which the most important is the large intrusion of granite forming the lower part of Ben Nevis. It is capped by andesitic lavas, breccias, and tuffs, presumably of Lower Old Red Sandstone age.

Loch Lochy (see Plate I.).—Loch Lochy is the southernmost of the chain of lochs occupying the Great Glen, which were utilized in forming the Caledonian Canal. Its southern end is about 8 miles north of Fort William. It is a straight loch, running nearly north-east to south-west. In form Loch Lochy is a narrow triangle, with the apex at the north end, gradually widening southward to near Bunarkaig, where the greatest breadth is found, after which it rapidly narrows for the remaining 2 miles to the outflow at Gairlochy. A good road runs along

FIG. 2.—LOCH LOCHY, FROM THE SOUTHERN END.
(*Photograph by Mr. James Chumley.*)

the eastern shore, a rough cart-road on the western side, and several stations of the Invergarry and Fort Augustus railway now give easy access to the loch on the east side. The surroundings are wild, gloomy, and solitary (see Fig. 2). No village is found on its shores, an occasional house being passed on the east side, while the west side is uninhabited save for one or two distant cots.

The hills on the west rise with a uniform very steep slope to a height of more than 3000 feet (Sron a Choire Ghairbh), broken only by the deep gashes torn by the torrents in the glacial *débris*, which here extends far up the mountains. On the east the slope is about the same, but the hills less high, the ridge (almost wholly covered with *débris*) which separates Loch Lochy from Glen Gloy reaching to 2000 feet.

The only important streams feeding the loch are the river Arkaig, bearing the superfluent waters from Loch Arkaig, entering near the lower end, and a large burn coming down Glen Gloy, the rest of the feeders being mere mountain torrents. A very small portion of the overflow of Loch Oich enters Loch Lochy by the Caledonian Canal.

The length of the loch is a little under 10 miles, the greatest breadth 1¼ miles, opposite the mouth of the Arkaig, and the average breadth three-fifths of a mile. The greatest depth is 531 feet, and the mean depth 229 feet. The loch has a superficial area of nearly 6 square miles, and drains directly an area of about 58 square miles, but as it receives the outflow from Loch Arkaig the total drainage area is nearly 124 square miles. The overflow of Loch Lochy is carried by the river Lochy into Loch Linnhe.

The survey of the loch occupied from April 28 to May 1, 1903; the height of the surface above sea-level on commencing the survey was found to be 94·24 feet, as compared with 93·2 feet observed by the officers of the Ordnance Survey on July 1, 1870. Loch Lochy contains 37,726 millions of cubic feet of water, or nearly 50 per cent. more than Loch Arkaig, the second largest loch in the basin.

At the north end a small basin, called Ceann Loch, measuring one-half by one-third of a mile, and having a maximum depth of 66 feet, is cut off from the main loch by a narrow channel in which the greatest depth is 40 feet.

The main loch is a simple basin, with the U-shaped section characteristic of glacier-formed lakes. All the contours are continuous, those at 50 and 100 feet enclosing areas little less than the total length of the loch. The area enclosed by the 200-feet contour measures 6½ miles in length, by the 300-feet contour 4¾ miles, and by the 400-feet contour a little over 3 miles in length. The 500-feet contour encloses a very small area, one-third of a mile long by one-eighth of a mile broad, just about the middle of the loch, and includes the deepest sounding in 531 feet. From opposite the mouth of the river Arkaig to the outflow, the loch shallows rapidly and the contours are irregular.

The following table gives the approximate areas between the consecutive contour-lines drawn in at intervals of 100-feet, with the percentages to the total area of the loch:—

Feet.		Acres.		Per cent.
0 to 100	... ...	923	...	24·4
100 „ 200	... ...	937	...	24·8
200 „ 300	... ...	651	...	17·2
300 „ 400	... ...	571	...	15·1
400 „ 500	... ...	678	...	17·9
Over 500	... ...	23	...	0·6
		3783		100·0

The flat-bottomed character of the basin is indicated by the comparatively large area covered by water between 400 and 500 feet in depth, an area greater than in the two shallower zones; the zone between 100 and 200 feet, also, is rather larger than the shore zone.

*Temperature Observations.**—The surface temperature varied from 43°·5 Fahr. to 42°·1. A series taken on April 29 showed the small range from the surface to 425 feet of only 1°·2. It will be seen from the table that the change is very gradual, but quickest in the upper 50 feet, where half of the total range occurs:—

Surface	42°·7 Fahr.
10 feet	42°·5 „
50 „	42°·1 „
100 „	42°·1 „
150 „	41°·9 „
200 „	41°·7 „
300 „	41°·7 „
350 „	41°·6 „
400 „	41°·5 „
425 „	41°·5 „

Loch Arkaig (see Plate II.).—Loch Arkaig is a long, narrow, curved loch, running nearly due east and west, the lower end about 1 mile west of Loch Lochy and 10 miles north of Fort William.

The lower part of the loch is well wooded, picturesque, and romantic, with hills to north and south, reaching well over 2000 feet in height (see Fig. 3). The upper part is barer and grander, the mountains exceeding 3000 feet in height. A road runs along the north side of the loch, deteriorating towards the west end into a rough track which leads to Loch Nevis and Loch Morar. Several wooded islands enhance the charm of the scenery, and on one of these is one of the few nesting-places of the osprey, still occupied by the birds at the time the survey was made. There is very good fishing in Loch Arkaig, and lake trout up to 10 lbs. in weight were taken from the loch while the survey was going on.

Loch Arkaig is 12 miles long, of somewhat irregular outline, but broadest in the middle parts and tapering towards each end. The greatest breadth is nearly a mile, the mean breadth half a mile. The maximum depth is 359 feet, the mean depth 152¾ feet. The surface has

* During the past twenty years Sir John Murray has taken many temperature observations in Loch Lochy, and has published and discussed the results in the following papers, to which the reader is referred for further details: (1) "On the Effects of Winds on the Distribution of Temperature in the Sea- and Fresh-water Lochs of the West of Scotland," *Scott. Geogr. Mag.*, vol. 4, p. 345, 1888; (2) "On the Temperature of the Salt- and Fresh-water Lochs of the West of Scotland, at Different Depths and Seasons, during the years 1887 and 1888," *Proc. Roy. Soc. Edin.*, vol. 18, p. 139, 1891; (3) "Some Observations on the Temperature of the Water of the Scottish Fresh-water Lochs," *Scott. Geogr. Mag.*, vol. 13, p. 1, 1897.

an area of 6¼ square miles, and the loch drains an area of 66 square miles. The volume of water is estimated at 26,573 millions of cubic feet.

No large loch drains into Loch Arkaig, but several very small lochs do so, the largest being Loch a' Bhlair, a mile to the north. The chief streams enter at the west end, where a short river brings the drainage of Glens Pean and Dessary, and on the south side, where the stream from Glen Camgharaidh enters near the upper end, and that from Glen Mallie

FIG. 3.—LOCH ARKAIG, FROM THE EAST END.
(*Photograph by Mr. James Chumley.*)

near the lower end. Only mountain torrents enter on the north. The river Arkaig, a mile long, conveys the overflow of Loch Arkaig into Loch Lochy.

When surveyed, in the middle of June, 1902, the height above sea-level was found to be 139 feet; the officers of the Ordnance Survey found the elevation to be 139·8 feet above the sea on July 10, 1869.

The basin of Loch Arkaig is nearly simple, the slight irregularities doubtless correlated with the curving outline. The contours at 50 feet and 100 feet are continuous. A little over 2 miles from the west end of the loch there is an abrupt narrowing, and the loch continues narrow to the end. Corresponding with this the 200-feet contour is broken into two basins. In the narrow western part is a separate 200-feet basin, with a maximum depth of 262 feet; this is only separated from the main 200-feet basin by a slight shallowing to 183 feet. The main 200-feet basin is about 8 miles long; it includes three areas of over 300 feet, which, however, are only separated by very slight shallowings. The largest of these 300-feet areas is about 2 miles long, is situated just about the middle of the loch, and includes the maximum depth of 359 feet. The others, further to the east, are close together, and of very slight extent. Though the wide portion of the loch, fully 9 miles in length, forms a simple basin, there is not the well-marked U-section found in typical glacier-formed lochs (see cross-section E–F on map).

The following table gives the approximate areas between the contour-lines laid down at intervals of 100 feet, with the percentages to the total area of the loch, and shows a gradually decreasing area with increasing depth:—

Feet.	Acres.	Per cent.
0 to 100	1412	35·3
100 „ 200	1257	31·5
200 „ 300	1073	26·9
Over 300	253	6·3
	3995	100·0

Through the kindness of Mr. Thomas Honeyman, factor to Cameron of Lochiel, we have inspected a bathymetrical chart of Loch Arkaig, based upon soundings taken in 1889 by an officer in the German army named Sandler. The chart is drawn to the scale of 1¾ inches to the mile, and the soundings are given in fathoms. A comparison of Sandler's map with the Lake Survey map shows that: (1) Sandler's soundings are much less numerous than those taken by the Lake Survey, and many of his lines were taken in zigzag fashion instead of running at right angles to the axis of the loch; (2) Though there is a general agreement between the two maps, the Lake Survey map shows as a rule rather deeper water, position for position; for instance, taking the deepest soundings on each of Sandler's lines, and placing it approximately on the Lake Survey map, deeper soundings occur in the vicinity; thus Sandler's deepest sounding in 55 fathoms (330 feet) approximates to the Lake Survey maximum in 359 feet.

Temperature Observations.—The surface temperature in the centre of the loch varied from 48°·3 Fahr. to 51°·5 during the three days of the survey; near shore it reached 52°·3 on June 13. A series taken in the main basin on June 11 showed a range of 4°·7 from the surface to 280 feet, the greatest variation being observed in the superficial layers of water, as shown in the accompanying table:—

Surface	49°·4 Fahr.
10 feet	48°·9 „
25 „	47°·5 „
50 „	46°·5 „
100 „	45°·5 „
150 „	45°·0 „
200 „	44°·9 „
250 „	44°·7 „
280 „	44°·7 „

Loch Pattack (see Plate VII.).—Loch Pattack (or Pattaig) lies at a considerable elevation among the mountains which separate Loch Ericht from Loch Laggan. It is only about 2 miles distant from Loch Ericht, though it belongs to a different drainage system, draining by the river Pattack, some 9 miles long, into the upper end of Loch Laggan. It is a loch of somewhat irregular form, about a mile long by half a mile broad, its long axis running nearly north-east and south-west. The maximum depth is 58 feet, and the mean depth 14 feet. The volume of water is estimated at 106 million cubic feet. The superficial area is about 173 acres, or fully a quarter of a square mile, and it drains an area of 18 square miles. It receives the greater part of the drainage of the east side of the mountain mass, of which Ben Alder (3757 feet) is the highest peak. In this drainage area are three smaller lochs, which were not surveyed. When surveyed in May, 1904, the height above sea-level was estimated (from spot-levels) at 1419 feet.

The basin is quite simple, the contours roughly following the irregular outline of the shore, and the deepest part almost in the centre of the loch. The slopes are gentle, except opposite the mouths of the two rivers, both of which have laid down alluvial promontories, with small islands, from which the incline to the deepest water is rapid. The loch is on the whole shallow, for 78 per cent. of the lake-floor is covered by less than 20 feet of water, and 60 per cent. by less than 10 feet of water.

Temperature Observations.—A series of temperatures, taken in the deepest part of the loch, gave 42°·6 Fahr. at the surface, 41°·4 at 25 feet, and 40°·8 at 50 feet.

Lochan na h-Earba (see Plate III.).—The two lochs which bear this name may have formed at no very distant date a single loch, as suggested by the common name and by the appearance of the ground. Be that as it may, they are now two distinct lochs, differing by nearly 10 feet in level. In April, 1873, the Ordnance Survey officers found the elevation of the west loch to be 1151·7 feet, and that of the east loch 1142·3 feet, above sea-level. They lie in a valley, which runs nearly parallel to that occupied by Loch Laggan, to the south side of that loch, and distant from it about a mile. Hills of over 3000 feet rise close on the east; on the west they are separated from Loch Laggan by a ridge of between 2000 and 2500 feet in height. The shores are for the most part wooded.

The West Loch.—This is the larger, broader, and deeper of the two. It lies at an elevation of about 1150 feet, some 330 feet higher than Loch Laggan. It is fully 1¾ miles in length, rather less than one-third of a mile in greatest breadth, and a quarter of a mile in mean breadth. The greatest depth is 81 feet, the mean depth over 35½ feet. It has a superficial area of about 263 acres, or less than half a square mile, and drains an area of fully 5 square miles. The volume of water amounts to 408 millions of cubic feet. The loch is fed chiefly by two small streams, coming down from Beinn a' Chlachair, which unite just before entering the loch. A stream, half a mile long, winds through a boggy flat, conveying the overflow to the east loch. The long narrow loch is nearly straight. From the centre it narrows to the outflow, but southwestward to the upper end the width is nearly uniform, the end rectangular, straight, and a quarter of a mile across.

The basin is quite simple, none of the contour lines being broken. The contours do not closely follow the shore-line; they narrow more decidedly than the outline from the centre to each end, the slopes being much steeper towards the centre of the loch, where the sections are U-shaped. The deepest part is rather to the east of the centre, and it is curious to note in close proximity an elevation with only 30 feet on it, surrounded on all sides by water exceeding 50 feet in depth.

The approximate areas between the contour-lines, and the percentages to the total area of the loch, are as follows:—

Feet.	Acres.	Per cent.
0 to 25	102	38·7
25 „ 50	85	32·2
50 „ 75	67	25·6
Over 75	9	3·5
	263	100·0

Temperature Observations.—A series of temperatures at the deepest part of the loch showed a range 4°·8 Fahr. from top to bottom. The greater part of this was in the upper 10 feet, the difference between 10 and 60 feet being only 1°, as shown in the following table:—

Surface	49°·9 Fahr.
10 feet	46°·1 „
20 „	45°·8 „
60 „	45°·1 „

Near shore the surface temperature was as high as 53°·4, the air temperature being 62·°2

The East Loch.—This is about half a mile distant from the west loch, and nearly 10 feet lower, about 1140 feet above the sea. It is 1¼ miles long, a quarter of a mile in greatest breadth, and averages just under one-fifth of a mile in breadth. The maximum depth is 69 feet, and the mean depth 31 feet. It has an area of about 146 acres, or nearly a quarter of a square mile, and drains an area extending to about 9½ square miles, including that draining into the west loch. The volume of water is 191 millions of cubic feet, or less than half the volume of the west loch. The chief feeder is the stream from the west loch. There enters also at the upper end a branch of the Allt na Magha, the stream which has laid down the delta now separating the two lochs. About the middle of the east shore enters the small stream coming from Loch an Iubhair. The waters of Lochan na h-Earba are discharged by the Allt Lowrag, about a mile long, into Loch Laggan.

The east loch has the same general form as the west loch, long and narrow, broader at the upper end and tapering to the outflow. The deep water is all towards the upper end, the lower half of the loch being very shallow. The area enclosed by the 50-feet contour is about half the total length of the loch, and in this part the sections are somewhat U-shaped. A slight shoaling is observable opposite the entrance of the stream near the middle of the eastern shore, where, in the centre, the deepest sounding was 52 feet, with depths of 60 feet and over both to the north-east and south-west.

Temperature Observations.—Serial temperatures in the deepest part indicated practically the same range (5°) as in the west loch, and the distribution of temperature was exactly similar, but all parts of the loch were about 1° higher:—

Surface	51°·0 Fahr.
10 feet	47°·5 "
20 "	46°·2 "
50 "	46°·0 "

The air temperature was 55°·2.

Loch Laggan (see Plate III.).—Loch Laggan is situated in the southern portion of Inverness-shire, between the Highland and West Highland railways, being about equally distant from the nearest points of each. Dalwhinnie, on the Highland railway, is about 6½ miles from the upper end of the loch; Tulloch, on the West Highland railway, is about 6 miles from the lower end. The coach road from Kingussie to Tulloch passes along the northern shore. The loch runs nearly north-east and south-west, and occupies a valley lying between the very high mountains of Badenoch on the south-east and an equally high and more extensive mountain mass of the district of Lochaber on the west. The loch is of the usual elongate narrow form of Scottish lochs, narrowest in the central parts, and somewhat expanded towards each end, where deeper water occurs. The outline is very irregular, and the bottom, as shown by the contours, correspondingly irregular. A number of larger and smaller islands are found in the narrower parts of the loch. The length is a little over 7 miles, the greatest breadth two-thirds of a mile, the mean breadth nearly half a mile, the superficial area about 1900 acres, or nearly 3 square miles. The maximum depth is 174 feet, the mean depth 68 feet, and the volume of water about 5600 millions of cubic feet. The loch was surveyed on June 2 and 3, 1902, when the elevation of the lake-surface above the sea was found by levelling from bench-marks to be 818·6 feet; the officers of the Ordnance Survey found the elevation to be 818·9 feet above sea-level on October 19, 1867. The

FIG. 4.—LOCH LAGGAN.
(*Photograph by Sir John Murray.*)

shores are wooded nearly throughout, and the scenery wild and picturesque (see Fig. 4), the mountains rising abruptly on the north side into a series of peaks, culminating in Creag Meaghaidh, 3700 feet high. On the south-east the high mountains are more distant, Beinn a' Chlachair, over 3500 feet, being 4 miles from the lower end of the loch. Close to the loch on this side, two hills, rather more than 2000 feet in height, separate it from the valley in which lies Lochan na h-Earba. Loch Laggan drains directly an area of 34 square miles, but since it receives the overflow from Loch Pattack and Lochan na h-Earba, its total drainage area is nearly 62 square miles. The principal stream entering the loch is the river Pattack, which drains Loch Pattack and a number of smaller lochs. The Allt Lowrag brings the overflow of Lochan na h-Earba. Near Aberarder, in the middle of the north shore, two large burns enter, and there are many smaller streams on this side. The river Spean issues from the loch, and flows into the Lochy close to Loch Lochy.

Contours are drawn for every 25 feet of depth. The bottom is so irregular that only the 25-feet and the 50-feet contours are continuous, and follow approximately the outline of the shore. All the others are much broken up. The 75-feet contour is broken into four distinct portions; the largest of these approaches the west end of the loch, and is $2\frac{1}{3}$ miles in length. Two lesser areas, each about two-thirds of a mile in length, occur close together in the narrow middle part of the loch. The 75-feet area towards the upper end of the loch is nearly $1\frac{1}{2}$ miles in length. The shallowings between these various basins are all opposite the mouths of streams, but in one instance the stream is too small to account for the shallowing, and other larger streams appear to have had no effect on the contours. The largest 75-feet basin includes two areas of over 100 feet, a very limited one in the narrow part of the loch, with a maximum depth of 105 feet, and another, $1\frac{1}{2}$ miles in length, near the west end. This 100-feet area is at the broadest and deepest part of the lake, and includes an area, two-thirds of a mile in length, of over 150 feet, in which two soundings of 174 feet and 170 feet respectively were taken, with a shallowing of 155 feet between them. The two small 75-feet areas near the middle of the lake include depths of 112 and 114 feet respectively. The easternmost 75-feet area includes two very small basins of over 125 feet, with maxima of 133 and 141 feet. Many lesser irregularities occur. For about half a mile from the inflow of the river Pattack the loch is very shallow, and the bottom and shores are sandy.

The approximate areas between the contour-lines at intervals of 50 feet, with the percentages to the total area of the loch, are given in the following table:—

Feet.	Acres.	Per cent.
0 to 50	765 ...	40·3
50 „ 100	686 ...	36·1
100 „ 150	396 ...	20·8
Over 150	53 ...	2·8
	1900	100·0

Temperature Observations.—The following series of temperatures, taken towards the east end of the loch at noon on June 3, 1902, indicates a range of only 1°·2 Fahr., the greater part of the variation occurring in the upper 10 feet of water:—

Surface ...	47°·0 Fahr.
5 feet ...	46°·6 „
10 „ ...	46°·2 „
20 „ ...	46°·0 „
30 „ ...	45°·9 „
50 „ ...	45°·9 „
70 „ ...	45°·8 „
100 „ ...	45°·8 „

Loch Ossian (see Plate IV.).—Loch Ossian (or Ouchan) is a narrow loch in a valley running nearly north-east and south-west to the north of Rannoch moor (see Fig. 5). It lies at a considerable elevation, about a mile north-east of the summit of the West Highland railway, at Corrour station, from which the loch can be seen. The mountains rise to over 3000 feet both on the north-west and south-east. The former solitude is now relieved, since the mansion of Sir John Stirling Maxwell, Bart., has been built on the shore of the loch.

In form Loch Ossian is narrow, with its long axis slightly curved, and of nearly uniform breadth throughout. It is 3½ miles long, nearly half a mile in greatest breadth, and has a mean breadth of about one-third of a mile. The greatest depth is 132 feet, and the mean depth 43 feet. It has a superficial area of just about a square mile, and a volume of 1224 millions of cubic feet. It drains an area of nearly 10½ square miles, receiving only mountain torrents from the surrounding hills, and flows out by the river Ossian into Loch Ghuilbinn, 2½ miles to the north. The loch was surveyed on May 14, 15, and 16, 1902, when the height of the water above sea-level was found to be 1268·7 feet; this is nearly identical with the level determined by the Ordnance Survey officers on May 27, 1870, viz. 1268·6 feet.

The bottom of Loch Ossian is very uneven, the transverse, as well as longitudinal, sections being undulate. Only the 25-feet contour follows the line of the shore. The 50-feet contour encloses an area 2 miles in length. The south-western portion of this for three-quarters of a mile is exceedingly narrow. Near the middle of the loch it broadens to a quarter of a mile, and continues broad to near the outflow. The area over 75 feet in depth is fully a mile in length, that over 100 feet half a mile, and that over 125 feet a quarter of a mile in length. One mile from the upper end there is in the centre of the loch a shoal, over which the depth is only 11 feet. The approximate areas between the contour-lines, and the percentages to the total area of the loch, are as follows:—

Feet.	Acres.	Per cent.
0 to 25	214	32·6
25 „ 50	234	35·6
50 „ 75	104	15·8
75 „ 100	72	10·9
Over 100	33	5·1
	657	100·0

It will be observed that the area of the lake-floor covered by water between 25 and 50 feet in depth is larger than the shore-zone covered by less than 25 feet of water.

FIG. 5.—LOCH OSSIAN.

(Photograph by Sir John Murray.)

Temperature Observations.—The following temperatures taken at 1 p.m. on May 16, 1902, shows a range of less than 1° Fahr. :—

Surface	44°·3 Fahr.
10 feet	44°·1 „
25 „	43°·7 „
50 „	43°·8 „
100 „	43°·4 „

Loch Ghuilbinn (see Plate V.).—Loch Ghuilbinn (or Gulbin) is a small and relatively broad loch, lying in the midst of the high mountainous region between Lochs Ericht, Treig, and Laggan. The long axis runs nearly north and south. The surrounding hills rise on all sides into peaks of well over 3000 feet. The loch is fully three-quarters of a mile long, and nearly half a mile in greatest breadth, with a mean breadth of a little over a quarter of a mile. The greatest depth is 49 feet, and the mean depth over 13 feet. The superficial area is about 146 acres, or nearly a quarter of a square mile, and the volume 85 million cubic feet. It receives the drainage of a basin extending to 29 square miles, including Loch Ossian. It is fed chiefly by the river Ossian, which, besides bringing the overflow of Loch Ossian, receives the drainage of considerable glens both to the east and west. Its outflow is by the river Ghuilbinn, which flows due north about 5 miles and enters the river Spean just below Loch Laggan. The level of the loch is estimated from spot-levels on the shore to be 1160 feet above the sea.

Loch Ghuilbinn is a simple basin. The sides slope very gently down to 20 feet, nearly 86 per cent. of the whole area of the loch being less than 20 feet in depth. From 20 to 40 feet the slope of the sides is much steeper. A very small area exceeds 40 feet in depth, only about $3\frac{1}{2}$ per cent. of the whole. The surface temperature on May 17, 1902, varied from 45°·0 to 45°·3 Fahr.

Loch Treig (see Plate VI.).—Loch Treig occupies a deep narrow valley among very high mountains in the region of Lochabar (see Fig. 6). The valley trends nearly due north and south. The West Highland railway runs along the east side, and Tulloch station, whence the coach road goes off towards Kingussie, is only 2 miles from the north or lower end of the loch. There is no road on either side of the loch, nor is there to the south any public road nearer than Kingshouse, at the head of Glencoe, Rannoch station being about equally distant. The old road from Struan to the old Corrour Lodge came to the head of the loch, but is now disused and in bad condition. A cart-road approaches the north end of the loch. The sides of the loch are quite uninhabited, but at or near either end are a few keepers' houses and farms. The mountains rise very steeply on either side, those on the west being higher, rising in a series of peaks, the highest of which (Stob Choire an Easain Mhoir) reaches a height of 3658 feet; on the east the highest peak is Cnoc Dearg, 3433 feet high.

The length is a little over 5 miles, the greatest breadth three-quarters of a mile, mean breadth just under half a mile. The maximum depth is 436 feet, the mean depth 207 feet. The area of the loch is nearly $2\frac{1}{4}$ square miles, and it drains an area of about 42 square miles. Three streams, considerable only during floods, enter the upper end of the loch; the sides are unbroken by any large stream, but are scored by the torrents which cut through the glacial *debris*, which here, as at Loch Lochy, extends far up the hillsides. The overflow is carried by the short river Treig into the river Spean at Tulloch. On May 29, 1902, when the survey was finished, Loch Treig was 787·0 feet above sea-level; the level was high in consequence of recent rains. On

July 13, 1868, the Ordnance Survey found the height above the sea to be 783·9 feet. In volume Loch Treig comes third among the lochs of the Lochy basin, containing 13,907 millions of cubic feet. This is more than twice the volume of Loch Laggan, rather more than half that of Loch Arkaig, and one-third that of Loch Lochy.

In form Loch Treig is a narrow triangle, broadest towards the south end, and tapering all the way to the outflow. Half a mile from the north end a rocky promontory, the Rudha Ceann Ard Thonnaich, constricts the loch, but there is no shallowing in the narrows, where the depth is

FIG. 6.—LOCH TREIG.

(*Photograph by Dr. T. N. Johnston.*)

well over 200 feet. The basin is quite simple, all the contours approximately following the shore-line. The steep slope of the hills is continued under water, and there is in most parts but little beach. The axis of the loch is slightly curved, and the line of greatest depth is nearer the west shore. The area over 400 feet deep is very narrow, about 2 miles in length, and at both ends comes very close to the west side, the steepest slopes in the loch being at these points. The cross-sections in the middle parts of the loch, as at C–D on the map, only show slightly the U-shape which distinguishes glacier-hollowed lochs. The valley is so narrow, relatively to the depth of the loch, that the steep slopes reach far towards the middle, and leave but little comparatively level bottom. Towards the south end, where the loch is broader, and the depth less (from 200 to a little over 300 feet), there is a greater extent of nearly flat bottom, and the U-section is more clearly marked. The approximate areas between the consecutive contours at intervals of 100 feet, and the percentages to the total area of the loch, are given in the following table :—

Feet.		Acres.		Per cent.
0 to 100	... ...	415	...	27·0
100 „ 200	... ...	294	...	19·1
200 „ 300	... ...	440	...	28·6
300 „ 400	... ...	256	...	16·6
Over 400	... ...	135	...	8·7
		1540		100·0

The striking characteristic brought out by this table is the large area of the lake-floor covered by water between 200 and 300 feet in depth—an area greater than in either of the two shallower zones.

Temperature Observations.—At the early season when Loch Treig was surveyed, the surface was very little warmer than the bottom, the whole difference between the surface and 300 feet, on May 29 when the last series was taken, being only 1°·7 Fahr. Four days earlier, May 24, the difference was only 0°·7. In the interval the surface had risen in temperature 1°·6, while at 300 feet the rise was only 0°·6. The three serials are contrasted in the table appended :—

	May 24, 11.30 a.m.	May 27, 9 a.m.	May 29.
	° Fahr.	° Fahr.	° Fahr.
Surface	41·2	41·6	42·8
5 feet ...	41·2	—	—
10 „	41·0	41·2	—
20 „	41·0	41·7	—
30 „	41·0	—	—
40 „	—	41·4	—
50 „	41·0	—	42·0
100 „	40·9	—	41·8
150 „	40·8	—	—
200 „	40·8	—	41·2
250 „	40·6	—	—
300 „	40·5	—	41·1

An Dubh Lochan (see Plate VII.).—A very small loch situated about halfway between Loch Treig and the river Spean and a little to the west of the river Treig. It lies at an elevation of 785 to 790 feet above the sea, at the west side of an extensive deposit of gravel and sand, hills of moderate height rising on the west shore (see Fig. 7). It is of somewhat oblong form, diversified by many little bays, and is shallow and weedy towards the south end. It is nearly a quarter of a mile long, and covers an area of about 8½ acres. The greatest depth is 40 feet, and the mean depth 15½ feet. The volume of water amounts to 6 millions of cubic feet. It has a drainage area of about one-sixth of a square mile, receiving only local superficial water. It drains by a small stream northward into the river Spean.

The basin of the loch is quite simple, the deepest part being much nearer the north end, and the longitudinal slope is accordingly quicker at the north end and very gradual towards the south. The temperature

FIG. 7.—AN DUBH LOCHAN.
(*Photograph by Colonel Mainwaring.*)

of the water on October 18, 1904, was 46°·0 Fahr. at the surface, the same at a depth of 20 feet, and only a trifling fraction less at the bottom, 45°·8.

Lochan Lùnn dà-Bhrà (see Plate VIII.).—A very picturesque loch, almost halfway between Fort William and Ballachulish. It is about 5 miles south of Fort William, and is reached by a very rough road, one of General Wade's military roads. It is a narrow loch, with its axis running north-east and south-west. The surrounding hills are of moderate height (1500 to 2000 feet) and grassy, except on the east, where Mullach nan Coirean rises steeply to 3000 feet. Patches of fir wood towards the lower end of the loch enhance the beauty of the scene.

The loch is nearly a mile long and relatively very narrow, the greatest breadth being only about one-sixth of a mile, and the mean breadth one-eighth of a mile. The maximum depth is 25 feet, and the mean depth 8½ feet. The surface has an area of about 66 acres. The volume of water is 23 millions of cubic feet. It receives the drainage from an area of over a square mile, by small burns only, and flows out by the Water of Kiachnish into Loch Linnhe.

At the date when surveyed (May 9, 1903) the height above sea-level was 510·1 feet, exactly one foot lower than the elevation determined by the Ordnance Survey officers in May, 1867.

The basin of Lochan Lùnn dà-Bhrà is broken by islands, about a quarter of a mile from each end, and nearly in the middle of the loch. The island towards the upper end is on a bar, the greatest depth to the north-west and south-east of it being respectively 9 and 8 feet. This bar cuts off a separate small basin, with a maximum depth of 21 feet. The greatest depth of the loch, 25 feet, was found not far to the north-east of this island. North-east from the lower island it is everywhere shallow, nowhere exceeding 7 feet.

The shores of Lochan Lùnn dà-Bhrà are composed chiefly of gravel with boulders, which form many heather-covered mounds. Rock is exposed in many small spots. The stream flows out through a flattish tract, covered with moraine mounds, about half a mile long, and rock was seen in the channel at a distance of about 100 feet from the loch. The promontory below Lundavra farm has been laid down by the stream.

We were told by the local inhabitants that the loch will sometimes freeze all over in a single night, and that small dark trout are abundant in it. There are also some pink-coloured trout, and others silvery like salmon.

The temperature was 48°·0 Fahr. throughout.

Loch nan Gabhar (see Plate VIII.).—Loch nan Gabhar (or Gour) is a little weedy hollow lying close to the sea-shore, and very little above sea-level, on the west side of Loch Linnhe, nearly opposite Ballachulish. It runs nearly east and west, and occupies the southern portion of a large oval alluvial flat, in the midst of which rises an abrupt boss of rock, the Tòrr an Duin, apparently some 70 or 80 feet in height. This alluvial flat is surrounded by steep rocky hills, which form the southern shore of the loch.

The loch is of very irregular form, and interrupted by narrows, bays, and promontories. It is fully half a mile long, one-sixth of a mile in greatest breadth, and one-eighth of a mile in mean breadth. The maximum depth is 5 feet, and the mean depth 2½ feet. The area of the water-surface is only about 45 acres, and it receives the drainage of 13 square miles of country. The height above sea-level, on the date when the survey was made (May 12, 1903), was 7·35 feet, as compared with 7·5 feet observed by the officers of the Ordnance Survey on July 19, 1867.

Loch nan Gabhar receives by the river Gour the drainage of a considerable mountainous stretch of country, bordering Glen Gour, which extends 5 miles west from the loch, among peaks rising to nearly 2500 feet. Two branch glens extend several miles to the north, and one of these brings the overflow of a small loch, Lochan na Beinne Baine, which was not surveyed. As a consequence of the extensive drainage area, the loch is subject to great alterations of level. The river has laid down long spits of sand, and threatens to silt up the loch altogether. A very short stream conveys the overflow to the sea; there is a boss of rock on the north side where it leaves the loch. In volume Loch nan Gabhar is the last in the basin, containing only 5 millions of cubic feet, or one million less than the volume of an Dubh Lochan.

The temperature of the water on May 12, 1903, was 51°·5 Fahr. at the surface and at the depth of 5 feet.

The particulars regarding the lochs dealt with in this paper are collected together in the table on the following page for convenience of reference and comparison.

From this table it will be seen that in the twelve lochs under consideration, which cover an area of about 20 square miles, nearly 2600 soundings were taken, or an average of 214 soundings per loch, and an average of 129 soundings per square mile of surface. The aggregate volume of water contained in the lochs is estimated at 85,855 millions of cubic feet, or more than one-half of a cubic mile, and the area draining into them is over 270 square miles, or nearly fourteen times the area of the lochs.

The Red Lochan at Tulloch.—The Red Lochan, called in Gaelic by a name which signifies "brown eye," is a very small pond lying in an extensive morainic terrace at Fersit, near the north end of Loch Treig. It is only about 30 yards in its longest diameter, and 5 feet deep in the centre, is fed only by rains, and has no outflow except by percolation through the gravel, yet its surface is maintained almost constantly at the same level. The water is always turbid, and varies in colour from dull green to brown or red.

It was first examined by Sir John Murray in May, 1902. The water was then brown; the collection taken with the coarse net very pale yellow, that taken with the fine net a decided red. At that time there were only two very abundant organisms—the larva of an insect, *Corethra*, known as the "phantom larva," and a reddish-coloured rotifer, *Anuræa valga*. There were many other rotifera, entomostraca, and other organisms common in ponds, but none of these were abundant enough to be held responsible for the colour of the water. The collection made with the fine net was examined by Dr. T. N. Johnston and James Murray. On adding a little formalin, which killed the animals, a blood-red sediment was deposited, which was found to consist chiefly

SUMMARY TABLE.

Giving Details concerning the Lochs described in this Paper.

Loch.	Height above sea. Feet.	Number of soundings.	Length in miles.	Breadth in miles.		Mean breadth per cent. of length.	Depth.			Ratio of depth to length.		Volume in million cubic feet.	Area in square miles.	Drainage area.	
				Max.	Mean.		Max. Feet.	Mean Feet.	Mean per cent. of max.	Max.	Mean.			Total in square miles.	Ratio to area of loch.
Lochy	94·24	527	9·78	1·26	0·60	6·1	531	228·95	43·1	97	226	37,726	5·91	123·76	20·9
Arkaig	139·00	667	12·00	0·87	0·52	4·3	359	152·71	42·5	176	415	26,573	6·24	66·03	14·2
Pattack	[1419 approx.]	78	1·03	0·48	0·26	25·5	58	14·07	24·3	94	386	106	0·27	18·18	67·3
Lochan na h-Earba (west)	[1151·7 Apr. 1873]	90	1·80	0·30	0·23	12·8	81	35·62	43·9	117	267	408	0·41	5·26	12·8
Ditto (east) ...	[1142·3 Apr. 1873]	81	1·27	0·26	0·18	14·2	69	31·11	45·1	97	21 6	191	0·23	4·27	18·5
Laggan	818·6	513	7·04	0·66	0·42	6·0	174	67·68	38·9	214	549	5,601	2·97	61·86	20·8
Ossian	1268·7	176	3·20	0·45	0·32	10·0	132	42·75	32·4	128	395	1,224	1·03	10·36	10·0
Ghuilbinn	[1160 approx.]	59	0·82	0·40	0·28	34·2	49	13·32	27·2	88	325	85	0·23	29·13	91·3
Treig	787·0	253	5·10	0·75	0·47	9·2	436	207·37	47·6	62	130	13,907	2·41	42·32	17·5
an Dubh Lochan ...	[785 to 790]	31	0·24	0·08	0·06	23·1	40	15·50	38·8	32	82	6	0·01	0·16	16·0
Lùnn dà-Bhrà ...	510·1	52	0·86	0·16	0·12	13·8	25	8·44	33·7	182	538	23	0·10	1·13	11·3
nan Gabhar	7·35	43	0·58	0·16	0·12	21·0	5	2·50	50·0	612	1125	5	0·07	12·82	18·3
		2570										85,855	19·88	271·18 *	13·6

* The drainage area of Loch Arkaig is included in that of Loch Lochy; those of Loch Pattack and Lochan na h-Earba in that of Loch Laggan; and that of Loch Ossian in that of Loch Ghuilbinn.

of *A. valga* and myriads of its red eggs. At that time this species seemed to be mainly the cause of the red colour.

Examined at different seasons, the colour was found to vary. In October, 1903, it was very red; in May, 1904, dull brown; in January, 1905, green. On all these occasions the phantom larva was about equally abundant, and none was seen in a more advanced stage of development. The changes of colour are doubtless correlated with the predominance of one or another organism. The *A. valga* is not always red; in May, 1903, it was dull grey in colour. When algæ are swarming, the colour will incline to green. The colour may be affected by the development of certain entomostraca — *Diaptomus gracilis*, for instance, was very abundant, but quite colourless, in May, 1903. Later in the year it becomes brown or red.

There are other ponds in close proximity to the Red Lochan, but none of these shares the turbidity and reddish-brown colour. The peculiarity is probably due to its being more closely shut in. The surrounding rim of gravel is 14 feet above the pond at its lowest part. There is, besides, a fringe of birch trees. The water is stagnant, which favours the growth of certain organisms, particularly *Anuræa valga*. The blood-red larva of *Chironomus*, though abundant, could have no part in causing the red colour, as it was not in the open water, but among the weeds and mud.

Mr. Robertson, the keeper at Fersit, to whom we are indebted for several collections and much information about the loch, states that it is later in freezing than the other ponds in the region. The more active decomposition in the stagnant water would account for this.

The temperature of the water in May is about 45°·0 Fahr. It is said that wildfowl never settle on this pond, and that the common frog cannot live in it.

The following legend was related to Sir John Murray concerning this Red loch :—

" Many centuries ago there lived in these parts a noted hunter named Donnuil. In return for some services rendered to the witch of Ben-a-Vreich, she offered to deprive the deer either of the sense of sight or of smell, so far as he was personally concerned. He chose to have the deer deprived of the sense of smell, 'for,' said he, 'I can easily cheat their eye.' The witch, however, told him that in the stomach of the last stag he would kill there would be found a ball of worsted thread. As time passed Donnuil became ill, and, while weak in bed, his daughter told him a fine stag was caught by the horns in some bushes near the house. He asked for his cross-bow, and, although in bed, he shot the stag through his bedroom window. Later on his daughter brought him a ball of worsted which had been found in the stomach of the stag. He knew his end was near; indeed, he died the same evening. On the following morning the Red Lochan had appeared at the place where the stag was killed."

This story was evidently invented to explain the origin of the Red loch, and is of the same order as those stories invented to explain why the fox has a bushy tail, and why the serpent crawls on his belly.

NOTES ON THE BIOLOGY OF THE LOCHS IN THE LOCHY DISTRICT.

By JAMES MURRAY.

There is little peculiarity in the biology of the large lakes in the basin, except in that of Loch Lochy. They contain the ordinary fauna of great lakes of low temperature. Most of them were surveyed so early in the season that the water was little above the minimum winter temperature, and the summer crustacea (*Holopedium*, *Leptodora*, etc.) had not arrived. The smaller lochs were warmer, and some of those crustacea were present.

Loch Arkaig.—The plankton is almost exactly that typical of large lakes, with hardly any local peculiarity. The larva of *Leptodora*, which we have rarely found, was present. A few examples of the somewhat rare *Latona setifera* were found. A few species of plankton-desmids, chiefly of the genus *Staurastrum*, occurred, but they were less conspicuous than in the lochs farther west.

Loch Lochy.—Though the situation of Loch Lochy is so similar to that of Loch Ness, and though the depth in the two lochs is comparable, the plankton of Loch Lochy offers a remarkable contrast to that of Loch Ness. In two different years when the lochs were examined, the plankton in Loch Lochy was found to be much richer. The quantity was many times greater, the species more numerous, but the special feature was the quantity and variety of the phytoplankton. This will be treated in detail later by Prof. Bachmann. Diatoms were very abundant. *Tabellaria fenestrata*, var. *asterionelloides*, was of more luxuriant growth than had been observed elsewhere, the colonies often making more than two complete turns of the spiral. The rare crustacean *Ophryoxus gracilis* (discovered in Britain in Loch Ness by Mr. D. J. Scourfield) was present. The heliozoon *Clathrulina*, of frequent occurrence in our larger lakes, but usually as skeletons merely, was here abundant and alive, the majority of the examples having the pseudopodia fully extended.

Lochan na h-Earba.—The fauna calls for little comment. *Latona setifera* was found in the west loch. Of the summer crustacea, *Holopedium* was in both lochs, *Leptodora* only in the east loch, and *Diaphanosoma brachyurum* only in the west loch. Desmids were conspicuous in both lochs, and included some species which we have not often found.

Loch Laggan.—The plankton is quite ordinary, except that it is the only loch of the basin where we observed two species of *Diaptomus*. One was the common *D. gracilis*, the other difficult to determine, owing to the lack of fully matured examples, but almost certainly *D. laticeps*.

Loch Ossian and Loch Ghuilbinn.—The fauna of these lochs is in no way peculiar. Desmids were scarce in Loch Ossian, and abundant in Loch Ghuilbinn, where, among others, *Staurastrum ophiura* occurred.

Loch Treig.—*Bosmina obtusirostris* had a very long spine, approaching the variety *longispina*, as found in Loch Morar. This is the only large lake where we found the rotifer *Triarthra longiseta*. Skeletons of *Clathrulina* were abundant. The phytoplankton was fairly rich in species, and about a dozen Desmids were noted.

An Dubh Lochan.—This was examined very late in the season. The chief peculiarity noted was the red colour of the *Diaptomus*, a feature found in more marked degree in Lochan Lùnn dà-Bhrà. Desmids were abundant, and the two fine species, *Staurastrum braziliense* and *S. longispinum* occurred.

Lochan Lùnn dà-Bhrà.—The *Diaptomus* in this loch was so deep red that when the nets were taken out after towing, they seemed to contain blood.

Loch nan Gabhar.—From its shallow weedy character an abundant fauna would be expected here, yet we found the collections exceptionally poor.

CORRECTION.—*King Eider Duck.*

In our paper on the "Lochs of the Tay Basin," Part III., which appeared in the *Journal* for January, 1904 (vol. 23, p. 40), the following sentence occurs: "The king eider is said to have bred in the White Loch for some years, and to have successfully reared its young." This is evidently an error, and I am sorry the sentence should have escaped my notice in reading the proof of the paper. The statement was entered in the note-book of one of the assistants of the Survey on the authority of one of the neighbouring proprietors of the district, familiar with the ornithology of the White loch. I am not able to state what bird was taken for the king eider.—JOHN MURRAY.

THE VOLCANO OF SMEROE, JAVA.

By I. A. STIGAND, B.A., F.G.S.

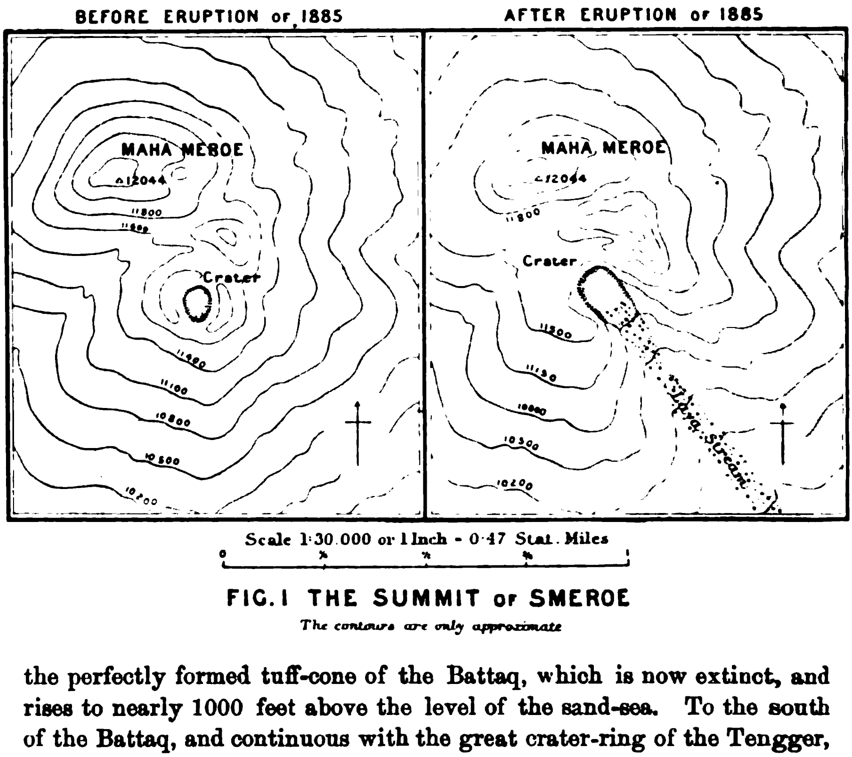
THE Smeroe, the highest peak and most persistently active volcano in Java, is situated in a wild and uninhabited district of East Java, and its cone has raised itself on the southern edge of an elevated and extensive system of ancient craters. As viewed from a distance, it appears as a lofty grey cone, upraised above the surrounding mountains, and from time to time—at intervals of from one minute to half an hour—a steam-cloud of globular structure is discharged from the crater, which, gradually detaching itself from the mountain, is borne away towards the leeward horizon. The form of these outbursts is variable; sometimes all the materials blown out by the steam fall in the vicinity of the crater, sometimes blocks of all sizes are scattered over the mountain. There are also times when the volcano is in a state of violent activity, *e.g.* in the year 1885 there was a great eruption.

The ascent of the mountain can either be made from Malang, to the north-west, or from one of the resorts situated on the Tengger mountain —above Passoeroean, to the south. In the latter case, a descent to the plains is not necessary, but the route keeps on a high level across the system of ancient craters.

I will not dwell on the Tengger and the well-known "sand sea," enclosed by the ring of hills forming its crater, and enclosing the volcano of the Bromo with the extinct volcanoes of the Widodaron and Battaq, but, since these lie on the route to the Smeroe, a short description may not be out of place.

The Tengger mountain is an ancient volcano of prodigious size, which must have formerly reached a height of, perhaps, 15,000 feet. To-day the summit consists of a vast crater-ring whose maximum diameter has a length of about 4 miles, the crowning peak of the encircling hills—the Penandjahan—rising to an altitude of 9035 feet. The interior of this great ring consists of a vast plain of sand and volcanic dust, with some blocks which have been discharged at the times when the Bromo has been more than usually active.*

In the midst of this great ring, and slightly to the east, is situated



Scale 1:30.000 or 1 Inch - 0·47 Stat. Miles

FIG. 1 THE SUMMIT OF SMEROE

The contours are only approximate

the perfectly formed tuff-cone of the Battaq, which is now extinct, and rises to nearly 1000 feet above the level of the sand-sea. To the south of the Battaq, and continuous with the great crater-ring of the Tengger, is situated the extinct volcano and craters of the Widodaren (*i.e.* Phantom), which include the craters called the Segara Kedi Kidoel (South sea), and the Segara Kedi Lor (North sea). The former, which is to the south-west, has an elongated shape, and is situated at a high altitude. The highest point of the crater ring—the summit of the

* It has been suggested by Dr. Verbeek that the ancient Tengger volcano had originally two principal centres of eruption, about 2 miles apart, in 'Geologische Beschrijving van Java en Madoera' ('Verbeek en Fennema'), vol. i. § 2, II.

Widodaren—attains an altitude not much below that of the Penandjahan, the culminating point of the whole Tengger. The Segara Kedi Lor is situated on the north-east of the Widodaren, and is a large circular crater, similar in form to that of the Bromo, the bottom being at the level of the sand-sea, and the sides only rising about 500 feet. The bottom is comparatively level, and consists of dark sand with loose blocks of lava. Adjoining this on the north-east, and overlapping it, is situated the active crater of the Bromo.

The Bromo.—This volcano is composed of a low tuff cone, proportionately, of very great diameter, the sides only rising a few hundred

FIG. 2.—DISTANT VIEW OF THE SMEROE FROM THE PENANDJAHAN (9085 FEET), WITH THE "SAND SEA," CONTAINING THE BATTAQ AND BROMO, IMMEDIATELY IN FRONT, WHILE THE MOUNTAIN BETWEEN THE LATTER AND THE SMEROE IS THE AJEK AJEK.

feet above the surface of the sand-sea, while the bottom of the crater is slightly below the level of the sand-sea. The cone is composed of fine volcanic sand and solidified mud with blocks of lava. The volcano is usually only in a state of solfatarous activity, but there are also times when the activity is of a more violent nature, and immense volumes of steam rise up, carrying lapilli and the blocks which can be observed strewn on the cone and even on the sand-sea itself. On the bottom of the crater and around the lower part of the sides there are a number of fissures and holes, from which steam escapes in the form of jets with a hissing sound. These are continuous and not spasmodic, as is the case with the steam issuing from volcanic vents of greater activity. The fissures and holes, and indeed a considerable part of the bottom of the crater, are coated with sulphur, which is precipitated, doubtless, by the chemical action of the gases, sulphur dioxide and sulphuretted hydrogen, which issue from the vents, thus—

$$2H_2S + SO_2 = 2H_2O + 3S^*$$

At times the fumes of sulphur dioxide are suffocating at the edge of the crater. The bottom of the crater and sides are coated also with other precipitations or sublimations of white and pale yellow colours, much of which is probably due to chlorides and sulphates of iron. Numerous blocks that lie scattered about the cone and sides of the crater are thus coated. At the bottom of the crater a system of cracks may be observed through the deposits, resembling gigantic mud-cracks.

The normal activity of the Bromo is not of a very imposing nature; a number of fumeroles, or small steam-jets, which are more numerous at the lower part of the sides of the crater than at the bottom, issuing from fissures and holes which are coated with sulphur, together with the presence of other deposits abundant at the bottom and sides of the crater, constitute the usual phenomena of activity of this volcano. Were it not for the occasional eruptions referred to above, this volcano could only be denoted a solfatara. If, however, we visit the volcano at night-time, a much more imposing spectacle is witnessed, and the close proximity of molten lava is revealed by the ruddy glow coming through the various fissures and holes from the molten lava beneath. The lava of the Bromo is a dark pyroxene andesite on the verge of the basalts. Dr. Verbeek considers that it has sufficient olivine to rank among the basalts.

To the north-west of the Bromo, and, at the base, overlapped by its newer materials, is situated the Battaq, the only one of the series of newer volcanoes which have risen up within the great ancient crater of the Tengger—the sand-sea, which remains to be observed.

This is a perfectly formed tuff cone, rising about 900 to 1000 feet above the sand-sea, with steep sides, and the beautifully curved outlines typical of such cones. It is almost wholly composed of tuff, but on the east side, at a considerable altitude, there has been an ancient flow of lava, which is exposed in the gullies. This lava is a red-coloured basalt with plagioclase crystals, the colour being due to the decomposition of its ferruginous ingredients.

A series of gullies has been carved out by water all round the cone, and these gullies gradually deepen as they approach the base of the cone. By the regularity of these gullies, which start from the very top of the cone and run straight down, the formation of this mountain must have been very rapid. The crater at the top has been, to a large extent,

* Another reaction—$2SO_2 + H_2S = H_2SO_4 + 2S$—may also take place, resulting in the production of sulphuric acid (as well as sulphur), which, combining with the iron, etc., contained in the surrounding rocks, would form sulphates.

obliterated by deep watercourses, which start from the low crater ring on the north-west side, and run towards an outlet on the south-east side; but the crater must always have been a shallow one.

As formerly observed by Jukes, these extinct volcanoes of the Tengger give a remarkable exhibition of different stages in the sculpture of volcanoes.

On the occasion that we made the excursion to the Smeroe, having left the hotel at 3 a.m., we reached the edge of the sand-sea at the Moenggal pass just at daybreak. Looking down on the sand-sea, we saw that the arena was carpeted with white clouds, a curious phenomenon, not unusual in the early morning. Having descended to the sand-sea, we crossed over the plain to a pass on the opposite side of the ring.

From the top of the pass there is a good view of the Smeroe, which then appeared to be belching forth steam clouds with unusual vehemence and rapidity. After skirting for a considerable distance the southern part of the ring of the Tengger, the track descends through bush and long grass, which reaches almost as high as the ponies. The path here enters a wilder district to a plateau, containing three small lakes at the intersection of the Tengger and Ajek Ajek, formed by the overlapping of the materials accumulated by these two ancient volcanoes.

A halt is convenient at one of these lakes, which can be reached in about three hours from the southern part of the Tengger. Beyond the lake the track again threads through bush and tall grass, concealing numerous pitfalls, and then begins to mount along a narrow spur of the Ajek Ajek. The track unnecessarily crosses the highest point of the mountain, and the ascent is long and tedious, through thick grass, which almost completely envelops the ponies, and which is interspersed with tjemara trees and bush.

After some while the culminating point of the Ajek Ajek (9162 feet) is reached, but the bush and trees tend to hide a magnificent view. The Tengger is situated to the north, while to the south and south-west are the mountains belonging to the remnants of a gigantic ancient crater ring, situated between the Tengger and Smeroe, of which the Ajek Ajek itself is the northern portion. The western half only of this ring remains, consisting of a semicircular range of mountains, stretching from the Ajek Ajek on the north to a mountain called the Kepala, situated to the south and in front of the Smeroe. Also there are several newer volcanic peaks which have risen up within this crater; the Kepala (9864 feet) has also been a separate centre of later eruption, consisting of basaltic rocks; the rocks of the Ajek Ajek belong to the pyroxene andesites. The panorama includes the Kloet and Kawe, etc., on the other side of the plain of Malang, on the west; also, on the north-east a distant view of Probolinggo; while the peak of the Smeroe lies behind the Kepala to the south.

The track, if it may be called even this, now descends in zigzags the precipitous south side of the Ajek Ajek, which is, of course, the inner wall of the great crater ring above mentioned. The descent has to be made on foot; here, too, the route is through the long leaf grass, interspersed with tjemara trees.

Ajutting from this side of the Ajek Ajek is a later volcanic cone, and the route descends to the pass between this and the Ajek Ajek; then, turning westward, it descends to a portion of the old crater plain below, which now presents the appearance of a valley, of which the northern and western side is bounded by the Ajek Ajek and the ancient crater ring, while the newer volcanic peak, referred to above, shuts in the valley on the east. Other newer volcanic peaks are situated to the south and east, which, overlapping, form one massif.

The route traverses the length of the valley, at the end of which a small crater lake * is reached. This is surrounded completely by hills, but with a large mound on the north side, over which the lake is approached. If an early start is made from the Tengger, the lake can be reached in an hour or two before sunset, and is a convenient place to pass the night, there being a suitable place for a camp at the western side of the lake. The base of the actual peak of the Smeroe is about five hours distant.

After an uncomfortable and unrestful night here, which was bitterly cold—the altitude of the lake being not far short of 8000 feet—we started for the Smeroe on the following morning. There was hoar-frost on the grass until about 8 a.m. The route, after ascending out of the hollow in which is situated the lake, follows along a grassy valley, and at length ascends slantwise the northern slopes of the Kepala to a pass in the mountains. The route along the Kepala is through very thick and long jungle grass and a forest of tjemara trees. The track is obscure, being frequently not recognizable, and over rough country; but the trees were blazed in some places to point out the route. At the top one finds one's self in an open grassy place, which gradually slopes down to the Smeroe, and there a magnificent view of the Smeroe, which is quite close, opens out. Fig. 3 was taken from this point at the time when the mountain was blowing. The view is taken from the north side of the mountain, being the side on which the ascent is made. The crater lies at the other side, just below another point on the south side, which is not quite so high as the Mahameroe, the latter being the summit seen in the photograph. From here the route descends to the hollow lying between this pass and the Smeroe, and the descent is not very long. At the bottom of the hollow there is a lot of *débris*, deposited by the torrents descending from the mountain, and on the north side there is a low cliff of old red lava much decomposed. The first half of the ascent is up steep slopes through forests of tjemara trees. After

* Named "Kembolo."

FIG. 3.—THE SMEROE FROM A POSITION IN THE VICINITY.

ascending for about one hour and a half, a place is reached where two small idols are situated, which the natives worship, and where, placing food before them, ostensibly for sacrifice, they elicit favour of the god of the volcano, and for the ascent; and some time was spent by them in thus invoking the gods in the form of these idols.

At not a long distance above this joss-place the woods cease, and there is no more vegetation on the bare cone. A first look up the grey slopes of sand and coarser ejectamenta does not give a correct impression of distance to the top. When, however, the comparatively slow progress up the mountain is observed, the great height is realized. The progress is the more slow on account of the looseness of the sand, which makes one slide back and sink in to a considerable extent at each footstep, and in some places it is very steep and somewhat difficult to gain a foothold. The ascent over these loose materials occupies about two and a half hours. As the summit is approached the slope gets steeper, the sides forming the curves typical of volcanic ejectamenta cones, thus becoming more precarious.

Not far from the summit the route crosses a narrow ridge formed of loose fragments in a crumbling condition, which descends steeply on either side, and then a gentle slope is traversed, and the summit of the Mahameroe is reached, the highest point of the Smeroe, which is 12,044 feet above the sea, and situated on the north of the mountain. It is a flat top, covered with angular blocks and other ejectamenta from the crater. It is separated by a depression from the crater and the other point on the south-east which is overlooking the crater.

Fig. 4 is taken from the Mahameroe, showing the other point. Although it looks higher in the photograph, there is a declination of 2° from the former to the latter. On the right-hand side of this is situated the crater. Fig. 1 shows the configuration of the summit before and after the great eruption of 1885, and it seems that before the crater —known as the Djonggring Seloko—was intact, whereas now it is open on the south side of the mountain.*

The point referred to on the side of the crater, which is, of course, part of the crater wall, is sometimes known as the Smeroe proper. It can be reached in half an hour from the Mahameroe, but the ascent is attended with some danger on account of the proximity to the crater; but the whole top of the mountain is subject to missiles from the sudden and capricious outbursts. The guides and coolies appeared to be very

FIG. 4.—VIEW FROM THE MAHAMEROE, SHOWING THE SOUTH PEAK (SMEROE PROPER), WHICH OVERLOOKS THE CRATER.

fear-stricken, probably as much from awe of their deity (the volcano) as from the danger, being anxious to go down, and none of them would

* Also, there was reported to have been a small depression, in the form of a crater, on the east of the summit of the Mahameroe before the eruption of 1885 (*vide* Fig. 1), which was filled up during that eruption; possibly the ancient lava-stream on the east flank of the cone (visible in Fig. 3) may have originated from this crater; there are also vestiges of a former lava-flow near the summit on the same side.

accompany me to the other point. Being anxious to see the crater and get a photograph of it, I rapidly descended to the hollow and followed along the ridge to this point, where the whole of the crater may be viewed.

On the ridge leading to this point there was a large block, fully one and a half tons in weight, which was radiating out a considerable amount of heat; and a small piece split off the side, which I wanted as a specimen, was still so hot that it could not be held in the hand. This block, therefore, could only have been lately ejected.

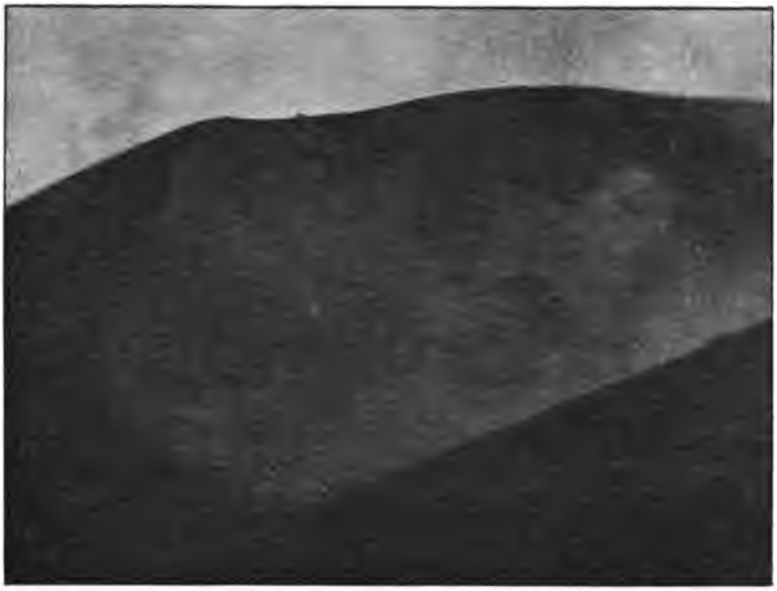


FIG. 5.—THE CRATER.

The crater is not very deep, and the surface consists of sand with blocks of lava, just the same as on other parts of the cone. There were small quantities of steaming liquid lava and sulphur scattered about the sides of the crater, and some close to the summit of this point. These had been shot out by the blasts of steam. Fig. 5 is a view of the crater from the adjacent point.

Having returned to the Mahameroe we waited to witness an outburst, but it was about half an hour before one occurred, and then only a small one, the stones ejected by the steam blast falling in or near the crater.*

* This periodic and rhythmical nature of the eruptions may be explained in the following manner. As might be expected, there is probably a column of liquid lava in a state of ebullition in the volcanic neck, and the top of the chimney being filled and covered with solid materials (blocks, sand, etc.), formed in the first instance by the

It was fortunate for us that we did not wait for the next eruption. Making a rapid descent down the side of the cone, sliding over the loose sand and stones, half an hour sufficed to reach the verge of the woods.

The idols were reached in one hour from the summit, and here the natives again prayed and gave thanks for our safe ascent and return. On the way down from this place to the foot of the cone there was a prolonged roar from the top, and the noise of falling rocks. We were in the woods, and could not, of course, see the top of the mountain. On reaching the place where the horses were left, the coolie with them said there had been an eruption, rocks falling down the sides of the mountain.

It was a tedious journey returning to the camp at the lake through the long grass, which got entangled in one's legs and the stirrups. We reached the camp just before sunset, and on the next day returned to the Tengger.

The lava of the Smeroe is a beautiful green rock with well-defined plagioclase crystals, the glassy ground-mass giving a vitreous or resinous lustre: it is a pyroxene andesite. At the northern foot of the cone there is an older lava which has a red colour, arising from the decomposition of its ferruginous ingredients, also containing plagioclase phenocrysts and some pyroxene.

REVIEWS.

ASIA.

Afghanistan.

'Afghanistan.' By Angus Hamilton. London: Heinemann. 1906. *Map and Illustrations. Price 25s. net.*

As an amateur contributor of useful information to the Intelligence Department of the War Office, Mr. Angus Hamilton probably stands unrivalled. The results of a year's travel in Central Asia and a year's study of the literature bearing on the subject of Afghanistan are combined in this one volume, and if the year's travel did not take him over the borders of Russia into Afghanistan itself, it at any rate enabled him to collect a mass of information at first hand bearing on the relations of Russia to that country which may be accepted thankfully as a most useful contribution to our knowledge on the subject. If the subject-matter of the book had been the Russian borderland in Central Asia rather than "Afghanistan," it would perhaps have been more within the limits of the author's grasp. So far as Afghanistan is concerned,

solidification of the top of the molten lava, there is not a free transit of the steam from below; accordingly, as the bubbles of steam rise from the molten lava, the steam collects over the column and in the crevices and cavities of the plug of *débris*, until sufficient pressure is generated for the steam to force an exit, blowing out, with also small quantities of liquid lava, blocks, sand, and clouds of dust. As the blocks and other materials settle down and rearrange themselves after the passage of the steam blast, and solidification of the top of the lava column is taking place, the barrier must vary in effectiveness, and this, together with the extent of ebullition in the liquid lava, would influence the force and frequency of the outbursts.

Mr. Hamilton has necessarily been dependent on the work of others, and his selection of authorities is not always a happy one. Any compilation, however, which lumps together in one review so much information gathered from so wide a field must have a considerable value—the value which an official gazetteer would have if it were offered to the public by the War Office. As no such offer is likely to be made, Mr. Hamilton's book will probably rank as a standard book of reference for many years to come. Mr. Hamilton's style of writing naturally lapses occasionally into that of the gazetteer rather than of a popular descriptive geographical work, and his use of Russian and Persian equivalents for measures, weights, and distances does not add clearness to his statements. Nor can the map be altogether commended as an enlightened illustration of modern Asiatic geography. The spelling is inconsistent. It might almost be regarded as one of those "reversions" to an original type which occasionally check the course of a too rapid development in the general scheme of natural progress. The map is not, however, the only, nor the most important, part of the book which wants amendment in order to bring it to the level of modern requirement. The extreme pessimism of Mr. Hamilton's views as regards Russia is happily rare in these days; when the real value of Russia as a military power, and the possibilities of an annexation of India to her Asiatic dominions after a successful invasion through Afghanistan, are weighed by the light of what is positively known both of her powers of offensive military action and of the physical difficulties of the Afghan bufferland. Also, Mr. Hamilton treats the question too much from the European standpoint, as if it were the question of a fight between two European countries for the possession of a slice of Asia.

Needless to say, this is not the popular view of the subject either in Afghanistan or in India, as Mr. Hamilton would have learned had he been in those countries. In Asia it is regarded as an Asiatic—as a Mohammedan—problem, and the question at issue is the destruction, or maintenance, of that which many Asiatics regard as the first Mohammedan state in the world. As to the fighting capacity of Afghanistan, the author adopts the superficial view that an Afghan army would be a contemptible force in the field, basing his theory on want of discipline, of leading, and of modern military weapons. The last want may certainly be remedied, and the two first would admit of much modification under the pressure of actual service. Without any of these three undoubtedly important factors in the composition of an efficient military force, it is not for Englishmen to belittle Afghan fighting capacity with the memory of the Khaibar, of Maiwand, Kandahar, Sherpur, and Ahmed Khel fresh in our memories. But this is, after all, but idle speculation. It would have been more to the purpose if Mr. Hamilton had given us his views on the possibility of the existence of any basis for a sound and lasting agreement (as agreements go in this changeful world) with Russia, arising out of her own schemes for peaceful developments in Asia, or out of ours. In the opinion of some of those who should be competent to judge, such a basis does exist; and, inasmuch as we are approaching gently and slowly, but surely, towards that point where a mutual recognition of the advantages of an international agreement will become the popular view, we shall probably soon hear more about it. Setting aside Mr. Hamilton's pessimistic views, we are only too glad to recognize the value of his book. His patience and his research have resulted in the best general compendium of the actual condition of affairs in Afghanistan as they exist at the beginning of the twentieth century that has yet been given to the public, and even when the lapse of a few more years may make large alterations in his statistics, and witness a possible total change of face on the part of the ruling authorities in Afghanistan, the book will still be valuable for the wealth of accurate detail which it contains about much which is as permanent as the everlasting hills.

T. H. H.

Central Asia.

'Mongolia i Kam. Trudi Ekspeditsii Imperatorskavo Russkavo Geographicheskavo Obshchestva, covershenno v' 1899–1901 gg., pot rukovodstvom P. K. Kozlova.' Vol. i. parts i. and ii. St. Petersburg: 1905. Pp. 732.

Kham was the proposed goal of Prjevalski's fifth expedition, which he did not live to carry out, and Roborovski was struck down by illness on the threshold of Eastern Tibet. Kozlof, who had accompanied Prjevalski, Pevtsof, and Roborovski, determined to explore this part of Central Asia, and in the spring of 1899 crossed the frontier to Kobdo, whence he gained the Mongolian Altai. East of the meridian of Kobdo this range assumes a different character, rising only in three points above the limit of perpetual snow, and partaking of the drought of the adjacent Gobi. Having made an excursion from the Artza-Bogdo mountains into the Gobi, the expedition turned southwards to the Kuku-nor and westwards to Tsaidam. Then began the most interesting part of the journey, in which Kozlof and his companions marched through the little-known country of Kham as far south as the vicinity of Chamdo, returning northwards by a more easterly route from Khor-Gamje on the Ja-chu. South of the Dividing range, between the basins of the Hwang-ho and Yang-tse-kiang, three great ranges running from north-west to south-east were crossed, to which Kozlof gave the names of the "Pundit A.-K.," "The Imperial Russian Geographical Society," and "Woodville Rockhill," while a smaller range on the upper Yang-tse-kiang, or Di-chu, was selected to commemorate the unfortunate Dutreuil de Rhins. These mountains are of considerable height—up to 18,000 feet at least, and many of the passes are over 15,000 feet. The country contrasts strongly with Tibet proper. Being within the range of the south-west monsoon from the Indian ocean, it receives abundant precipitation. The valleys are clothed with vegetation, which becomes more luxuriant towards the south, in the basin of the Mekong, and harbours a large variety of wild animals and game birds. Even in winter the climate is mild for such an altitude.

At the Mekong Kozlof reached the furthest point of his journey, being prevented by the armed opposition of the Tibetans and the protests of the authorities from entering the sacred province of Lhasa, or even visiting Chamdo. On his homeward journey he again passed by the Kuku, and crossed the Gobi by a route to the west of Prjevalski's. He has much to say on the manners and customs of the Mongols and the people of Kham, and on the flora and fauna of the country. Among the specimens he obtained was the "jara" (*Nemorhædus khamensis*), a link between the antelope and the goat, the Chinese leopard (*Felis fontanieri*), the white Tibetan pheasant (*Crossoptilon thibetanum*), and the ape (*Macacus vestitus*). This animal is never molested by the natives, who fear to incur the guilt of murder by killing a creature so like a human being. Kozlof is the first traveller who has navigated the Central Asiatic lakes to any great extent, having taken with him a collapsible boat with a view to collecting plankton.

The work is accompanied by maps, showing the geographical results of the exploration, which was extended on either side of the main route by the excursions of Kozlof's companions, MM. Kaznakof and Ladigin. Some of the excellent views represent charming Alpine scenery, and one strikingly portrays the utter desolation of the Gobi hills.

AMERICA.

Alaska.

'The Geography and Geology of Alaska: a Summary of Existing Knowledge.' By H. Brooks. With a section on Climate by Cleveland Abbé, jr., and a Topographic

Map and Description thereof by R. U. Goode (U.S. Geological Survey, Professional Paper No. 45). Washington: Government Printing Office. 1906. *Maps and Plates.*

Alaska, though still only an "unorganized territory, district, or colony" of the United States, without a territorial form of government, is developing so rapidly that the attention of many explorers and surveyors—officials of the Federal Government as well as private investigators—has been turned to it. Within the last eight years papers and books on the country have appeared in great numbers, so that an official summary of existing knowledge is especially welcome to the student of geography. Very great progress has indeed been made in this short period in the investigation of both the topography and geology of Alaska, and it is now possible to obtain some idea of the relationship between the structure and surface features of the country, though the conclusions on this subject must be only tentative as yet. The detailed topography is very complicated, and the country is best treated of in its four main natural regions—the Pacific Mountain system, the Central Plateau, the Rocky Mountain system, and the Arctic Slope region—which are continuations northwards and westwards of the familiar orographic divisions of the western United States and Canada. The Pacific system is a mountain mass from 100 miles to 200 miles wide, rising steeply from the coast and generally dropping sharply on the northern side to the interior plateau. It consists of four main divisions—the coast, Alaska, St. Elias, and Aleutian ranges—and these all, with the exception of the last, which is volcanic in origin, its anticlinal axis (north-east to south-west) showing a series of cones of the typical ash-built form, give evidence, in the striking uniformity of the height of their summits, of having been carved out of an older highland whose surface had been previously base-leveled. The whole pacific zone has been subject to many dynamic revolutions, but these crustal movements have had no direct effect on the present topography, which is of a very youthful character. In the Alaska range the main central mass of the system (crest-line from 8000 to 10,000 feet), the presence of enfolded Eocene beds in the heart of the mountains, indicates extensive disturbance since early Tertiary times, and the uplift from which the present mountains were carved was probably later than this Eocene deformation, and took place in the middle or later Tertiary period. It was a differential elevation, with its maximum line along the present crest of the mountains, and the uplift rejuvenated the sluggish river systems of the old peneplain, and, being slow and probably intermittent, the larger streams were able to maintain their old valleys, so that the present main drainage channels have been determined by antecedent conditions.

The Rocky Mountain system is of about the same width as the Pacific zone, but has a less marked relief, its crest-line being from 5000 to 8000 feet high. It rises from the central plateau in a gradual slope, but drops sharply to the plain of the north. This region is less known than the southern mountain system, but sufficient evidence has been obtained to show that it also has been subject to many periods of disturbance. Two anticlinal axes can be distinguished, separated by a broad syncline, following an east-to-west line. The last of the crustal movements must have taken place in early Tertiary times, as the Eocene strata are gently folded, while the Pliocene are undisturbed. Like the Pacific zone, this region was then reduced to a peneplain, and subsequently uplifted along the same east-to-west line, the rivers taking consequent courses to the north and south. The main drainage, as far as it is known, is transverse, only the smaller tributaries taking longitudinal courses, with the exception of the Kobuk and Noatak rivers, which flow in broad longitudinal valleys, dividing the western end of the system into distinct ranges.

The central region of Alaska is a dissected plateau, whose surface is cut up by numerous river-channels, the interstream areas presenting an even flat-topped appearance. These have no constant relation to rock structure, being formed by the upturned edges of both hard and soft strata, and the surface is, in fact, "entirely discordant to the highly contorted metamorphic rocks which make up much of the plateau." Its general form is that of a broad shallow trough, the axis coinciding with the river Yukon, from 4000 to 5000 feet high at the edges, and 3000 feet in the centre. The rivers have carved out broad valleys several thousand feet below the summit level, with gently sloping sides, except in a few cases where recent local uplift has caused an acceleration of stream-cutting. A not uncommon feature of the plateau is the presence of broad flat lowlands, shut in by steep scarps in the surrounding highlands. The Yukon flats, with an area of about 20,000 square miles, is the largest of these "basin lowlands," the existence of which is explained by changes in the cutting power of the streams caused by barriers, probably due to warpings in the crust of the Earth. Within the basins the rivers are sluggish, and aggradation is going on, while in the narrow exits the channels are being rapidly cut down.

The Yukon plateau is the oldest part of Alaska, containing a belt of Archæan gneiss, and here, probably, lies the protaxis of the north-eastern part of the continent. The Eocene sandstones and conglomerates of the Yukon valley are closely folded and faulted, so that the base-leveling of the plateau must have been as late as the middle Tertiary period.

The correlation of the various peneplains is a matter of considerable importance in the interpretation of the physiographic history of the Alaskan region. Mr. Spencer has already contended that the Pacific Mountain system and the Yukon plateau were planated at the same period,* either late Eocene or Miocene, and that the present relief is largely due to subsequent differential uplift. The author of the present monograph supports that contention, and further correlates with these peneplains that of the northern Rocky Mountain zone, which Mr. Schrader had considered to be an older planation surface. Mr. Brooks includes also the Anaktuvuk plateau, on the northern margin of the Rockies, forming part of the Arctic Slope region, which is very similar in character to the Yukon plateau. It is about 60 miles wide, and stands at an elevation of 2500 feet, falling in a well-marked escarpment to the lower level of the coastal plain, a constructional plateau of fluvial formation.

The coast-line of the Arctic ocean, and that of the Bering sea also, is uniformly straight, with gentle inland slopes, broken in parts by a series of terraces marking old sea-beaches and indicating recent elevations. The Pacific shore-line, on the other hand, is very irregular, with numerous deep inlets, suggesting recent depression. But although these fiords of south-eastern Alaska have all the characteristics of a drowned topography, it must be noticed that much of the erosion of the channels now below high-water line was the result of glaciation. Except in this region, however, glaciation has had only a small effect on the topography. The ice from the coast and St. Elias ranges, uniting with the cordilleran glacier, did indeed block the southward-flowing streams, such as the Alsek, and divert them to the Yukon, and in the case of this river the diversion of some of its headwaters has been permanent. In all the higher ranges, also, cirques and U-shaped valleys are the typical forms, but they are regarded as only modifications of a previous topography.

N. E. M.

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* A. C. Spencer, "The Pacific Mountain System in British Columbia and Alaska." *Bull. Geol. Soc. Amer.*, vol. 14.

GENERAL.

History of Colonization.

'Die Territoriale Entwicklung der Europäischen Kolonien.' By Prof. Dr. Alexander Supan. Gotha: Justus Perthes. 1906.

In his desire to supply a marked deficiency in our historical literature, the author of this work has attacked a subject which might well daunt the most learned and industrious historian. To crowd into the space of a single volume the world-wide expansion of the territory and influence of the European races during the last four centuries, even with the proviso that the work is to be a compilation rather than a monument of original research, is a task requiring special aptitudes and methods, if the result is to be anything more than a mere dictionary of reference. The chronological rather than the regional treatment is adopted as being most suited to the object in view; and the work is divided into periods, in each of which is set out the territorial development of all the different regions of colonization. It is evident that only on some such principle can the essential unity of the whole movement of expansion be preserved. But there are two kinds of chronology—that of the chronicler and that of the historian. The use of dates depends on the point of view adopted, and a list of dates explains nothing, in the absence of a clear expression of the principles, either political and economic or geographical, which underlie the facts enumerated. The principle of orderly development, particularly in the earlier part of the book, is often so buried under a mass of details that it can be disinterred only with the utmost difficulty. Dates in large numbers are inserted which would be more in place in a detailed study of special regions, and place-names frequently occur which could hardly be marked on a world-scale map, while the insets in the text do not always supply the deficiency. In short, the excellent general maps at the end of the volume give a clearer idea of the broad features of colonial development than the text to which they are related. This superabundance of detail is less in evidence in the sections dealing with the nineteenth century. There is more criticism and less uncorrelated fact. The individuality of the author asserts itself with good results, and so we have an interesting and well-reasoned account of recent changes. The value, to the English reader, lies particularly in the standpoint of the author. The interpretation of the motives and methods of English colonial policy by a foreign critic is sometimes startling, and always gives food for thought. The whole volume will be found very useful for reference, as the author is careful to give his authorities, and has worked out the subject with great completeness. He has given in convenient shape information on neglected subjects and odd corners of the Earth which has hitherto been inaccessible to the ordinary reader. But to the geographer or historian who expects to find new points of view, the volume is likely to prove disappointing; while the want of proportion between details and general scheme detracts greatly from its value to the casual student. The dates for the maps are well chosen, and the most fruitful method of study would probably be to examine the maps first with care, and then to seek the explanation in the details of the text.

A. J. S.

An Autobiography.

'A Varied Life.' By General Sir Thomas Edward Gordon. London: Murray. 1906. *Maps and Illustrations. Price 15s. net.*

The interest of Sir Thomas Gordon's autobiography commences, from the geographical point of view, with his appointment as second in command to the Kashgar Diplomatic Mission, during the course of which a flood of light streamed across the hidden areas of Asia, about which only the scantiest information had hitherto been available. The writer's experiences were published in the 'Roof of the World,' perhaps the most striking and appropriate title ever given to a book, which title, it is interesting to learn, was suggested by the late Sir Henry Yule.

Sir Thomas Gordon was, most appropriately, appointed to meet the late Amir Abdur Rahman when His Highness visited Lord Mayo and Rawul Pindi; but of still greater interest is the account, albeit an extremely brief one, of the author's journeys in Persia, during the course of which he visited the Karun valley, Yezd, and Tabriz. As is only natural, the military aspect is repeatedly referred to, and illustrations are given of the Zil-u-Sultan's troops, which were unfortunately disbanded nearly twenty years ago, but the memory of which will perhaps encourage the Persian reformer of to-day. To conclude, Sir Thomas Gordon's career, if it does nothing more, may, at any rate, prove to our youth what a fascinating life of adventure, combined with interest, is still to be found in the gorgeous East.

P. M. S.

THE MONTHLY RECORD.

EUROPE.

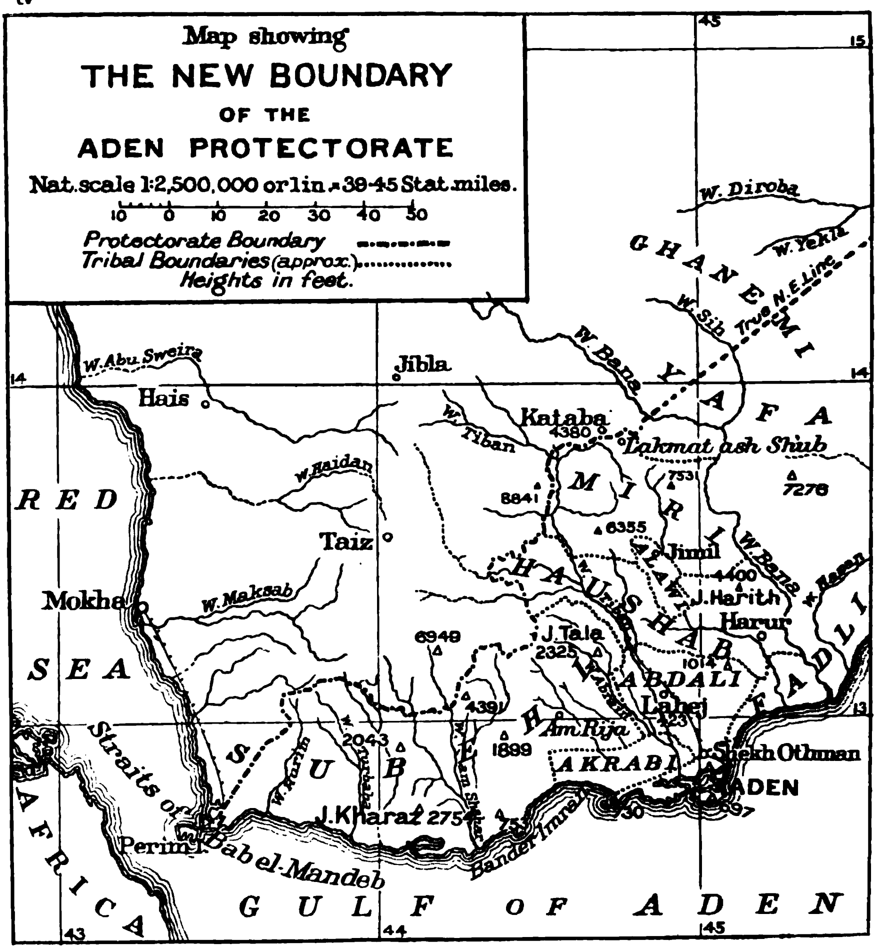
The New Route to Ireland.—The new route to the south of Ireland inaugurated by the Great Western Railway Company was opened for public traffic on August 30. Since the opening of the Severn tunnel and other improvements in the Great Western route to South Wales, the most serious undertaking has been the provision of harbour facilities near Fishguard, which has long been recognized as the most favourable starting-point for the cross-channel service. The exact spot chosen for the harbour was at Goodwick, a little west of Fishguard, which lies in a sheltered bay, but has hitherto entirely lacked accommodation for shipping. Extensive blasting of the cliff, and the building of a breakwater on the one exposed quarter, have now supplied a harbour with a minimum of 20 feet of water at the quay-side. The corresponding port on the Irish side is at Rosslare on Wexford bay, which is reached by a service of turbine-propelled steamers, capable of a speed of 22½ knots. Cork is reached in 13 hours from London, Killarney in less than 14 hours; the time taken from London to Fishguard being 5½ hours, and from Fishguard across the channel to Rosslare, 3 hours 20 minutes. It is claimed that Fishguard will attain importance in the future in connection with the mail route to New York and the trans-oceanic services, being some 50 miles nearer to New York than Plymouth, 115 miles nearer than Liverpool, and about 175 miles nearer than Southampton.

Encroachments of the Sea on the Coast of Mecklenburg.—The Mecklenburg coast has, like other of the lands bordering the North Sea and Baltic, from time to time suffered losses from the encroachments of the sea, the last occasion on which a severe inroad occurred being in December, 1904, when, as the result of storms from the south-west and north-west, veering ultimately to the north-east, the level of the sea became abnormally raised on this coast, and considerable damage resulted. The changes thus effected were soon afterwards carefully examined by Prof. Geinitz, of Rostock, who has long been intimately acquainted with the physical features of this coast, and had, only in 1903, published a memoir on the encroachments of the sea thereon. The results of his most recent study have been printed as No. 16 of the *Mitteilungen aus der Grossherzogl. Mecklenburg. Geologischen Landesanstalt* (Rostock, 1905), accompanied by a series of excellent photographs, in some cases showing the state of the coast-line before as well as after the storm of 1904. The structure of the coast varies in different localities, and Dr. Geinitz traces in an instructive way the corresponding differences in the effects of the onslaught of the waves. Dunes fringe the coast in places, whilst elsewhere there is an abrupt cliff formed of sandy and marly strata, known by the name of "klint." As a general rule the dunes were found to have efficiently protected the land behind them, though often in great measure destroyed themselves and occasionally breached so that the sea flooded the low-lying tracts on the landward side. On the other hand, the cliffs were frequently undermined so that large slices collapsed, and it was in these cases that the most serious loss of land occurred. The shore has of late years been protected by a series of low breakwaters, and these suffered considerable damage, though their beneficial effect was traceable, not only directly, but by means of the accumulation of beach material to which they had given rise. A measure of this accumulation was afforded at one spot by a large block of granite which had fallen from the cliff, and in a short time had been completely buried. At another spot Dr. Geinitz was able to accurately measure the retreat of the cliff face (1 metre) by the aid of a block whose previous distance from it had been known. He also gives photographs showing the position of a tree, relatively to the shore, before and after the storm, having chosen it as an example of the action of the prevailing winds. The greatest loss amounted to over 20 yards, this occurring on the margin of the Rostock heath, an area composed of sands, etc., apparently not much above sea-level. By the removal of these strata, the underlying peaty beds were in places laid bare on the shore. Dr. Geinitz noticed that new accumulations of sand were already forming in places, and expresses the hope that the dunes may re-establish themselves before the next severe inroad occurs.

Anthropogeography of Southern Bavaria.—An article by Dr. J. Reindl in the *Mitteilungen* of the Munich Geographical Society (1, part iv.) demonstrates, with copious illustrative detail, how the geography of a region, more particularly its orography and geological structure, prescribes the mode of human settlement, and exercises a determining influence on the character of its population and their mode of settlement. The region dealt with ranges from the Bavarian frontier in the south, northwards to the southern edge of the Jura and the Bavarian forest, and from the Lake of Constance and the Iller on the west to Salzach and the Inn on the east. This region is highly diversified, not only in its orographical and geological, but also in its anthropological features. Very different is the anthropology, *e.g.*, of the somewhat retired but fruitful Algau from that of the unfruitful but more accessible mountain systems of old Bavaria; that of the undulating moraine zone of the Outer Alps from that of the plain of Munich. Even in districts geologically and orographically alike, there is room for important anthropological differences. The Lech, *e.g.*, not only divides language from language and people from people; it still to-day divides also Alemannian from Bavarian settlements. By its endless arms, its woody, rushy, marshy, and sandy islands, and its vast inundations, it opposed great difficulties to transit. Further, its meridional course intersected all west to east ways, and imposed a barrier on expeditions of peoples, armies, and trade. Hence its military importance and the sharp line of demarcation it drew between the inhabitants on either side, also in a moral sense. The anthropogeography of the region falls, therefore, into that of Swabia on one side and of Bavaria on the other. The former, again, is divided into five, the latter into six, sections. A preliminary historical survey notes how on an underlying settlement of lake dwellers, probably Keltic, as conclusively authenticated in the case of the Würm, Chiem, Schlier, Staffel, Rieg, and Ammer lakes, came the impress of Roman rule. At the end of the fifth century, the extant names of the inhabitants of this region, so far as not newly immigrant German, are Roman; thereon followed the German immigration. The Bavarians (Baujvari) were Marcomanni and Quadi who had formerly taken possession of the land of the Keltic Boii (Bohemia), and thence transferred the name to their new settlements. As in England the Anglo-Saxons gave the name of Welsh to the Romanized Britons, so did the Bavarians to the Romanized Kelts, as is to be seen in the name *Walchensee*, etc. Swabia, on the other hand, became the possession of the Alemanni. Regardless of the Roman form of settlement, the Germans transplanted into this region their own type of settlement, which subsists in part to the present day.

ASIA.

The New Frontier of the Aden Protectorate.—We are indebted to the Director of Military Operations for the copy of a map prepared at the War Office, showing the new frontier of the Aden Protectorate, from which the accompanying



sketch has been reduced. The boundary has hitherto been shown somewhat vaguely on our maps, and had given rise to frequent local disputes, when, in November, 1901, an Anglo-Turkish Commission was appointed to carry out surveys on the spot with a view to its demarcation. The results of the labours of the commissioners were embodied in an agreement signed in April, 1905, according to which the boundary was definitely accepted by both parties as shown in the accompanying map. It will be noticed that to the south-west the line runs down to Husn Murad, not far from Perim island, though it has frequently been shown as reaching the sea considerably further east.

Mr. Calvert's Journey in Western Tibet.—An interesting journey in Western Tibet has been carried out by Mr. H. Calvert, Assistant Commissioner of Kulu. He crossed the frontier to Shipki on July 17 last, and proceeded towards Gartok by the summer route, which had not been previously traversed by any European. Crossing the Chumurti plain (15,500 feet) and the Laoche La, the party reached Gartok, a tiny hamlet of fourteen or fifteen houses and a few tents. Thence Mr. Calvert proceeded to Gargunsa, a miserable hamlet in a swamp, though for nine months the head-quarters of Nari Khorsum, a province 60,000 square miles in area. The return journey to Gartok was made through unmapped country, and was attended with some difficulty. On August 20, Mr. Calvert and the deputy collector of Almora set off for the goldfields, reaching Chukang on the Indus by a hitherto unknown route. The river was here small and fordable, flowing in a steep narrow valley. Thok Jalung, the famous goldfield, was found to be practically deserted, all the diggers having migrated to Thok Dalung, which was reached the next day. Mr. Calvert met the "serpon," or official sent from Lhasa to collect the gold tax, and made a thorough inspection of the gold-fields, being the first European to do so. Rudok, a picturesque village on a rocky eminence, was next reached, but was found to be largely in ruins. From Rudok Mr. Calvert proceeded to Tashijong, a large monastery on the Indus, and reached Shipki by way of the Bongru La (18,600 feet), the Chumurti plain (16,000 feet), and the difficult Badpo La (19,400 feet). For weeks the party had never been below 15,000 feet. The Tibetans were generally friendly.

The Hejaz Railway.—A very full and interesting account of the progress of this line under construction from Damascus to Mecca is given in a recent supplementary number (154) of *Petermanns Mitteilungen*, by Auler Pasha. Some information is also given in the *Bulletin du Comité de l'Asie française* for September, 1906. At present the line reaches Tebuk, 750 kilometres from Damascus, the total distance being approximately 1750. It is expected to be completed in 1913, or 1910 if the sections between Jiddah and Mecca and Mecca and Medina are simultaneously put in hand. One of the greatest obstacles was the carriage of materials, which had, at its inception, to be brought entirely by the French line from Beirut *viâ* Damascus to El Mezeirib, in the valley of the Nahr Yarmuk, a tributary of the Jordan from the east. Attempts to purchase the French line failed, and Turkey was obliged to construct a parallel line to Deraah, just west of El Mezeirib. The British concession from Haifa to Damascus was, however, purchased, and the line completed to Deraah. Owing to the necessity of making a stone bridge over the Jordan, and of constructing tunnels and aqueducts, this has formed, up to the present, the most expensive and laborious section of the route. Even with Haifa as base of operations for materials, land carriage is found very expensive, as from Maan onwards to the present terminus, all water as well as food has to be brought by rail. Hence the late attempt to extend the Turkish sphere in the neighbourhood of Akaba can be explained as much by economic as political reasons, since easy access from the Red sea to the main line would materially expedite the work. The object of the line is partly political and partly religious, subscriptions having been obtained for it from numerous Mohammedans interested in the pilgrimage to Mecca. As it seems, moreover, to have already considerably diminished the expenses and hardships involved in reaching Mecca from the north, it is probable that there will be no difficulty in obtaining the money necessary to complete the work, though beyond Maan it will be solely a pilgrim route. Its importance will become very much greater when the Euphrates valley railway is completed, and Damascus linked up with Constantinople. The work, even so far as it has gone, is an undoubted achievement on the part of Turkey, the manual work having been done by soldiers, whose experience will considerably add to the strength of the Turkish army. Nearly all technical work had necessarily to be done by foreigners. So far as the present survey of the continuation of the line to Mecca can determine, there will be very little in the way of engineering difficulties to contend with, but ever-increasing obstacles to the obtaining of fuel, water, food, or materials as the railway advances further and further from its base. Definite advance is, however, being made, and it is hoped that the water difficulty may be partially solved by the construction of huge cisterns to store up the scanty rainfall. A very complete account is given of the history and construction of the line, and the country through which it passes is fully described. There is also a sketch-map and a section of the route.

The Franco-Siamese Frontier.—The delimitation of this frontier by the commissioners of the two countries has made considerable progress during the past year. The work on the southern section, from the coast by the Tonle-sap to the Dang-rek chain of mountains, was referred to in September, 1905 (p. 331), since which date the delimitation of the northern section, including the frontier of Luang-Prabang, has been proceeded with (*Bul. Comité de l'Asie Franç.*, September, 1906, with map). The result has been once more to slightly modify the line as originally drawn, in favour of France. In the extreme north-west, the frontier fixed in 1904 was to have followed the first line of heights west of the basin of the Muang Khop, a small stream entering the Mekong at the elbow below Chieng Khong. But as it was found that the historic frontier of the kingdom of Luang Prabang had always followed the meridional range of the Phu-Pha-Dai, further to the west, this was adopted in the place of the former line. To the south of the kingdom, where by the Protocol of June, 1904, the line had been shifted to the advantage of France, so as to follow the upper course of the Nam Huong instead of its northern tributary the Nam Tang, the delimitation has still further extended the French sphere, since the Nam Man, recognized in 1904 by both parties as the upper course of the Nam Huong, has proved to rise much further south than had been expected. The result is to give France a narrow wedge of territory (between the Nam Man and the Mekong-Menam divide) running far into that of Siam, and intersecting one of the main routes between the two river-basins. The frontier so constituted, though no doubt conforming to the letter of the agreement, is hardly in accordance with natural fitness. From the October number of the paper above referred to we learn that Colonel Bernard, the French commissioner, has started for Indo-China, to complete the delimitation in the middle section, between the Tonle-sap and the Mekong.

Archæological Questions in Turkestan.—Mr. A. Cahn, a Russian traveller who has made various tours in Russian Turkestan, especially around Lake Issyk-kul, sends some notes on questions of archæological interest which have not yet been fully elucidated by explorers. One relates to the tradition, held locally, that beneath the waters of Issyk-kul there are ruins of former cities, supposed to have been overwhelmed by some past seismic catastrophe, such as has more than once visited the region in modern times. At Koi-sary, on the south-east shore of the lake some 40 miles from Prjevalsk, remains of household utensils, etc, have been found in the water, and during a visit to the spot Mr. Cahn made an attempt to obtain some definite information about them. He examined a broad stretch of the muddy shore as far as the depth permitted, and the objects found included fragments of burnt clay pots decorated with straight and spiral lines, some bones of men and domestic animals, and hard clay squares reminding him, in shape and size, of the tiles by which the walls of mosques are decorated in the more southern parts of Turkestan. He found, also, a flat disc of black fossilized wood with a hole in the centre, which he suggests may have been used in a flour-mill. He learnt that the Kirghiz had once found an unbroken oval bowl 10 or 11 inches high, as well as an iron bracelet. It is also reported that the dim outlines of walls and buildings can sometimes be seen when the water is clear. For further examination, divers, or at least a boat, would be needed; but the latter cannot be obtained on the whole southern shore or even at Prjevalsk. It is thought by Prof. Nikolsky that these remains date from the time of the Ussuns, who settled in this region in the second century B.C. when driven from Western China by the Huns, and lived here till the fifth century A.D. Mr. Cahn also refers to remains to be found in many parts of the Alatau, some having the character of mountain forts and others of fortified posts on trade routes. On the north coast of Issyk-kul, near Preobrazhensky village, there is a system of angular forts, surrounded by moats filled from the lake. They are said to have been built by Timur, and in the centre lies a row of granite figures resembling the stone figures common in Southern Russia, which represent human beings in a recumbent posture. Another ruin is not far from the Naryn fort, on the At-bashi river, and lies in a broad valley. This fortification had extremely thick walls of beaten clay, surrounding a regular square court, and an aged Kirghiz declared that it was built by Koshoi, general under the Khans of the Golden Horde in the fourteenth century. The walls are in great part still standing, and reach a height of 70 feet and a thickness of 20 to 25 feet. The famous Tashrobat ("The Stone-house"), not far from Chatyr-kul, is built of basalt blocks bound together by layers of hard cement, and consists of forty rooms symmetrically arranged round a central hall, which has a dome-shaped roof. It is still in good preservation and affords shelter for caravans, but its origin is unknown. In the gorge of the Barskaun river, in the Terskei Alatau, there are two granite slabs, leaning one against the other, and bearing short inscriptions in Arabic. They are much revered by the Kirghiz, who come here when childless and leave the horns and hoofs of animals they have killed and eaten, as offerings between the slabs. Among the natural phenomena, the peculiar outlines of the crumbling hills bounding the Chakmak valley, on the caravan route from the Turgart pass to Kashgar, deserve mention. From a distance they present the appearance of Gothic towers.

AFRICA.

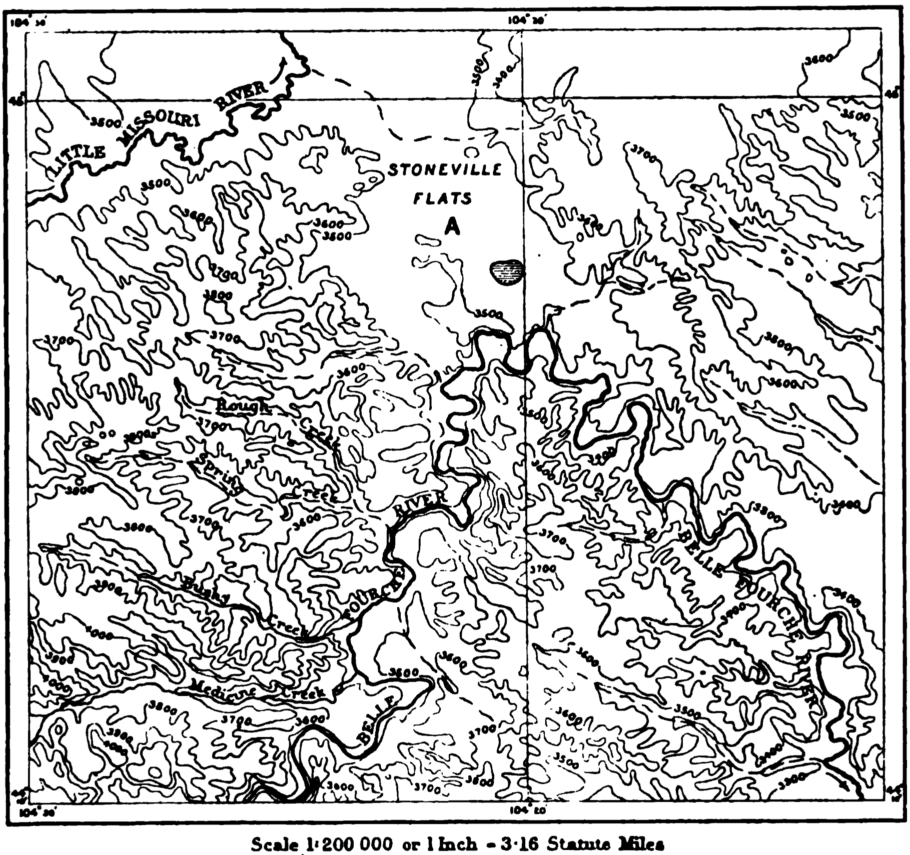
Mr. Vischer's Journey across the Sahara.—Mr. Vischer (*Journal*, vol. 28, pp. 181, 507) wrote from Murzuk on September 15, giving some account of his experiences up to that point. He had, in the main, followed Barth's route, passing through Mizda and the Hammada el Homra, and afterwards keeping more or less closely to the route of E. von Bary to Tekertiba and Murzuk. He had taken copious notes and observations for a route-map, and with the help of the Turkish officer who accompanied him had obtained much information on the tribes along the route. Murzuk had apparently changed little since the days of Rohlfs and Nachtigal, though its importance as a trade centre had declined. Mr. Vischer thinks that this will be regained with the returning prosperity of Bornu. The political situation was not very favourable to travellers, partly owing to the French occupation of Bilma and advance towards Ghat, and partly from disputes between the Tibbus and Tuareg. The Arab tribes further north seemed less under control than formerly. While passing through the Hammada and the enormous sand-dunes south of it, Mr. Vischer had excellent opportunities of studying the influence of wind and changes of temperature on the desert formation. In the hill country beyond Gharian, he made some examination of the Roman ruins and of the underground dwellings, and observed considerable areas of petrified forest before reaching Murzuk.

Commercial History of North-East Africa.—In a well-digested article in the *Geogr. Zeitschrift* (19th year, 5th and 6th Nos.)., Lieut. Kürchhoff discusses the history of trade-routes and trade-centres in North-East Africa. Ranging in space as far south as the Victoria Nile, and as far west as Lake Chad and Bagirmi (the common frontier of North-East and North-West African trades), the article deals more particularly with the period from the beginning of last century to the present. The main gateway of entry and exit for the movements of people and goods is, of course, the Nile. Since the Turkish conquest of Egypt, Cairo has been the chief focus of trade with the southern lands. Over 500,000 before the cholera of 1833, its population thereafter dropped to 300,000. At the opening of the nineteenth century three great caravan routes transported slaves and ivory from the interior to Cairo, from Murzuk, Darfur, and Senaar. The caravan from Murzuk arrived generally a little before Ramadan, one part proceeding thence to Mecca, the rest awaiting in Cairo the return of pilgrims from Morocco. But, controlled as were the movements by the political situation in the interior, the caravans from the south arrived when they could. Two or three might arrive in one year; two or three years might pass before another arrived. From Cairo the routes to Darfur and Senaar followed first the course of the Nile; that to Darfur leaving the river at Siut (the most important town of Upper Egypt at the beginning of the nineteenth century), that to Senaar at Assuan. On the Egyptian occupation of Dongola, a caravan route was opened thence to El Obeid, and another to Shendy. The revival of Dongola carried with it the development of Wadi Halfa. By 1825 Senaar and Kordofan were brought under Egyptian rule. Founded in 1823 as a basis for further conquests, Khartum, from an insignificant fishing village, expanded by 1858 into a town with a population of 30,000, and by 1885 of 50,000. Drawing into itself the whole North-East African trade, Khartum continued, till its destruction by the Mahdi, the reigning emporium for Central African products. After describing the conquest of the Sudan, the article presents a succinct but picturesque account of its principal trade centres.

AMERICA.

Sir William Macgregor's Visit to the Coast of Labrador.—Though Labrador is physically a fringe of the Canadian continent, it is in many ways much more a kind of annexe of the great island of Newfoundland, from which it is separated only by the narrow strait of Belle Isle, and with which it was at one time politically associated. When, indeed, in 1774 it was transferred to Quebec, the Governor of Newfoundland was still instructed, not only to look after the fishing and maritime interests of Labrador, but to continue and protect the establishment of the Unitas Fratrum, or Moravian Brotherhood. This notwithstanding, Governor Macgregor is the first Governor of Newfoundland to pay an official visit to the western seaboard of the strait. His report is full of interesting matter in regard to the country and its people, and their social and economic condition. The total winter population of Labrador is only 4000 (about 1000 native Innuit and half-breeds, or "settlers," as they are locally called); but the influx of fishermen, etc., brings the number up to 20,000 to 23,000 in summer. The exports in 1905 amounted to $3,082,563, of which dry cod represented $2,938,488, the remainder being made up of sealskins, salmon, furs, timber, whalebone, etc. Agriculture there is practically none. The Moravian missionaries with great difficulty grow a few cabbages, turnips, and (protected by mats) potatoes. In regard to the climate, Sir W. Macgregor gives abundant details of observations. At Hopedale (55° 27′ N. lat.) the maximum temperature was in 1890 only 30°·9 Fahr. for April, 55°·0 for May, for June 70°·3, July 82°·2, August (the hottest month) 86°·2; and the minimum of these months were −11°·5, −6°·9, 20°·5, 27°·3, 27°·8. Spring really comes in late summer. In the beginning of August, at Chateau, cabbages and turnips were only 2 or 3 inches high, the rowan-tree was in early flower (though the fruit was red at St. John's, Newfoundland), the larch, too, was in flower. The cloudberry (locally "bake-apple"), which in Scotland is found not lower than at an altitude of 1200 or even 1500 feet, grows here on the coast, as does the cranberry (or "partridge berry"). Not only is the interior of the country largely *incognita*, thanks mainly to the hideous plague of mosquitoes and "black flies," but even the best and most recent charts are extremely defective and erroneous in their delineation of the many-fiorded coast, with its countless bays, "tickles," and islands. What appears, *e.g.*, on the map as the solid peninsula of Chidley is really a group of many islands separated by narrow channels of deep water. Sir W. Macgregor has set a good example to himself and his successors.

An Instance of River-diversion is to be seen in the central plains of the United States. Along the east side of the Black hills many of the streams are



Scale 1:200 000 or 1 Inch = 3·16 Statute Miles

Contour interval 100 feet

cutting new valleys, and in cutting back have tapped other streams and altered the drainage system. Thus the upper waters of the Belle Fourche have been diverted from the Little Missouri, of which it once formed the headwaters, to the Cheyenne river, at the sharp bend north of the Black hills (A in accompanying sketch). North of this bend there is a wide flat-bottomed valley, which merges into the Little Missouri valley, and along which the Belle Fourche formerly flowed. It now occupies a new canyon cut about 50 feet below the floor of the older valley. This diversion was due to a small branch of the Cheyenne river, which had a steep declivity and was cutting along the strike of soft shales, so that it had the advantage over the original headwaters of the Little Missouri, and finally tapped them.

POLAR REGIONS.

Commander Peary in the Arctic.—Since reaching the far north towards the end of 1905, Commander Peary had been unable to communicate, as he had hoped to do, with the civilized world, and no news of his doings had come south until, at the beginning of last month, he appeared himself in the *Roosevelt* on the Labrador coast, after his friends had all but abandoned the expectation of obtaining tidings until well on in 1907. Telegraphing to the secretary of the Peary Arctic Club from Hopedale, Labrador, on November 2, the explorer was able to announce that the record of farthest north had been once more won for the United States, since he had made his way to 87° 6′, or nearly 40 miles nearer the pole than the furthest point attained by Captain Cagni, of the Duke of the Abruzzi's expedition in 1900, which was in 86° 33′, itself an advance of 20′ beyond Nansen's farthest in 1895. In achieving this success he seems to have shown his usual pluck and determination, while fighting against odds which made it impossible to attain the pole itself, though a point only just over 200 miles distant was reached. The *Roosevelt* wintered on the north-east coast of Grant Land, near Cape Sheridan, a little north of the headquarters of the *Alert* in 1874–75. On February 21, Peary went north with sledges, reaching Cape Hecla in three days. This formed the point of departure from the land, advance parties being sent on under Bartlett, Henson, and Clarke, while later on Peary went on himself with Henson and a small party of Eskimo. Open water proved a hindrance between 84° and 85°, while beyond 85° a gale, which raged for six days, broke up the ice and destroyed the caches, cutting off communication with the supporting parties, and drifting the explorer and his companions to the east. The furthest point was reached by forced marches on April 21, and during the return journey it became necessary to kill eight of the dogs for food, the party being hard put to it before reaching the north coast of Greenland. During a severe snowstorm the temperature fell to 75° below zero, Fahr. At about 84° a big lead was encountered, and the party encamped on a great floe, which drifted eastward. Only after five days was a passage effected, over young ice which bent beneath the travellers' weight. On May 12, Cape Neumayer was reached. Here they killed some musk-oxen, and made their way along the Greenland coast towards the ship. Both the supporting parties were driven on to the north coast of Greenland, and one was rescued in a starving condition. After resting a week on board the *Roosevelt*, Peary undertook a sledge-journey to the westward, during which he completed the tour of the north coast of Grant Land, and reached other land near the 100th meridian. It is not clear from the telegram whether this was land not previously discovered, or a portion of the lands brought to light by Captain Sverdrup during the second voyage of the *Fram*—a question on which further information will be awaited with interest. The homeward voyage seems to have been made under unusual difficulties, ice, storms, and head winds being incessantly encountered. The propeller became damaged, as well as the stern-post and rudder-post, the bows were damaged by the fall of the foretopmast, and all the coal was exhausted before the Labrador coast was reached. The *Roosevelt* is said, however, to have proved herself an excellent sea-boat and good at battling with the ice. The health of all on board was good throughout. Commander Peary himself has arrived in New York.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Mariner's Compass Card.—For the prismatic compass used by explorers in route traversing it has for a long time past been customary to graduate the ring into 360°, reckoning from the magnetic north point round by E., S., W. to the starting point. The advantage of this system, specially in plotting bearings, over the older methods of "points," or even of four quadrants of 90° each, is readily acknowledged by all who have any practical knowledge of the matter, and it certainly seems surprising that it has not long since been adopted for the mariner's compass. Doubtless one reason that the change has not been made is the possibility of confusion that such an alteration would be likely to lead to in the maritime world until the new system became generally recognized. However, apart from this difficulty, and the general conservatism in such matters, there seems no real reason why the change should not be made. A compass card, called the "F. Howard Collins's 360° Mariners' Compass Card," is now being constructed on this principle by the makers of Lord Kelvin's compasses, Messrs. Kelvin & White, Cambridge Street, Glasgow, a specimen of which, with accompanying letter-press setting forth its advantages, has been sent to this Society, and there is little doubt that, if it could be adopted generally, as the chief hydrographer to the American navy is stated to have said concerning it, "all work in relation to the compass would be facilitated." In addition to the 360° circle, an inner circle is shown, giving points as usual, which arrangement is perhaps advisable for the present. It would perhaps be too much to expect the makers to divide their card according to the metric system instead of into quadrants of 90°, although this would doubtless be a more rational arrangement, and one which in all probability will come into use in the future.

Ancient Flora of the Southern Hemisphere.—Among the collections obtained in the south by the Swedish Antarctic expedition were certain plant-remains discovered by Dr. J. G. Andersson in the Falklands (Speedwell island) and thought by him to be associated with a marine fauna of Devonian age. On this account, Dr. Nathorst, to whom they were submitted for examination, was at first inclined to assign the most important of them to the genus *Asterocalamites*, though the character of others of the remains made him somewhat doubtful. He has lately pointed out, in a reprint from the *Bulletin* of the Geological Institute of Upsala, vol. 7, that this identification was erroneous, and that the plant in question was in reality a *Phyllotheca*, representatives of which belong to the "*Glossopteris* flora" known from India and various parts of the southern hemisphere, and dating from Permian or Carboniferous times. Should the plant from the Falkland islands be a member of the same group, its distribution in space would extend some 12° to the south of its hitherto known limits in this direction. Although the probability is that the Speedwell island formation belongs to the Upper Carboniferous or Permian, Dr. Nathorst points out that another possibility (for it cannot be regarded as more) exists. The *Glossopteris* flora seems to have displaced an older flora of northern type, and it is not impossible that before doing this its habitat was within the Antarctic. In this case traces of it might be expected to occur in the Devonian of the Antarctic region, and the *Phyllotheca* from the Falklands might be older than the *Glossopteris* flora known elsewhere, or at least the genus might have made its appearance here at an earlier period than elsewhere. The question can only be solved by further exploration in the south.

GENERAL.

Gift to the Society by the late Captain Wiggins.—In accordance with the will of the late Captain Wiggins, his niece, Miss Kelman, has transmitted to the Society a handsome silver salver, which, with other pieces of plate, had been presented to Captain Wiggins by the Czar of Russia, on account of his continued efforts to establish a commercial route by sea along the north coast of Europe and Asia and up the river Yenisei. Around the border of the plate is an inscription in Russian, and the following inscription has been placed on the centre of the plate by Miss Kelman: "This salver was presented to Capt. Joseph Wiggins, Siberian Explorer, by the Czar of Russia, 1894, and left by Capt. Wiggins to the Royal Geographical Society, England, September, 1905." She has also presented to the Society the charts which were used by Captain Wiggins in carrying out his navigations.

The Ninth International Geographic Congress.—Circulars of invitation to this Congress, which, as is known, is to be held at Geneva in 1908, have been distributed by the organizing committee, and include preliminary announcements as to the programme and general arrangements, which follow, broadly, the lines adopted at former meetings. The proceedings will consist both of general and sectional meetings, the number of sections provisionally arranged for being fourteen. For these, separate rooms will be allotted in the University buildings. Offers of communications will be received up to November 30, 1907, and must be accompanied by *résumés*, distinctly written (preferably type-written) on one side of the paper only, and not exceeding three hundred words. The languages recognized will be German, French, Italian, and English, and besides these Latin may also be employed. Delegates may be named by governments, universities, geographical and other learned societies. A preliminary list of communications offered is printed in the circular.

The International Geodetic Conference at Budapest.—The following facts regarding the proceedings of this Conference (September 20 to 28) are gleaned from a communication made to *Nature* by Sir George Darwin, the delegate of the British Government, who declares that the work of the Conference was more interesting than that of any other at which he has been present. The observation of the variation of latitude, with which the name of Dr. Albrecht is specially associated, was matter of much debate. If the mysterious term z, discovered by Prof. Kimura, in the expression for the position of the pole, represents a real physical factor, it may be concluded that the equator oscillates backwards and forwards parallel to itself. In the southern hemisphere observations have been made in this connection by Dr. Hessen at Bayswater, West Australia, since June 6, 1906, and by Prof. Carnera, at Oncativo, in the Argentine Republic, since May 5. Mr. Innes will probably take observations at Johannesburg. For the northern hemisphere the situations selected are Pulkova, Leyden, Mizusawa, Charjui, Carlsforte, Gaithersburg, Cincinnati, Ukiah, and Tokyo. Prof. Helmert reported on the present position of the whole investigation. A preliminary report was read by Dr. Hecker on his voyages (*a*) from Portugal to Brazil, and (*b*) in the Indian ocean and across the Pacific for the purpose of determining the value of gravity at sea. His conclusions are regarded by Sir G. Darwin as forming one of the most noteworthy geodetic acquisitions of the last twenty years. M. Grullaume, assistant-director of the International Bureau of Weights and Measures at Bréteuil, described the improvements made in the use of the Jäderin wires for the measurement of base-lines, and especially the base-line measurement of the Simplon tunnel which the geodesists accomplished in five days by working night and day. Sir G. Darwin was happily able to report, *inter alia*, that in June Captain Gordon again began work at the triangulation of Rhodesia, which will in a few months be finished up to and beyond the Zambezi. From Tanganyika the survey northward will fall to the German Government. In Egypt Captain Lyons is preparing to work southwards. In the course of the discussion as to the reply to be given to the Congresses of Geology and of the academies who requested geodetic assistance in investigating the internal distribution of masses in the Earth and the rigidity and isostasy of the Earth's crust, one or two highly important communications were presented. Mr. Tittmann and Mr. Hayward gave an elaborate account of the anomalies of gravity in the United States. Mr. Hayward showed that the matter of the Earth is in hydrostatic equilibrium at a depth of about 70 miles. Baron Eötvos explained his application of the torsion balance to the determination of local abnormalities of gravity.

CORRESPONDENCE.

The Fall of the Central African Lakes: Lake Nyasa.

The enclosed photograph shows the marks on the rock at Monkey bay, on the west side of Lake Nyasa, placed there by the captains of the various steamers plying upon the lake, and indicating the water-level at different dates during the past nine years, and, as far as its evidence goes, seems to show a regular and persistent fall of the lake-level. The lowest (and latest) date is October 3, 1904, and this photograph was taken on October 19, 1905. When taking the photograph I also personally measured the then lake-level, and found it 15 inches below that mark. There is thus shown by the photograph direct evidence of a fall of some 10 feet 3 inches in eight years, taking the height in November, 1897, as the starting-point.

A further indication of the permanence of the fall is found in the universal native tradition that considerable districts bordering on the lake which are now inhabited, were at one time under water which formed part of the lake, *e.g.* the Tiwi plain. In most cases, however, native tradition is so innocent of definite dates that it is difficult to draw any deductions from it. But in the case of one such tradition the dates can be fixed very definitely. About 20 miles south of Kota-kota the short river Chia still marks the outlet of a "Lake Chia" found on old maps, but now non-existent. About 3 miles south of that is the village of Chididi, picturesquely perched on what is obviously the cliff of this lake, about half a mile inland from Lake Nyasa and facing westwards. Opposite this village I had the place pointed out to me where the *Itala* anchored in what was then "Lake Chia" and is now a dry plain. This would be in 1876. I inquired when the lake dried up, and the reply was "when the Government came." This might refer to 1883, when the first resident British consul was appointed, but far more probably to 1889, when the treaty with Jumbé, the great slave-dealing chief of Kota-kota, was made, and the actual influence of the "Government" was first realized by the natives in this part. It was also stated by the chief of Chididi and others that, within the memory of living men, Lake Chia was but part of a continuous "lake" which included also the now-existing (but now unconnected) string of lakes, Kanipa, Tabetabe, and Chikukutu. If this were so—and the positions and surroundings of these lakes certainly allow of it—it would mean that this body of water had a connection

MARKS SHOWING FALL OF LAKE NYASA.

with Lake Nyasa, not only near its southern end through the river Chia, but also just north of Kota-kota through the river Kaombe. This agrees exactly with the unanimous assertion of the older Kota-kota natives, that Kota-kota itself was formerly on an island. But the important point, as bearing on the Lake fall, is that the whole physical surroundings show that, on the assumption that there has been since 1876 or earlier a regular fall of the lake, that fall would naturally drain this area, leaving small lakes (as actually occurs) in the deeper hollows of what were, on this theory, part of the lake-bed in comparatively recent times. This is corroborated by the fact that three of these small lakes still exist *without having any source of supply* westward from the hills, which are some distance away and are drained on this side of their watershed by the river Bua, which has its outlet some 16 miles further north than the Kaombe. I have said "since 1876 *or earlier*," because it is evident, from Livingstone's maps, that Lake Chia was not connected with the river Kaombe when he visited Kota-kota. So that this argument, if sound, pushes still further back the date of the commencement of a period of desiccation. A corroborative evidence of this process may be found at various points round Lake Nyasa, where there appear to be evident marks of old "beaches" at considerable distances from the present lake-shore. This was first noticed by Livingstone himself (see *LAST Journals*, vol. 1, p. 94, where he speaks of "two beaches of the lake" near "the confluence of the river Misinjé," "one about 15 feet above the present high-water mark, and the other about 40 feet above that").

There is a great outcry of the European colony at the present time for afforestation, to prevent the serious consequences which seem to be arising from this process of nature.

I am, yours sincerely,

WM. C. PIERCY.

P.S.—Since writing the above, I have heard that in April last the *Charles Janson*, one of the smallest steamers on the lake, crossed the bar at the south end of Lake Nyasa into the upper Shiré river on six occasions, the last time on which either it or any other steamer crossed the bar being about five years previously. But this crossing was due to an extraordinarily heavy but very temporary fall of rain, and its repetition had already become impossible by the end of April. For this information I am indebted to Mr. S. Lyon, the engineer of the *Charles Janson*, but it is doubtful whether the fact that some years ago the bar used to be constantly crossed by steamers has any bearing on the question of general desiccation, as the change in this respect might be accounted for by a silting up of the bar and upper reaches of the river, and by the notorious neglect of the channel of the upper Shiré by the authorities, which has led of recent years to the practically entire cessation of its use as a navigable waterway such as it was a few years ago.

General Report of the Survey of India, 1903–04.

In the *Geographical Journal* for August last, I note a review on the above, the only one I ever had the honour of preparing before my retirement from the department. There are some points which perhaps the writer may not be aware of, regarding these reports, which I should like to mention.

As he says, there is great delay in the publication of these reports. This is in a great measure due to references that have to be made to the foreign and military departments as to the desirability or otherwise of publishing matter connected with all transfrontier work. Then, again, for some years, partly owing to a peremptory mandate from the Government of India, the length of all official reports have been curtailed and restricted to a given number of pages; and the cutting down of the reports of executive officers in charge of field parties, and examining all the proof copies, a task which falls on the Surveyor-General and Deputy Surveyor-General, entails no small amount of labour in order to condense the final report within the prescribed limit of size. Owing to the above restrictions, the reports of late years have been somewhat scant, and void of matters of general interest to the public, a fact which has been commented on by the Indian press; and it was with a view to furnishing something of a more readable nature, I determined to include in the appendix as much interesting matter as it was possible to gather.

Another cause for the delay in publication of the last report was the extra work thrown on the administrative offices by the Survey committee, who were perpetually demanding returns, estimates, and statistics of every conceivable subject connected with the department.

The statement that "there is really very little of the Indian peninsula left to map" is hardly borne out by facts. I can assure the writer that there remain very large areas which will require "resurvey," and not merely "revision." A glance at the 'Report of the Survey Committee,' part i. p. 43, will show that the area to be surveyed is estimated at 655,360 square miles, whilst that for "re-survey" is quoted at 479,000 square miles.

There is no new material in the map of Nepal accompanying Captain Wood's report, beyond what has been in our possession for many years past, and to say that the map is "the work of Captain Wood" is quite misleading. Captain Wood was merely sent to Katmandu to finally set at rest the discussion that has been waged for years past regarding the identification of certain snow-peaks visible from that locality. No surveying of any description was attempted, and to say that "the passes leading into Tibet north of Katmandu can now be located with a fair approximation to exactness" is purely mythical.

J. R. Hobday, Colonel,
Late officiating Surveyor-General of India.

October 29, 1906.

Missionaries and Philology and Anthropology.

I was much interested in reading Prof. Haddon's paper in the August number of the *Journal*, proposing a systematic investigation of the biology and anthropology of Melanesia, and I sincerely hope that such an expedition may be organized. But I ask your permission to take exception to some remarks made in the discussion following the paper, because they are most unjust to a large body of men who have done an immense deal in various parts of the world to advance the knowledge of language and of folk-lore. I notice that Mr. Ray said that "the missionaries learn the languages, to a certain extent, far enough to be able to produce a Gospel translation, and when that is published, they rarely go any further. Very few of them take down native stories, and no native literature is preserved." Now, both these statements are very far from the truth. I affirm, on the contrary, that no missionary is content with translating a single Gospel, but that the object of every Protestant mission is to give the peoples among whom it works all the New Testament in the first place, and then the complete sacred Scriptures. The annual reports of the Bible Society will fully confirm what I say, and will show that every year missionaries are going on to complete the whole Bible in countries where it is not already completed; and, more than that, they are continually revising and improving first translations as their knowledge of the various languages becomes more perfect. I may cite Mr. R. N. Cust's book, 'A Sketch of the Modern Languages of the East Indies' (Trübner, 1878), Appendix G, to show what had been done by missionaries in the large Indian group of languages nearly thirty years ago, and there have been great advances since. It is the same in China now—a large body of missionaries from all the Protestant Societies are engaged in a careful revision of the Bible; and it was the same with us here in Madagascar. The first missionaries here were indefatigable in completing the New Testament within two years of their arrival, and the whole Bible before they had been fifteen years in the island. And it is the same with my friends of the L.M.S. Mission in New Guinea now. Dr. Lawes, after barely ten years in a part of the island where the language was previously utterly unknown, returned to England with a complete translation of the New Testament, not "a Gospel translation," to be printed by the Bible Society. And although the work is most difficult there in consequence of the number of languages, good progress is being made in studying several of them, and in giving the people the Scriptures in their own tongues. The fullest statement, and most carefully arranged account of what missionaries have done and are doing for philology is, however, given in the Rev. D. Dennis's monumental work, 'Christian Missions and Social Progress,' in three volumes, with a volume of statistics (New York: Revell Company), just completed. Such remarks as those made by some gentlemen are amply refuted by an inspection of facts and figures carefully compiled in Dr. Dennis's volumes. Missionaries have no need to be ashamed of their brethren as scholars, when such names are mentioned as Carey, and Hay, and Chamberlain, and Sherring in India; as Morrison, Milne, Legge, Edkins, and Griffith Johns in China; as Jones, and Griffiths, and Cousins, and Dahle in Madagascar; as Pattison, and Codrington, and Turner, and Wyatt Gill in Polynesia: but the list would be too long were I to attempt to make it anything like complete. All philologists know, and will gladly acknowledge, the debt their science owes to missionaries in all parts of the world, from the time of John Eliot down to the present day.

A word or two more as regards the second statement, viz. that "very few of them take down native stories, and no native literature is preserved." This is equally inaccurate, and I affirm, on the contrary, that numbers of missionaries are very anxious to preserve and study the folk-lore of the peoples among whom they live, and that a large amount of such material has been obtained by them and put on record. Away from access to libraries as I am in this country, I cannot try to give anything like a complete list, and can only give a few examples; but a reference to the volumes of the Folk-lore Society's proceedings will confirm my statements. As an instance, however, I may just say that here in Madagascar very full lists have been compiled and printed of the native proverbs, and a great many have been translated; two considerable books have been printed, giving a large number of folk-tales, songs, conundrums, children's games, etc., as well as the curious ideas of divination, charms, etc. (in fact, a few of us a few years ago formed a little society for the collection and publication of such literature); smaller books have also been issued, giving native customs, speeches, etc., at marriages, funerals, circumcision festivals, and royal speeches, all of which preserve obsolete or obsolescent forms of the language. I myself have taken much interest in the dialects of the island, and am now proposing a plan to the Académie Malgache for their systematic collection and study; and Dr. Dahle, of the Lutheran Mission, has made exhaustive studies of the divination practices of the people, and also of the language. Now, what we have done here is not an exceptional fact by any means; witness Dr. Turner's book, 'Nineteen Years in Polynesia;' Rev. Wyatt Gill's 'Historical Sketches of Savage Life in Polynesia, with Illustrative Clan Songs;' and 'Myths and Songs from the South Pacific;' Dr. Codrington's 'The Melanesians: their Anthropology and Folk-lore;' Rev. W. Ellis's 'Polynesian Researches;' Rev. R. Taylor's 'New Zealand and its Inhabitants;' Rev. M. A. Sherring's 'Tribes and Castes of India,' etc., etc. The contributions of Chinese missionaries to an accurate knowledge of the literature of China are also well known, such as Dr. Legge's many volumes of the Chinese classics, and the learned works of Drs. Chalmers, Edkins, Milne, and Morrison, and others.

Both philology and literature and folk-lore would be in a bad way were we dependent upon colonists and traders for our knowledge of such subjects; and had not Christian missionaries in all parts of the world, in addition to their chief work of making known the gospel, been determined to study accurately for themselves the languages and ideas of the peoples among whom they live. I therefore have no hesitation in again affirming that missionaries, notwithstanding the disparaging remarks often made about them by those who know least about what they do, have done, and are doing, valuable service to philological and anthropological science.

James Sibree,
Missionary of the L.M.S.

L.M.S. College, Antananarivo, Madagascar, September 29, 1906.

The Phœnician Periplus of Africa.

I am sorry that my remarks on this subject had to be compressed into so small a space as to lay me open to the criticism pronounced by Mr. Heawood on my letter. To him I would reply—briefly again—as follows. I am not the first to observe that the Phœnician legend, with its impossible harvest-story, would have found little, if any, support in modern times but for the supposition that the alleged report of a northerly sun must be true because it could not have been invented. I contend, not merely that it could easily have been invented, but that the last persons to deny this should be those who maintain that a Semitic traffic with Sofala had been going on for centuries before Necho's time. Mr. Heawood disputes my suggestion that the statement "startled" the world, or, indeed, anyone beside Herodotus. But surely the statement would hardly have been made had it not been thought remarkable. And that it could be thought remarkable, even by Herodotus, is surely strange if voyages to South Africa had ever been common. Herodotus, Mr. Heawood says, had "pre-conceived ideas." But were not these ideas, at least so far as concerned the extent of Africa, actually inspired by the Phœnician story? And are not such ideas, which were certainly not confined to Herodotus, hard to explain as surviving in the world if a circumnavigation of Africa had really been made? When Mr. Heawood says "the natural conclusion . . . is not so much that the sun was north at noon, as that it was, during the greater part of the day, on the right of the general course sailed," he seems to me to touch upon a weak point in the story. As a fact, in a circumnavigation of Africa, the distance to be sailed in an east-to-west direction is surprisingly small, and most of it is off the Guinea coast, north of the line, where Rennell maintains that the Phœnicians could only have made their way in the autumn, when the sun would be on the left hand. That Herodotus, and better-informed successors of Herodotus, should have fancied the chief part of the voyage to have been from east to west is surely an indication that a real voyage had never been recorded.

I am glad to learn that Dr. Keane does not "rely on the statement of Herodotus," though in that case I cannot tell what it is on which he does rely to prove against Mr. MacIver that the ancients had a knowledge of the Austral regions. I introduced Posidonius chiefly to show that a competent scientific authority, who knew as well as any modern—and much better than some moderns—what a northerly sun would imply, was not impressed by the mention of one. But Posidonius also was an opponent of a theory once widely current, that the equatorial heat was insupportable. How did this idea find a place in a world of which "the Austral regions" had long been known? Of Dr. Keane's wild attack upon Posidonius, as it has absolutely nothing to do with the subject in hand, I will merely say that I can find no justification for it in anything recorded of that eminent man.

I venture to think that Herodotus does speak of a Carthaginian circumnavigation, though no doubt in a provokingly elliptical phrase. Both Gaisford and Rawlinson understand him as saying that, whereas Necho gave the *first* proof, the Carthaginians in the *second* place represented themselves as having "made the voyage" (Rawlinson), or as having ascertained that it could be made (Gaisford), which amounts to the same thing.

E. J. Webb.

Trewollack, Bodmin.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *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:—


The PINAFORE LIBRARY
CHRISTINA'S
FAIRY BOOK
FORD MADOX HUEFFER
ALSTON RIVERS L^TD

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C. R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Is. = Isvestiya.
J. = Journal.
Jb. = Jahrbuch.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological, etc.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
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.

Albania. *B.S.G. Română* 27 (1906): 39–63. **Burileanu.**
Românii din triunghiul Vallona-Ardenița-Berat (Albania), de C. Burileanu.

Alps—Dauphiné. *La G.* 13 (1906): 437–442. **Jacob.**
Rapport préliminaire sur les travaux glaciaires en Dauphiné pendant l'été 1905. Par Charles Jacob.

Alps—Monte Rosa. *B.S.G. Italiana* 7 (1906): 639–662. **Alessandri.**
Due mesi sulla vetta del Monte Rosa, conferenza dal dott. C. Alessandri. *With Illustrations.*

Alps—Morphology. *Vierteljahrschrift Naturf. Ges. Zürich* 51 (1906): 1–49. **Heim.**
Geologische Nachlese von A. Heim. Nr. 15. Ein Profil am Südrand der Alpen, der Pliocaenfjord der Breggiaschlucht. *With Map and Profiles.*

Alps and Pyrenees. *La G.* 13 (1906): 417–424. **Lapparent.**
Les époques glaciaires dans le massif alpin et la région pyrénéenne. Par A. de Lapparent.

Austria. *Deutsch. Rundschau G.* 28 (1906): 397–405. **Mayer.**
Die südlichsten Uebergänge vom Donau- zum Elbegebiet. Von Prof. Dr. J. Mayer. *With Maps and Illustrations.*

Austria. *Globus* 89 (1906): 152–157. **Perko.**
Die Riesengrotte bei Triest-Opcina. Von G. A. Perko. *With Plan and Illustrations.*

Austria—Bohemia. *M.K.K.G. Ges. Wien* 49 (1906): 60–73. **Schneider.**
Das Duppauer Mittelgebirge in Böhmen. Von Dr. K. Schneider.

Austria—Tirol. *B.S.G. Italiana* 7 (1906): 546–568. **Marson**
Sui ghiacciai dell' Adamello-Presanella (alto bacino del Sarca-Mincio). Nota del Prof. L. Marson. *With Map and Illustrations.*

Austria—Tirol. **Frech.**
Ueber den Gebirgsbau der Tiroler Zentralalpen, mit besonderer Rücksicht auf den Brenner. Von Fritz Frech. (*W. Ergänsh., Z. Deuts. u. Oesterr. Alpenv.* 2, Heft 1 (1905): pp. x. and 98.) *With Map, Illustrations, and Diagrams.*

Belgium. *B.S. Belge Géologie, Procès-Verb.* 20 (1906): 100–102. **Simoens.**
De l'indépendance, en Belgique, des chaînes calédonienne et hercynienne. Par G. Simoens.

Belgium—Liége. **Hertslet.**
Arms Industry of Liége. Foreign Office, Miscellaneous, No. 650. 1906. Size 10 × 6½, pp. 54. *Diagram. Price* 7½*d.*

Bulgaria. *Tour du Monde* 12 (1906): 241–264. **Launay.**
Les Balkans de Bulgarie. Par L. de Launay. *With Map and Illustrations.*

Corsica and Sardinia. *M.K.K.G. Ges. Wien* 49 (1906): 74–86. **Schoener.**
Corsica und Sardinien in vergleichender Darstellung. Von G. Schoener.

Denmark. *G.Z.* 12 (1906): 361–378. **Machaček.**
Dänemarks Boden und Oberfläche. Von F. Machaček. *With Illustrations.*

Europe. **Philippson.**
Europa. Zweite Aufl. des von Dr. Alfred Philippson und Prof. Dr. Ludwig Neumann verfassten Werkes, neu bearbeitet von Prof. Dr. A. Philippson. (Allgemeine Länderkunde, herausgegeben von Prof. Dr. W. Sievers.) Leipzig und Wien: Bibliographisches Institut, 1906. Size 10½ × 7¼, p. xii. and 762. *Maps and Illustrations. Price* 17*s.*

Europe—Languages. *Deutsche Erde* 4 (1905): 47-51. **Zemmrich.**
Die deutsch-romische Sprachgrenze. Von Johannes Zemmrich.

France. *B.S.G. Com. Bordeaux* 27 (1901): 129–145. **Duffart.**
Topographie ancienne et moderne des lacs d'Hourtin et de Lacanau. Par C. Duffart. *With Maps and Sections.*

France. *B.S.G. Com. Bordeaux* 29 (1906): 31–36, 61–76. **Paniagua.**
Les Landes de Gascogne et les Deltas de la Gironde. Par A. de Paniagua. *With Map.*

Italy. **Baedeker.**
Italy. Handbook for Travellers by Karl Baedeker. First Part: Northern Italy, including Leghorn, Florence, Ravenna, and Routes through Switzerland and Austria. 13th edition. Leipzig: K. Baedeker; London: Dulau & Co., 1906. Size 6¾ × 4½, pp. lxiv. and 592. *Maps and Plans. Price* 8*m. Presented by Messrs. Dulau & Co.*

United Kingdom—Ireland. **Cooke.**
Handbook for Travellers in Ireland. Seventh Edition. Revised and Edited by John Cooke. London: E. Stanford, 1906. Size 7 × 5, pp. x., 58, and 576. *Maps and Plans. Price* 9*s. Presented by the Publisher.*

The sixth edition, issued in 1902, has been here subjected to a renewed revision.

United Kingdom—Isle of Wight. **Ward.**
Thorough Guide Series. The Isle of Wight, with Notes for Geologists and Cyclists. By C. S. Ward. New edition. London: Dulau & Co., 1906. Size 6½ × 4½, pp. xiv. and 86. *Maps and Plans. Price* 2*s.* 6*d. net. Presented by the Publishers.*

United Kingdom—Lake District. **Baddeley**
Thorough Guide Series. The English Lake District. By M. J. B. Baddeley. Tenth edition. London: Dulau & Co., 1906. Size 6¾ × 4½, pp. xxx., 16, 248, and 20. *Maps and Panoramas. Price* 5*s. net. Presented by the Publishers.*

United Kingdom—Meteorology. **Mill.**
British Rainfall, 1905. On the Distribution of Rain in space and time over the British Isles during the year 1905. . . . By Hugh Robert Mill. London: E. Stanford, 1906. Size 9 × 5½, pp. 88 and 272. *Maps and Illustrations. Price* 10*s. Presented by Dr. H. R. Mill.*

It is pointed out that the number of stations from which returns are published at last exceeds four thousand, though the distribution of the rain-gauges over the country (graphically shown on a map) still leaves something to be desired. Except in the extreme north of England, the areas more than 10 miles from any gauge occur only in Scotland, South Wales, and Ireland.

United Kingdom—Scotland. **Baddeley.**
Thorough Guide Series. The Northern Highlands, Scotland (part ii.) . . . By M. J. B. Baddeley. 7th edition. London: Dulau & Co., 1906. Size 6½ × 5, pp. xvi. and 150. *Maps and Plans. Price* 3*s.* 6*d. net. Presented by the Publishers.*

The only fault to be found with this guide is that the general map is so inserted that it cannot be kept open while the text is being consulted.

United Kingdom—Yorkshire. **Baddeley.**
Thorough Guide Series. Yorkshire (part ii.), West and part of North Ridings and all parts of the country West of the North-East Main Line; also Barnard Castle and Teesdale. By M. J. B. Baddeley. Fifth edition, thoroughly revised. London: Dulau & Co., 1906. Size 6¾ × 4½, pp. xvi. and 152. *Maps and Plans. Price* 3*s. net. Presented by the Publishers.*

A section map of Ripon and neighbourhood is added in this edition.

ASIA.

Asiatic Russia. **Tillo.**

Superficie de la Russie d'Asie, avec les bassins : des océans, des mers, des rivières et des lacs, ainsi que les superficies des divisions administratives sous le règne de l'Empereur Nicholas II. Par A. de Tillo. [In Russian.] St. Petersbourg, 1905. Size 14 × 11½, pp. xxiv., 66, 35, 101, 4, 6, 5. *Maps and Diagrams; also Map, separate. Presented by M. J. de Schokalsky.*

China. *Petermanns M.* 52 (1906): 91–92. **Lóczy.**

E. v. Cholnoky über Flussregulierung und Bodenmeliorationen in China. Von Prof. Dr. L. v. Lóczy.

Summary of a memoir published by the Hungarian Hydrological Office.

China and Korea—Meteorology. *Monthly Weather Rev.* 33 (1905): 477–480. **Okada.**

The Rainfall of China and Korea. By T. Okada. *With Map.*

China—Kwang-Si. *La G.* 13 (1906): 476–480. **François.**

Mission au Kouang-Si. Par M. le lieutenant François.

Chinese Turkestan—Historical. *Indian Antiquary* 35 (1906): 1–30. **Lévi.**

The Kharostra Country and the Kharostri Writing. By S. Lévi. Translated by Mabel Bode.

Dutch East Indies—Commercial. **Bockelmann.**

Wirtschaftsgeographie von Niederländsch-Ost-Indien. Von Albrecht von Bockelmann. (Angewandte Geographie. Hefte zur Verbreitung geographischer Kenntnisse in ihrer Beziehung zum Kultur- und Wirtschaftsleben. Herausgegeben von Prof. Dr. Karl Dove. 2 Serie, 2 Heft.) Halle a. S.: Gebauer-Schwetschke, 1904. Size 9½ × 6½, pp. 92. *Price* 1*m.* 80.

French Indo-China. *B. Comité l'Asie Française* 6 (1906): 229–234. ———

Les Voies de pénétration au Laos français et au Siam. *With Map.*

French Indo-China—Tongking. **Lajonquière.**

Ethnographie du Tonkin Septentrional. Par le Commandant E. Lunet de Lajonquière. Paris: E. Leroux, 1906. Size 11½ × 7½, pp. 384. *Map and Illustrations. Presented by the Publisher.*

India—Bengal. **Wilson.**

Indian Records Series. Old Fort William in Bengal. A Selection of Official Documents dealing with its History. Edited by the late Dr. C. R. Wilson. 2 vols. London: J. Murray, 1906. Size 9½ × 6½, pp. (vol. 1) xl. and 256; (vol. 2) viii. and 330. *Plans and Plates. Price* 24*s. net. Presented by the Publisher.*

India—Bhutan. ———

Through Bhutan with the Mission, 1905. [*Newspaper Cuttings.*] Size 13 × 8½, pp. 31.

Cuttings from the *Pioneer*, revised by Mr. A. W. Paul.

India—Bhutan. *Records Geol. Surv. India* 34 (1906): 22–30. **Pilgrim.**

Notes on the Geology of a portion of Bhutan. By G. E. Pilgrim, B.SC. *With Map and Sections.*

India—Bhutan. *Records Geol. Surv. India* 34 (1906): 31–36. **Pilgrim.**

Report on the Coal occurrences in the Foothills of Bhutan. By G. E. Pilgrim, B.SC.

India—Himalaya. *B.S.G. Genève* 45 (1906): 87–90. **Guillarmod.**

Au Kangchinjunga (8585^{m}). Voyage et explorations dans l'Himalaya du Sikhim et du Népal. (Résumé.) Par Dr. J. J. Guillarmod.

India—Himalaya. *Alpine J.* 23 (1906): 201–228. **Longstaff.**

Six Months' Wandering in the Himalaya. By T. G. Longstaff. *With Maps and Illustrations. Also separate copy.*

India—Historical. *Indian Antiquary* 34 (1905): 253–261. **Pearson.**

Alexander, Porus, and the Panjab. By C. Pearson. (With a Map, and a Prefatory Note by Vincent A. Smith.)

Discusses the topography of Alexander's march in the light of close personal knowledge of the ground.

India—Historical. *J.R. Asiatic S.* (1906): 553–580. **Vost.**

Identifications in the Region of Kapilavastu. By Major W. Vost. *With Map.*

Indo-China—Tonkin. *B. Economique (Indo-Chine)* 9 (1906): 150-156. **Lantenois.**
Note sur les Crues et Inondations en 1905 (au Tonkin). Par M. Lantenois. *With Map.*

Japan. ——
The Sixth Financial and Economic Annual of Japan. 1906. The Department of Finance, Tokyo. Size $10\frac{1}{2} \times 7\frac{1}{2}$, pp. vi., 210, and 60. *Map and Diagrams.*

Malay Archipelago—Nias. **Rappard.**
Ts. K. Ned. Aard. Genoots. Amsterdam 23 (1906): 713-724.
Verslag eener reis per Gouvernements-stoomschip "Condor" naar de Zuid-Oost en Zuidkust van Nias van den 20sten tot en met 28 October 1905. Door T. C. Rappard.

Malay Archipelago—Sumatra. **O'Brien.**
Ts. Ned. Aard. Genoots. Amsterdam 23 (1906): 939-1014.
Rapport omtrent de tegenwoordige politieke en economische verhoudingen en toestanden in de Kampar-Kiri-landen. Door J. L. O'Brien. *With Map.*

Northern and Eastern Asia. **Keane.**
Stanford's Compendium of Geography and Travel (New Issue). Asia. Vol. 1. Northern and Eastern Asia. By A. H. Keane, LL.D. Second Edition. London: E. Stanford, 1906. Size $8 \times 5\frac{1}{2}$, pp. xxvi. and 528. *Maps and Illustrations. Price 15s. Presented by the Publisher.*

The main results of geographical exploration during the past decade have been embodied in this edition.

Philippine Islands. **Dauncey.**
An Englishwoman in the Philippines. By Mrs. Campbell Dauncey. London: John Murray, 1906. Size 9×6, pp. xx. and 350. *Illustrations. Price 12s. net. Presented by the Publisher.*

Philippine Islands. **Foreman.**
The Philippine Islands. A political, geographical, ethnographical, social, and commercial history of the Philippine Archipelago. Embracing the whole period of Spanish rule, with an account of the succeeding American Insular Government. By John Foreman. Third Edition. London: T. Fisher Unwin, 1906. Size $10\frac{1}{2} \times 6\frac{1}{2}$, pp. xxii. and 668. *Maps and Illustrations. Price 25s. net. Presented by the Publisher.*

Carefully revised and brought up to date.

Southern India—Anthropology. **Thurston.**
Ethnographic Notes in Southern India. By Edgar Thurston. Madras: Printed by the Superintendent, Government Press, 1906. Size 9×6, pp. viii. and 580. *Illustrations. Price 6s. Presented by the Government Press, Madras.*

Brings together a large body of facts obtained both by personal observation and inquiry and from printed sources.

Tibet. **Sherring.**
Western Tibet and the British Borderland, the sacred country of Hindus and Buddhists; with an account of the Government, Religion, and Customs of its Peoples. By Charles A. Sherring. With a chapter by T. G. Longstaff, describing an attempt to climb Gurla Mandhata. London: E. Arnold, 1906. Size 10×6, pp. xvi. and 376. *Maps and Illustrations. Price 21s. net. Presented by the Author.*

AFRICA.

Abyssinia—Historical. **Beccari.**
Rerum Aethiopicarum Scriptores Occidentales inediti a Saeculo xvi. ad xix. curante C. Beccari S.I. Vol. 4. P. Emmanuelis Barradas S.I. Tractatus Tres historico-geographici. Romae: C. de Luigi, 1906. Size 11×8, pp. xxxii. and 402.

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Carmarthenshire, XXXVIII. 15; XLI. 16; XLIV. 16; XLV. 1, 2, 3, 5, 6, 7, 9, 10, 11, 12, 13, 14, 16; XLVI. 5, 6, 7, 8, 9, 10, 11, 12, 14, 15; XLVII. 5, 7, 9; XLVIII. 1, 2, 3, 4, 6; XLIX. 1, 2, 3; LII. 1, 2; LIII. 2, 3, 5, 11. **Cornwall**, XV. 15; XVI. 3, 8, 9; XXI. 1, 3, 4, 5, 6, 7, 9, 10, 11, 12; XXII. 1, 5, 7, 8, 9, 16; XXIII. 2, 6, 7, 11; XXVIII. 3, 6, 8; XXIX. 1, 3, 7, 10, 11. **Devonshire**, LXXXVI. 15; XCVI. 16. 3*s*. *each*. LXXXVI. 14; XCVI. 3, 7, 15. 1*s*. 6*d*. *each*. **Lincolnshire**, XXXV. 4, 6, 7, 8, 10, 11, 12, 14, 15, 16; XXXVI. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16; XXXVII. 1, 10, 11; XXXVIII. 3, 5, 6, 7, 9, 10, 11, 13, 15, 16; XLIV. 11; XLVII. 16; XLVIII. 1, 5, 7, 8, 10, 13; XLIX. 1, 2, 3, 5, 6, 7, 9, 10, 11, 12, 13, 14, 15, 16. **Norfolk**, XIX. 3; XX. 16; XXIX. 5, 6, 9, 10, 11, 12, 15; XXX. 15; XXXIX. 4, 8, 12, 16; XL. 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16; XLI. 1, 2, 4, 5, 6, 8, 10, 11, 12, 13, 14, 15, 16; XLII. (1 and 5), 9, (10 and 14), 13, (14 and 10); LI. 4, 8, 12; LII. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12; LIV. 9, 13; LXV. 3, 4; LXVI. 1; LXXXVII. 7, 10: XCI*a*. 2. **Yorkshire**, CCXXXVIII. 16; CCXXXVIII*a*. 9; CCLII. 5, 10, 11, 12, 13, 14, 15, 16; CCLVIII. 12, 16; CCLIX. 3, 6, 7, 8, 10, 12, 13, 14, 15; CCLX. 5, 9, 10, 13, 14; CCLXI. 2. 3*s*. *each*.

(*E. Stanford, London Agent.*)

England and Wales. **Railway Clearing House.**

Official railway map of England and Wales prepared at the Railway Clearing House. Scale 1 : 475,200 or 1 inch to 7·5 stat. miles. 4 sheets. London: Railway Clearing House, 1906.

France. **Ministère des Travaux Publics.**

Carte géologique de la France. Scale 1 : 1,000,000 or 1 inch to 15·8 stat. miles. 4 sheets. Paris: Ministère des Travaux Publics, 1905. *Price* 9 *fr*. 50.

Germany. **K. Preussische Landesaufnahme.**

Karte des Deutschen Reiches. Herausgegeben von der Kartographischen Abteilung der Königlichen Preussische Landesaufnahme. Scale 1 : 100,000 or 1 inch to 1·6 stat. miles. Sheets: (coloured) 297, Zielenzig; 345, Sommerfeld. Berlin: K. Preussische Landesaufnahme, 1906. *Price* 1.50 *marks each sheet*.

London. **Bartholomew.**

Road Surface Map of London and Neighbourhood. Scale 1 : 31,680 or 2 inches to one stat. mile. Revised by the Cyclists' Touring Club. Edinburgh : John Bartholomew & Co., 1906. *Price, mounted on cloth, 2s. 6d.*

Shows, by different colours, the material of which the surface of the roads is constructed in London and near suburbs.

Luxemburg. **Hansen.**

Carte topographique du Grand-Duché de Luxembourg. Par J. Hansen. Scale 1 : 50,000 or 1·3 inch to a stat. mile. Sheets: 10, Capellen; 11, Luxembourg; 12, Grevenmacher. Paris: Erhard Frères, [1906].

Russia. **Petri and Schokalsky.**

Carte de la Russie d'Europe tirée du Grand Atlas de Marcks. Commencée par M. le professeur E. Petri, et achevée et rédigée par M. J. de Schokalsky. Scale 1 : 2,000,000 or 1 inch to 31·5 stat. miles. 16 sheets. St. Petersburg: A. F. Marcks, 1905. [In Russian.] *Presented by M. J. de Schokalsky.*

Russia. **Peucker.**

Politische Uebersichtskarte des europäischen Russland. Bearbeitet von Dr. Karl Peucker. Scale 1 : 6,000,000 or 1 inch to 94·7 stat. miles. Vienna: Artaria & Co., 1906. *Presented by the Publisher.*

Russia. **Peucker.**

General- und Strassenkarte von Westrussland nebst den Oesterreichisch- Ungarischen und Deutschen Grenzgebieten. Bearbeitet von Dr. Karl Peucker. Scale 1 : 1,500,000 or 1 inch to 23·6 stat. miles. Third edition. Vienna: Artaria & Co., 1906. *Presented by the Publisher.*

Sweden. **Swedish General Staff.**

Järnvags- och Postkarta öfver Sverige. Scale 1 : 800,000 or 1 inch to 12·6 stat. miles. 2 sheets. Stockholm: Topographical Section, General Staff, 1906. *Presented by the Director, Swedish General Staff.*

This map shows railways, roads, post stations, and other information connected with means of communication in Sweden, and should be specially useful to tourists. It is printed in colours, and is without hill shading. The information given has been corrected up to July 1, 1906.

ASIA.

Asia. **Stanford and Mackinder.**

Stanford's New Orographical Map of Asia. Compiled under the direction of H. J. Mackinder, M.A. Scale 1 : 8,721,500 or 1 inch to 137·6 stat. miles. 4 sheets. London: Edward Stanford, 1906. *Price 16s. Presented by the Publisher.*

In general appearance and arrangement of colours this map is similar to others of the series to which it belongs. One great improvement upon many other orographical maps is the fact that only shades of one colour—brown—are used to represent the heights, so that the eye readily follows the graduations without the unnecessary and meaningless abrupt break from a dark green to a light brown which frequently occurs. The names, as before, are printed in a grey, so as not to spoil the graphic effect of the tinting, and this arrangement is most successful until the darkest shades are reached, where, owing to their faintness, the names become almost illegible. The dark tints, which occur principally over the plateau of Tibet, are perhaps somewhat unnecessarily dark, and if they had been a little lighter they would still have been sufficiently distinctive, and have rendered it possible to read the names clearly. However, the map, like the rest of the series, which is being produced under the direction of Mr. H. J. Mackinder, has much to commend it, and will doubtless be welcomed by educational establishments where geography is taught on the more enlightened and intelligent system.

Indian Government Surveys. **Surveyor-General of India.**

Indian Atlas, 1 inch to 4 miles. Sheets: 63, parts of district Tinnevelly and Travancore State (Madras Presidency), additions to 1904. 67 S.W., parts of districts Bareilly, Budaun, Aligarh, Etah, Moradabad, Bulandshahr, Shahjahanpur, and of Rampur State (U.P. of Agra and Oudh), additions to 1904. 80 S.W., parts of districts Madura, Tanjore, and Tinnevelly (Madras Presidency), 1906.—India and Adjacent Countries, 1 : 1,000,000. Sheet 70, parts of Tibet and Eastern Turkestan, 1906.—Northern Trans-Frontier Survey, 1 inch to 2 miles. Sheet 47, part of Kashmir, Season 1899, 1906.—North-Western Trans-Frontier Survey, 1 inch to 2 miles. Sheets: 431, parts of Afghanistan, Mohmand country, Dir and Swat

Agency (N.W.F. Province), Seasons 1894–1898, 1905; 457, parts of districts Mianwali (Punjab), Dera Ismail Khan, and Frontier State of Waziristan (N.W.F. Province), Seasons 1873–77, 1883–84, 1889–91, 1903; 458, parts of districts Dera Ismail Khan, Waziristan (N.W.F. Province), Dera Ghazi Khan, Mianwali (Punjab), and Baluchistan, Seasons 1873–76, 1880–81, 1884–85, 1890–91, 1903.—North-Eastern Frontier Survey, 1 inch to 8 miles. Sheet 23, parts of districts Bhamo, Katha, Upper Chindwin, Myitkyina, Ruby Mines, Shan State of Möng Mit (Burma), and Yün-nan (China), 1906.—South-Western Asia Survey, 1 inch to 4 miles. Sheets: 73 N.E., part of Persia (Fars), Season 1901–02, 1905; 89 S.E., part of Persia (Laristan), Season 1901–02, 1906.—Eastern Bengal and Assam Survey, 1 inch to a mile. Sheets: 57, parts of districts Sylhet and Cachar, Seasons 1879–81, 1892–93, 1898–99, 1903–04, 1906; 425, parts of districts Chittagong (E.B. and Assam) and Akyab (Burma), Seasons 1885–86, 1888–93, 1905.—Bengal Survey, 1 inch to a mile. Sheets: 17 and 18, parts of districts Mirzapur (U.P.) and Palaman (Bengal), Seasons 1868–69, 1884–86, 1906; 142, parts of districts Muzaffarpur and Darbhanga, Seasons 1893–95, 1897–1900, 1906; 180, parts of districts Hazaribagh and Manbhum, Seasons 1861–62, 1869–70, 1906; 199 and 200, parts of district Darbhanga, Seasons 1895–96, 1899–1900, 1906; 259, parts of districts Birbhum, Murshidabad, Sonthal Parganas, and Burdwan, Seasons 1850–52, 1854-56, 1906; 286, districts of Hooghly, Howrah, Burdwan; 24 Parganas and Nadia, Seasons 1849–57, 1869–72, 1905.—Gaya district, 1 inch to 4 miles; 1906.—Muzaffarpur district, 1 inch to 8 miles; 1902.—Bhagalpur district, 1 inch to a mile. Sheets: 5 and 5*a*, 1890; 15, 1889; 16, 1902.—Bombay Survey, 1 inch to a mile. Sheets: 153, parts of district Broach, and States Baroda and Rajpipla (Rewa Kantha Agency), Seasons 1875–76, 1906; 197, parts of districts Poona and Kolaba, Season 1877–78, 1901; 256, parts of districts Nasik and Khandesh, Seasons 1874–76, 1882–83, 1906; 281, parts of districts North Kanara (Bombay) and Shimoga (Mysore), Season 1898–1900, 1905.—Cutch, 1 inch to 8 miles, 1906.—Burma Survey, 1 inch to a mile. Sheets: 1, parts of districts Chittagong (E.B. and Assam) and Akyab (Burma), Seasons, 1885–86, 1888–93, 1905; 151, parts of districts Myingyan and Pakôkku, Seasons 1894–96, 1902–03, 1906; 199, parts of districts Myingyan and Meiktila, Seasons 1893-94, 1902–03, 1906; 212, parts of districts Henzada and Tharrawaddy, Seasons 1880–84, 1890–91, 1902–03, 1906.—Central India and Rajputana Survey, 1 inch to a mile. Sheet 412, parts of districts Jalaun (U.P.) and Gwalior (C.I. Agency), Seasons 1852–55, 1862–63, 1906.—Central Provinces Survey, 1 inch to a mile. Sheet 159, parts of districts Balaghat, Bilaspur, Drug and Mandla, and Kawarda State, Season 1873–75, 1906.—Madras Survey, 1 inch to a mile. Sheets: 1, parts of districts North Kanara (Bombay) and Shimoga (Mysore), Season 1898–1900, 1905; 42, parts of district Chitaldroog (Mysore), Season 1882–83, 1906; 43, parts of districts Chitaldroog and Shimoga (Mysore), Season 1881–82, 1906.—North-Western Frontier Province, 1 inch to 4 miles; 1905.—Punjab Survey, 1 inch to a mile. Sheets: 60, parts of district Dera Ismail Khan (N.W.F. Province) and Mianwali (Punjab), Seasons 1874–75, 1878–80, 1906; 61 and 63, part of district Mianwali, Season 1873–75, 1879–80, 1906; 64, parts of districts Mianwali and Muzaffargarh, Season, 1873–74, 1881–82, 1906; 95, part of district Multan (Bari Doab), Season 1902–04, 1906; 135, parts of districts Attock, Rawalpindi (Punjab), Hazara, and Peshawar (N.W.F. Province), Seasons 1853–55, 1865–69, 1906; 263, part of Kangra district and Chamba State, Season 1895–99, 1905.—Mianwali district, 1 inch to 4 miles, 1906.—Sind Survey, 1 inch to a mile. Sheets: 36, district Karachi, Seasons 1904–05, 1906; 45, 48, and 49, districts Karachi and Hyderabad, Seasons 1893–94, 1903–04, 1905; 65, parts of districts Hyderabad, Thar and Parkar and Khairpur State, Season 1901–04, 1906; 81, district Sukkur, Season 1901–02, 1905.—United Provinces Survey, 1 inch to a mile. Sheets: 200 and 201, parts of districts Mirzapur (U.P.) and Palaman (Bengal), Seasons 1868–69, 1884–86, 1906.—Etawah district, 1 inch to 8 miles, 1905.—Hardoi district, 1 inch to 8 miles, 1905.—Muttra district, 1 inch to 4 miles, 1906.—Map of Yun-nan, 1 : 1,000,000, 2 sheets, 1905. Calcutta: Survey of India Office. *Presented by the Secretary of State for India in Council.*

Malay Peninsula. **Stanford.**

A map of the Malay Peninsula. Scale 1 : 1,140,480 or 1 inch to 18 stat. miles. London: Edward Stanford, 1906. *Price* 8*s*.

A general map of an outline character. The Native States under British protection are tinted in pale pink, and separated by narrow red boundary-lines. British possessions are shown by a darker tint of pink. The map shows railways open, under construction, and surveyed, also roads and bridle paths.

Syria. **Huber.**

Carte de la Province du Liban publiée sous le patronage de la Société Orientale de Munich. Par H. Huber. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. 4 sheets. Cairo: Baader & Gross.

The author has constructed this map from route surveys and traverses hitherto unpublished, and which extend through the greater part of the Lebanon province; thus, although rough in appearance, it is important as containing fresh information. The names of places are in French and Turkish. The map includes the country bordering on the Mediterranean from Tripoli to Saïda; it also shows the railway to Damascus.

AFRICA.

Africa. **Topographical Section General Staff.**

Map of Africa. Compiled in the Topographical Section, General Staff. Scale 1 : 1,000,000 or 1 inch to 15·8 stat. miles. Sheet 72, Kumase. London: Topographical Section, General Staff, War Office, 1906. *Price 2s. Presented by the Director of Military Operations.*

Cairo. **Stanford.**

Map of Cairo. Scale 1 : 12,000 or 1 inch to 300 yards. London: Edward Stanford, 1906. *Presented by the Publisher.*

Egypt. **Egyptian Survey Department.**

Topographical map of a portion of the Eastern Desert of Egypt. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Sheets: 12 H, 14 E, 15 G. Giza: Survey Department, 1906. *Presented by the Director-General, Survey Department, Giza.*

Kamerun. **Moisel.**

Provisorische Ausgabe der Karte des südlichen Teiles von Kamerun. Bearbeitet von M. Moisel. Scale 1 : 500,000 or 1 inch to 7·9 stat. miles. 3 sheets. Berlin: Dietrich Reimer (Ernst Vohsen), [1906]. *Presented by Herr M. Moisel.*

This is a provisional publication only. It is based upon the survey work of the German South Kamerun Boundary Expedition of 1901–1903, carried out by Captain Engelhardt and others, together with hitherto unpublished material. The whole has been carefully collected and combined with the surveys and traverses of earlier expeditions, so that a fairly complete map of the region is the result. It contains much detail, but no attempt at hill shading is made in this issue. One praiseworthy feature is the complete list which is given of the authorities whose maps and route surveys have here been utilized for the first time. Reference is also made to the latitude and longitude observations taken on the South Kamerun Boundary Expedition, but it would have been an advantage if a list of these determinations had been given.

AMERICA.

Canada. **Department of the Interior, Ottawa.**

Sectional map of Canada. Scale 1 : 190,080 or 1 inch to 3 stat. miles. Sheets: 167, Bad Hills, revised to August 31, 1906; 271, Mossy Portage, revised to August 31, 1906; 318, Sheet River, revised to August 14, 1906. Ottawa: Department of the Interior, Topographical Surveys Branch, 1906. *Presented by the Canadian Department of the Interior.*

Canada. **Topographical Section, General Staff.**

Topographic map of Canada. Scale 1 : 63,360 or 1 inch to 1 stat. mile. Ontario. Sheet 5, Dunnville. London: Topographical Section, General Staff, War Office, 1906. *Presented by the Director of Military Operations.*

Chile. **Oficina de Limites, Santiago.**

Comision Chilena de Limites. Scale 1 : 250,000 or 1 inch to 3·9 stat. miles. Sheet, Llanquihue. Santiago: Oficina de Limites, [1906]. *Presented by the Director, Oficina de Limites, Santiago.*

An additional sheet in continuation of those mentioned in the *Geographical Journal* for November, 1905. It includes the Southern Andine region between 44° and 45° S. lat., and 70° 40′ and 72° 40′ W. long. The topographical sheet is accompanied by a diagram showing the triangulation and traverse lines of the survey. The newly demarcated boundary-line between Argentina and Chili is shown in red. In addition to the Chilian surveys, those of the Argentine Boundary Commission have been utilized to complete the sheet, as well as other survey work. It is printed in colours.

Mexico. **Bohmer.**

Mapa del Estado de Senora y del Territorio de la Baja California, Republica

Mexicana. Dibujado por Max. Bohmer. Scale 1 : 750,000 or 1 inch to 11·8 stat. miles. Hermosillo, 1906.

A large general map of the states of Sonora and Lower California, containing a great deal of detail. The number of place-names is unusually large, in addition to which the character, size, and relative importance of the town or village is indicated by the symbol employed to represent it. In addition to the principal map, numerous insets are given, as well as tables of the population of the principal towns. No attempt has been made to represent relief, the names only of the various mountain ranges being given. A table is added, giving a list of the material used in the compilation of the map. Although only in outline, it is certainly the best map of these states for general reference that has been published so far.

GENERAL.

World. **Bartholomew.**

Atlas of the World's Commerce. A new series of maps, with descriptive text and diagrams, showing products, imports, commercial conditions, and economic statistics of the countries of the World. Compiled from the latest official returns at the Edinburgh Geographical Institute, and edited by J. G. Bartholomew, F.R.G.S., F.R.S.E. Parts 11, 12, and 13. London: George Newnes, Limited, [1906]. *Price 6d. each part. Presented by the Publisher.*

With Part 11, half of the complete issue of the twenty-two parts of which this atlas is to consist, has been published, and in this part the interesting and useful list of Commodities of Commerce is brought to an end. This list alone forms a valuable contribution in commercial geography. The other contents of this part are—Plates: 69, Potatoes and manioc; 70, 71, Maize and oats; 72, Rice and rye; 105, 108, Fisheries, statistics; 106, 107, Fisheries distribution. With this part also commences an important article entitled "Development of New Lands," in which the commercial possibilities, natural products, minerals, climate, etc., of little developed regions of the Earth are dealt with.—Part 12 commences with the first part of "An Introduction to Economic Geography," by Mr. G. G. Chisholm, M.A., B.SC., than whom no more competent authority on this subject could be found. After this follows Plates: 73, Rice and rye statistics; 74, 75, 76, Barley, millet, sago; 93, Beer and spirits production; 94, 95, 96, Coco and spices.—Part 13 first contains a continuation of Mr. G. G. Chisholm's "Introduction to Economic Geography," and plates of maps and diagrams as follows: 117 to 120, Flax, hemp, and jute supply and statistics; 149 to 151, Precious stones; 152, Petroleum, asphalt.

World. **Harmsworth.**

Harmsworth Atlas and Gazetteer. 500 maps and diagrams, and gazetteer of 105,000 references. Part i., containing plates: 11–12, the Atlantic Ocean; 13–14, Europe; 25–26, the East of England; 45–46, France and the Low Countries; 103–104, the Near East. Part ii., containing plates: 3–4, the British Empire; 133–134, Africa; 155–156, Industrial North America. London: The Amalgamated Press, Limited, 1906. *Price 7d. each part. Presented by the Publisher.*

This atlas will be specially noticed when it is completed.

World. **Stieler.**

Neunten, von Grund aus neubearbeiteten und neugestochenen Auflage von Stielers Hand-Atlas, 100 Karten auf 200 Seiten mit 162 Nebenkarten in Kupferstich und einen alphabetischen Verzeichnis aller im Atlas vorkommenden Namen (ungefähr 240,000 Namen enthaltend) herausgegeben von Justus Perthes' Geographischer Anstalt in Gotha. Lieferungen 23, 24, 25, and 26. Gotha: Justus Perthes, 1906. *Price 60 pf. each part.*

Parts xxiii. and xxiv. (in one cover) contains the following maps: 26, Frankreich, general, 1 : 3,700,000; 46, Europäisches Russland, sheet 3, 1 : 3,700,000; 55, Asien, general, 1 : 30,000,000; 92, Mexico, Guatemala and Salvador, 1 : 7,500,000. Parts xxiv. and xxv. (in one cover) contain maps 19, Oesterreich-Ungarn, 1 : 1,500,000, sheet 3; 33, Pyrenäische Halbinsel, 1 : 1,500,000, sheet 2; 63, Vorder-Indien und Inner-Asien, 1 : 7,500,000, sheet 4. These maps are much as they appeared in the last issue; in fact, in some respects they are hardly revised as thoroughly as they might have been, as will be seen from the map of Asia, in which Major Ryder's recent survey of the course of the Brahmaputra has not been taken advantage of. In addition to the maps there is a continuation of the Index to place-names.

CHARTS.

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

Charts and Plans published by the Hydrographic Department, Admiralty, during September, 1906. *Presented by the Hydrographer, Admiralty.*

No.	Inches.	
3584 m	= {1·1, 1·1, 1·8, 4·1}	West Indies:—channels and anchorages in the Great Bahama bank, Man of War channel, Cays south-east of Andros island, Washerwoman's cut. 3*s*.
3587 m	= 3·75	West Indies:—Haiti, Fort Liberté bay. 2*s*.
3589 m	= 0·68	Chile:—Guaitecas islands. 2*s*.
3592 m	= 5·0	Siam:—Bangkok harbour. 2*s*.
3585 m	= 1·99	China, north-east coast:—Approaches to the Wusung river. 3*s*.
3575 m	= {1·97, 1·94}	Japan:—Plans on the west coast of Nipon, Futami Wan, Aikawa Wan. 2*s*.

New Plans and Plans added.

2291 m	= 3·4	Norway, sheet ii.:—Bergen to Stav fiord. New plan:—Lerdalsören. 3*s*.
219 m	= 1·8	Malacca strait:—Acheh head to Diamond point. Plan added:—Gighen road. 3*s*.
2284 m	= {2·4, 7·2}	Plans of anchorages on the west coast of Sumatra. Plans added:—Singkel road, Singkel creek. 2*s*.
2718 m	= {2·9, 2·1, 2·9}	Anchorages on the east coast of the Celebes. New plans:—Tomini road, Togean anchorage. Plan added:—Lambunu road. 2*s*.
2196 m	= 1·45	Sketch-plans of anchorages in the southern part of Celebes. New plan:—Bulekomba and Bintaru roads. 2*s*.
651 m	= 4·0	Japan:—Bungo channel. Plan added:—Amaji ko. 3*s*.
1176 m	= 0·6	Islands in the South Pacific. New plan:—Niue or Savage island. 2*s*.

Charts Cancelled.

No.	Cancelled by	No.
1296 Plans on the coast of Chile. Plans of Port Low, Inner Port, and Port Melinka on this sheet.	New chart. Guaitecas islands	3589
2082 Africa, south coast. Table bay to Cape Agulhas. Plans of Table bay and Simon's bay on this sheet.	— — —	—

Charts that have received Important Corrections.

No. 1188, The World:—Coal and Telegraph chart. 3421, Scotland, west coast:—Broadford bay. 117, Færoe islands. 2800, Baltic sea:—Gulf of Bothnia (Sheet 5). 2526, South America, east coast:—Buenos Aires. 1897*b*, British Columbia:—Victoria harbour. 1844, Borneo:—Labuan island. 1957, China, east coast:—Namoa island. 2653, China, north coast:—Pei ho or Peking river (Sheet 1). 3388, China, north coast:—Terminal head to Hai Yung tau. 2415, Japan:—Approach to Nagasaki harbour. 1079, Tasmania. 1423, New Zealand:—Port Nicholson. 3033, New Hebrides:—New Hebrides islands and New Caledonia.

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

Indian Ocean and Red Sea. **Meteorological Office.**

Meteorological Chart of the Indian Ocean north of 15° S. lat., and Red Sea for November, 1906. London: Meteorological Office, 1906. *Price* 6*d*. *Presented by the Meteorological Office.*

North Atlantic and Mediterranean. **Meteorological Office.**

Meteorological Chart of the North Atlantic and Mediterranean for November, 1906. London: Meteorological Office, 1906. *Price* 6*d*. *Presented by the Meteorological Office.*

North Atlantic. **U.S. Hydrographic Office.**

Pilot Charts of the North Atlantic Ocean for October and November, 1906. Washington: U.S. Hydrographic Office, 1906. *Presented by the U.S. Hydrographic Office.*

North Pacific. **U.S. Hydrographic Office.**

Pilot Charts of the North Pacific Ocean for November, 1906. Washington: U.S. Hydrographic Office, 1906. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

China. **Barnardiston.**

One hundred and sixty-five photographs of China, taken by Captain E. Barnardiston, R.E., in 1904. *Presented by Captain E. Barnardiston, R.E.*

Captain E. Barnardiston accompanied, as geographical surveyor, Colonel Manifold's expedition through Western China and the Yang-tse valley, an account of which was given in the *Geographical Journal* for June, 1905. These photographs, taken during his travels, form an interesting and instructive series. With the exception of five, which are enlargements, they are all quarter-plate size.

(1) Han river at junction of Shao-Chiang-Ho; (2) Han river, looking down; (3) Han river, looking up; (4) Han river, near Chin-Shan-Liang; (5) Han river, country on left bank towards Yüen-Shan; (6) Han river, near Jiun Jho; (7 and 8) Han river, our boats 10 miles above Jiun-Jho; (9–11) Han river, gorge 7 miles above Yün-Yang Fu; (12–15) Han river, Pai-Ho Hsien; (16) Han river, Yüeh-Erh-Tan; (17 and 18) Han river, Ni-Kho; (19) Han river from Lang-Shui-Ho; (20 and 21) Han river, from above Lang-Shui-Ho; (22) Han river at Siao-Ho-Kho; (23) Han river at Su-Ho-Kho; (24) Typical scenery, Han river; (25) Han river, Hsing-An Fu; (26) View from Mao-Kia-Shan to south of Lo-Ho; (27) Gorge on road to Lo-Ho; (28) Looking down valley near T'sing-Shui-Ho; (29) View down T'sing Ho; (30) View down Lan Ho; (31–34) Near U-To-Ho; (35) Two miles below U-To-Ho; (36) A gorge; (37) In valley of Ta Ho; (38) In valley of Ta Ho at Siu-K'iu-Ba; (39) My escort from Cheng-Kou-Ting; (40) Ta-Chu-Ho; (41) Two miles from Ta-Chu-Ho, on Tai-Ping Hsien road; (42) Near Tai-Ping Hsien; (43) On border of Shên-si and Ssŭ-Chuan, looking towards Tai-Ping Hsien; (44) On border of Shên-si and Ssŭ-Chuan, showing Kuan-Lun-Po pass; (45) View from Kuan-Lun-Po, looking south-south-east; (46) Crushed rock in river near Tai-Ping Hsien; (47) Near Tai-Ping Hsien; (48) Tai-Ping river; (49) Coolie carrying cloth near Tai-Ping Hsien; (50) Lo-Yang-Ba; (51) Bridge over Tin-Sa Ho; (52, 53, and 161) Tung-Siang Hsien; (54) Lao-Cheng Ho; (55) Boat-building on river above Sui-Ting Fu; (55) Dr. Wilson's hospital, Sui-Ting Fu; (57) Dr. Wilson's science lecture-hall, Sui-Ting Fu; (58) Rev. A. Palhill and his house, Sui-Ting Fu; (59) Sui-Ting Fu; (60) Eight miles from Sui-Ting Fu; (61) T'ung trees in bloom; (62) View on road to Liang-Shan Hsien; (63) Bridge over Liao Ho, between Liang-Shan and Wan Hsien; (64) On Wan Hsien road; (65) A common type of Ssŭ-Chuan bridge; (66) Junk on Yang-tzŭ above Kuei Fu; (67) Yang-tzŭ, looking down-stream, above Kuei Fu; (68) Yang-tzŭ, looking up-stream, above Kuei Fu; (69 and 70) Yang-tzŭ, entrances to gorges below Kuei-Chou Fu; (71) Yang-tzŭ just above Pei-Shih (72) Yang-tzŭ, Pei-Shih; (73 and 74) Yang-tzŭ below Pei-Shih; (75 and 76) Yang-tzŭ, the Yih-T'an from down-stream; (77, 79, and 162) Yang-tzŭ, above the Chin-T'an; (78) Yang-tzŭ, boat coming up the Chin-T'an; (80, 82, and 83) Yang-tzŭ, looking up-stream from below Chin-T'an; (81) Yang-tzŭ, looking down-stream from below Chin-T'an; (84 and 85) Yang-tzŭ Shan-Tao-Ping; (86) Yang-tzŭ, Lo-Tin-Chi; (87) Chang-Yang in Ching-Chiang Ho valley; (88) In Chang-Yang temple, the ten gods of hell; (89) In Ching-Chiang Ho valley at junction of the Ssŭ-Yang Ho; (90) Looking up Ssŭ-Yang Ho from the Ching-Chiang Ho; (91 and 92) Ching-Chiang Ho at Chang-Mu-Lai; (93) Ching-Chiang Ho, near Ya-Tsi-Keo; (94) At Si-Cheo in Ching-Chiang Ho valley; (95) Near U-Sha-Keo in Ching-Chiang Ho valley; (96) A cliff 6000 feet high at Shih-Pan-Chi in Ching-Chiang valley; (97) Kien-Chi Hsien; (98) Covered street, Tien-Chiao; (99) Salt industry at Ju-Shan-Ching, on Lung-Shui Ho; (100) Fou-chou-river; (101) Fou-chou river, gorge below Kong-Keo; (102 and 103) Fou-chou river above Ta-Koa-Pa; (104) "Man-tse-tung," or cave-dwellings, exposed in a stone quarry; (105) A bamboo water-wheel for irrigation about 30 feet high; (106) Irrigation wheels, worked by man inside; (107) A road bridge; (108) Chen-Tu plain from north wall of city; Timber-yard near north gate of Chen-Tu; (110 and 111) Examination hall of Chen-Tu; (112) In temple of Wan-Nien-Ssŭ, on O-Mei Shan; (113) A laughing Buddha, O-Mei Shan; (114 and 115) O-Mei Shan; (116 and 118) Wayside shrine, O-Mei Shan; (117) A temple, O-Mei Shan; (119) Priests in their room, Chin-Ting, O-Mei Shan; (120, 121, and 124) Chin-Ting temple on summit of O-Mei Shan; (122, 123, 163, and 164) Priests, Chin-Ting temple; (125 and 126) A valley on O-Mei Shan; (127) Entrance of Lung-Sheng-Kang, O-Mei Shan; (128) View on road at base of O-Mei Shan; (129) Coolies carrying coffin wood, O-Mei Shan; (130) On road at base of O-Mei Shan; (131) How pilgrims are carried up, O-Mei Shan; (132) Entrance to a Chinese town in Ssŭ-Chuan; (133) Ploughing in Ssŭ-Chuan; (134) An archway at Chang-Chia-Kang; (135) Inn at Lung-An-P'u; (136) Group at Hswang-Liu Hsien; (137) Pig on barrow going to market; (138) Ploughing rice-field in Ssŭ-Chuan; (139) Group in a village; (140) Two children on roadside; (141) Group at Chiu-Lin; (142) A typical Ssŭ-Chuan village, Ting-Kwan-Tzŭ; (143) Coolie with load of wood; (144) Old woman and child on bridge; (145) A Ssŭ-Chuan valley; (146) A Ssŭ-Chuan bridge;

(147) A Ssŭ-Chuan town; (148) Group at Yung-Feng-Chang; (149 and 165) Coolie with load of wooden bowls, etc.; (150) Chun Chou, on Yang-tzŭ Chiang; (151) Typical farmhouse, Ssŭ-Chuan; (152) Coolie with my bedding, etc.; (153) Scene on road in Ssŭ-Chuan; (154) A bridge in Ssŭ-Chuan; (155) A Ssŭ-Chuan valley; (156) "Three generations" (two rows of stepping-stones and one bridge); (157) A farmstead in Ssŭ-Chuan; (158) Old woman washing clothes; (159) Inn at San-Chan-Pu; (160) A load of reed-pith on the Yang-tzŭ at Yun-Yang Fu.

Nigeria. **Beak**

Sixty-four photographs of Northern and Southern Nigeria, taken by G. B. Beak, Esq. *Presented by G. B. Beak, Esq.*

A series of small photographs chiefly interesting as illustrative of the manner of life, industries, and customs of the natives. The titles are as follows:—

(1) The Residency, Ilorin; (2–4) The emir of Ilorin and his chiefs; (5) Women dyeing cloth, Ilorin; (6) Leather-workers, Ilorin; (7) Weavers at Ilorin; (8) Looms, Ilorin; (9) Group of political officers, Ilorin; (10) Building grass huts to accommodate small-pox patients, Ilorin; (11) A native smithy, Ilorin; (12) Brass workers, Ilorin; (13) Pot-makers, Ilorin; (14) "Le Coiffeur," Ilorin; (15) Group of Yorubas near Ilorin; (16) A native crowd at Ilcrin; (17) A typical crowd of Hausas and Yorubas at Ilorin; (18) The Baluguns of Ilorin; (19) A view on the Niger near Lokoja; (20) The tennis courts, Lokoja; (21) Polo at Lokoja; (22) Yoruba drummers; (23 and 24) A group of Yorubas; (25–27) Fishing on the Benue; (28) A reach of the Benue; (29) A halt on the caravan route between Lagos and Kano; (30) A group of headmen *en route* from Kano to Lagos; (31) The witch of Awtun; (32) The guard; (33) An officer's stores on trek; (34) *En route;* (35 and 36) A group of Munchis; (37) A procession at the Feast of Ramadan; (38) Crossing a stream; (39) An old woman winding thread; (40) Fulani horsemen; (41) The junction of the Niger and the Benue; (42) A Hausa bed; (43) Caravan toll station; (44) Sir Frederick Lugard's S.Y. *Corona;* (45) Native fire signs; (46) Native Indaba; (47) Quarrying stone; (48) A characteristic view from a stern-wheeler on the Niger; (49) The acting High Commissioner; (50) The bridge-builders; (51) Northern Nigerian cattle; (52–55) Road-making; (56) Road-making, the onlookers; (57) A Jukum king and his chief men; (58) A caravan of women; (59) A caravan *en route;* (60) A caravan outspanned; (61) Nupe huts; (62) A characteristic view on the Lower Niger; (63) Native canoes on the Lower Niger; (64) Preparing for an expedition, Southern Nigeria.

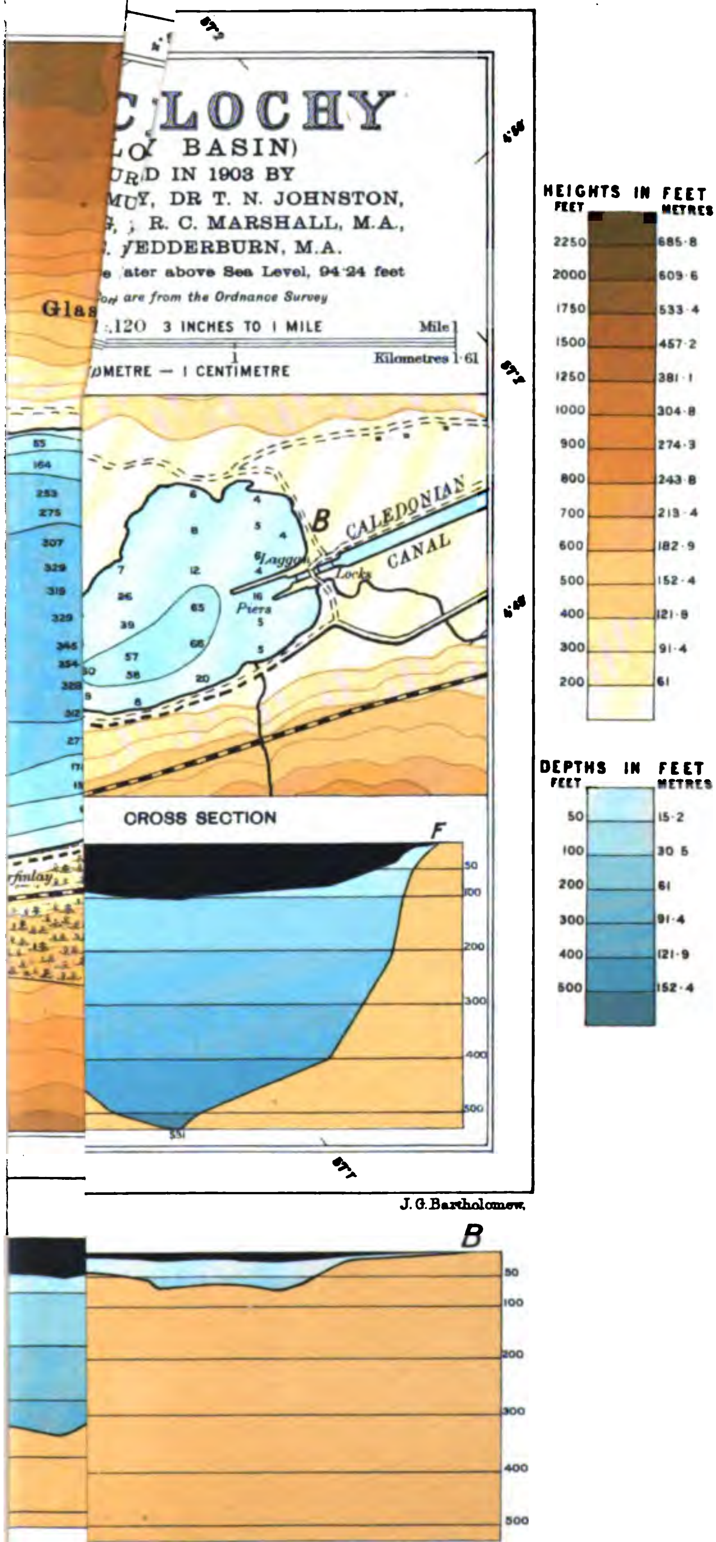
Northern Nigeria. **Temple.**

One hundred and forty-five photographs of Northern Nigeria, taken by C. L. Temple, Esq. *Presented by C. L. Temple, Esq.*

A set of half-plate photographs. Not only are they of exceptional merit as specimens, but Mr. Temple has been most careful in the selection of subjects, and has chosen those that are likely to be valuable, specially from a geographical and ethnological point of view. They are arranged in sets according to the subjects. Mr. Temple has held important positions in Northern Nigeria for years past, and is now Resident at Bauchi.

(1) Maifoni fort; (2) Maifoni market; (3–5) Freed slaves' home, Maifoni; (6–8) Troops resting, Maifoni; (9–17) Kanuri horsemen at Maifoni; (18–20) Sir F. Lugard at Maifoni; (21–30) Maifoni and Monganui markets; (31–34) The residency, Maigomeri; (35–36) Bornu prisoners; (37 and 38) Bauchi prisoners; (39–43) The emir of Gombe and native escort; (44 and 45) Poisonous plant; (46) Fulani dancers; (47) A Nigerian horse; (48) Wase rock; (49–53) Pagan Bolewa at Guduku on the river Gongola; (54–56) Views on river Gongola; (57) River Gongola near Gombe; (58) View of Gombe; (59) Ruined Kano gate, Kukawa; (60–63) Views in and about Kukawa; (64 and 65) Muster of carriers; (66) Rest house, Napada; (67 and 68) Animal transport, Bornu; (69) Camp in Bornu; (70–75) Kanuri wrestlers, Gujba; (76–83) Fulani herds; (84 and 85) Fishing nets; (86–92) Views on the river Benue between Ibi and Lokoja; (93–101) Views in and about Bauchi; (102–110) Emir of Bauchi's messengers; (111–121) Views in and about Napada, on river Gongola; (122–133) Kanuri dancers, Gujba; (134–145) Presentation of a state umbrella and saddle to the sultan of Bornu, by Sir F. Lugard, December, 1904.

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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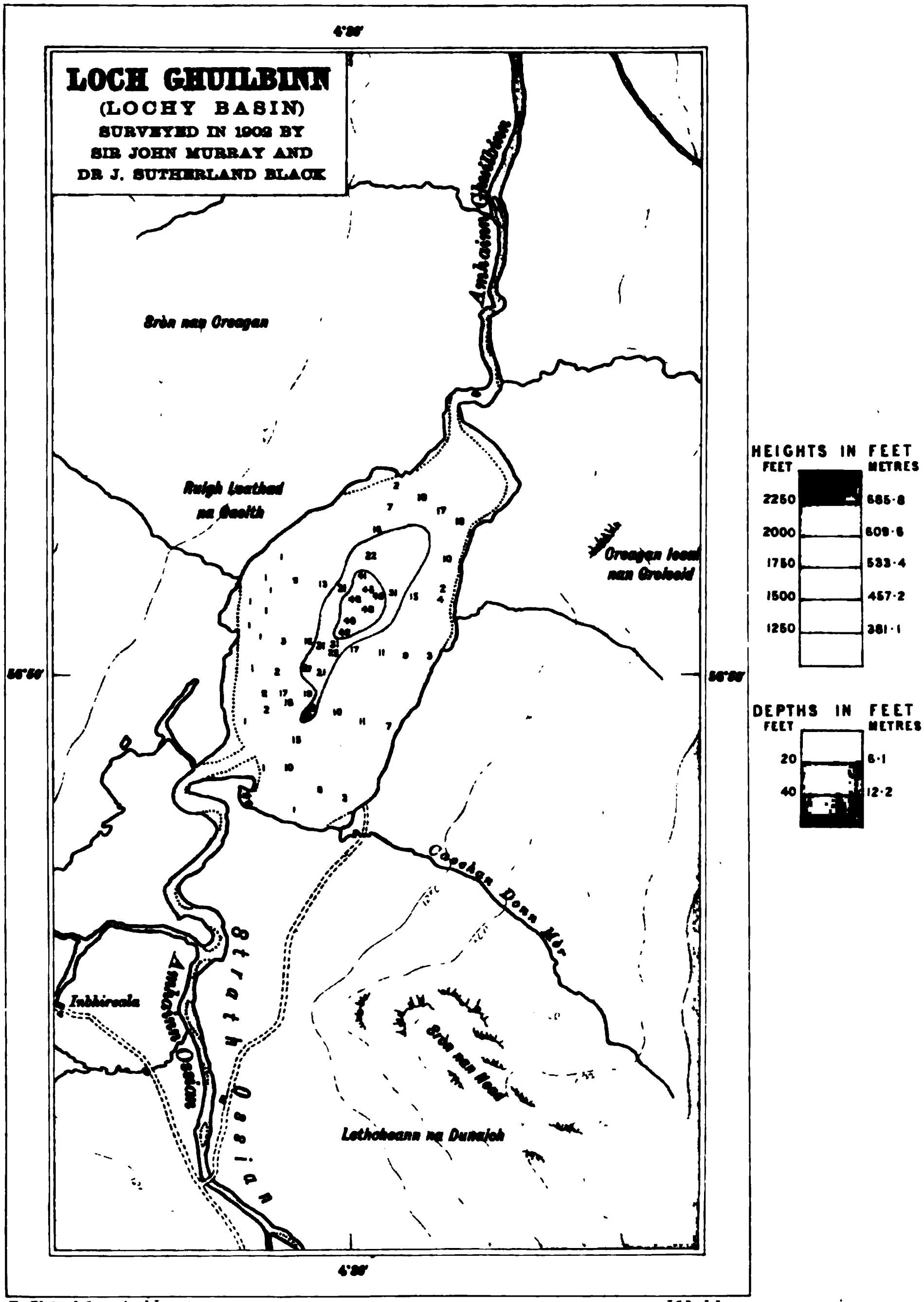
J. G. Bartholomew.

BATHYMETRICAL SURVEY OF THE FRESH-WATER LOCHS OF SCOTLAND

UNDER THE DIRECTION OF

SIR JOHN MURRAY, K.C.B., F.R.S., D.Sc., AND LAURENCE PULLAR, F.R.S.E.



The Edinburgh Geographical Institute J G Bartholomew

Scale 1 : 21,120 3 INCHES TO 1 MILE

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The Land Contours are from the Ordnance Survey

Published by the Royal Geographical Society

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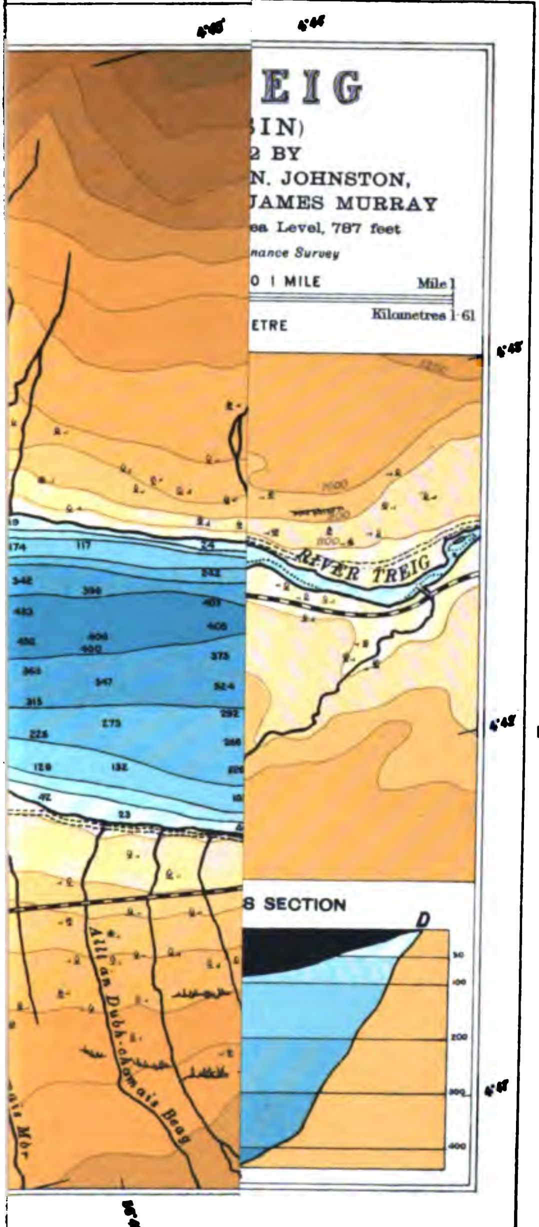

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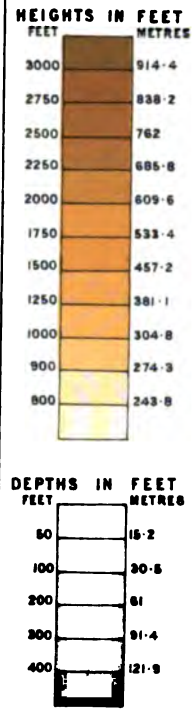

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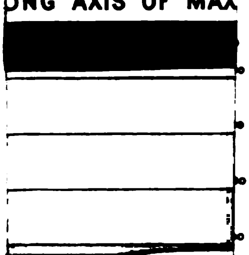
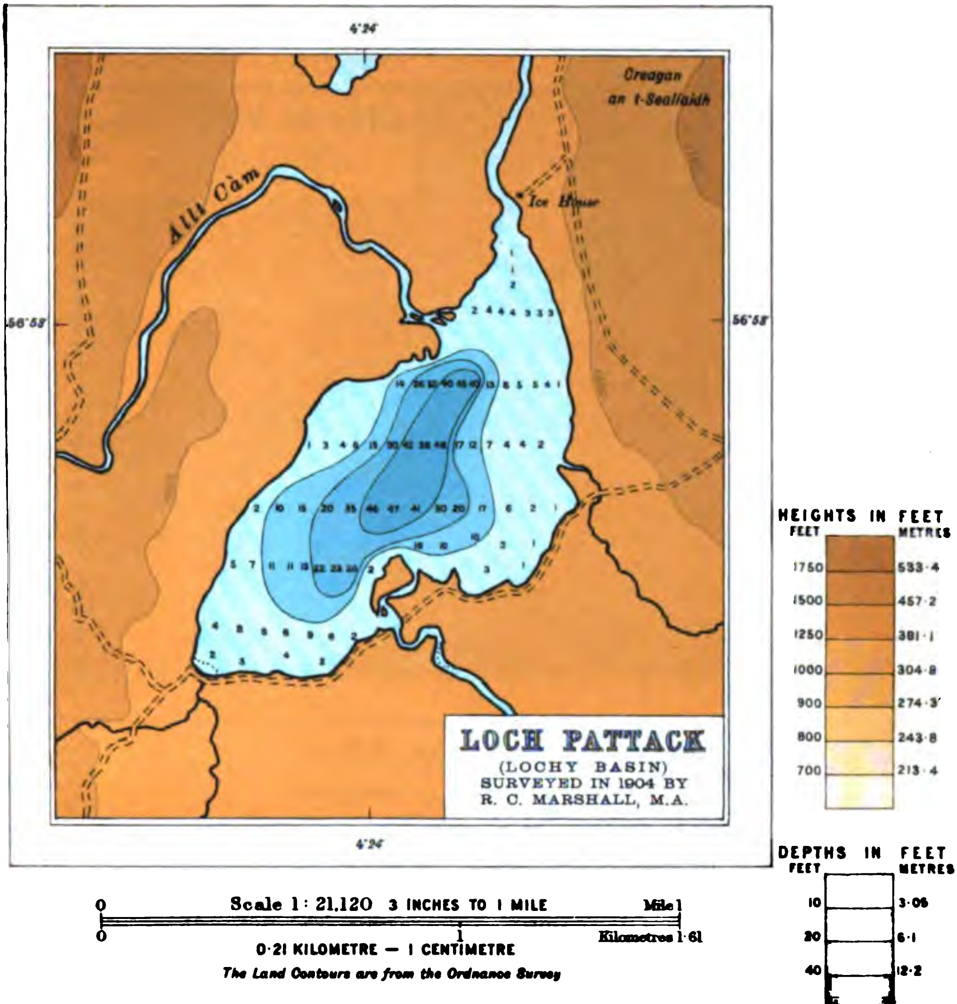


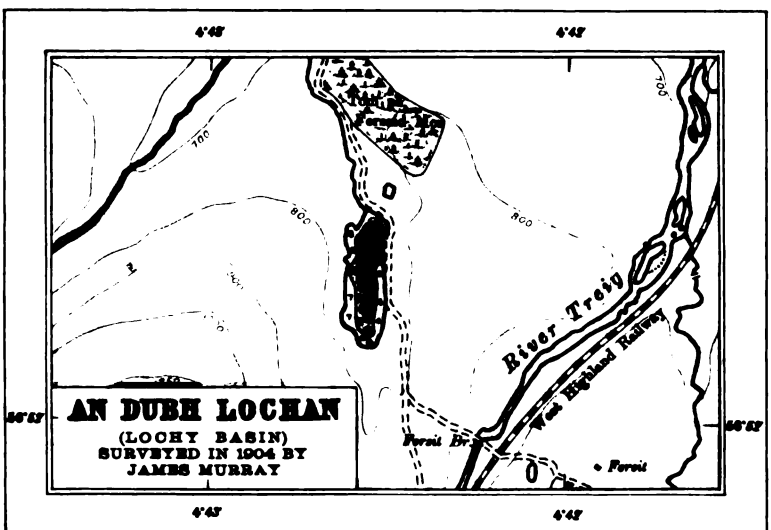
al Geographical Societ

Bathymetrical Survey of the Lochs of Scotland

under the direction of

Sir JOHN MURRAY, K.C.B., F.R.S., D.Sc., and LAURENCE PULLAR, F.R.S.E.





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Bathymetrical Survey of the Lochs of Scotland

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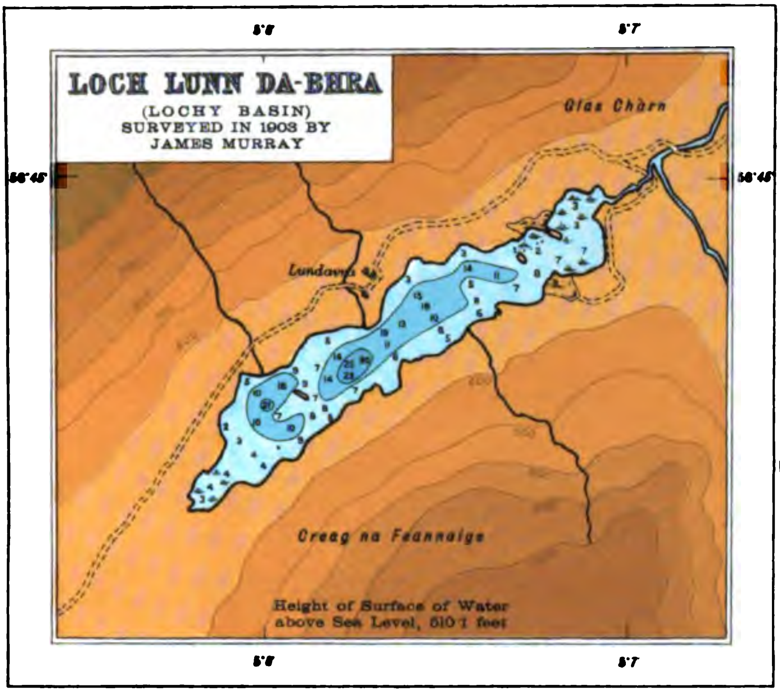

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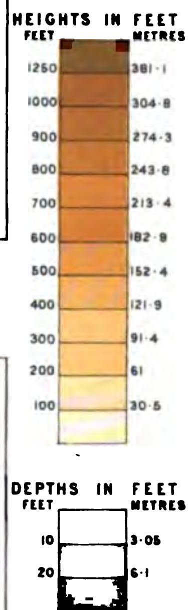

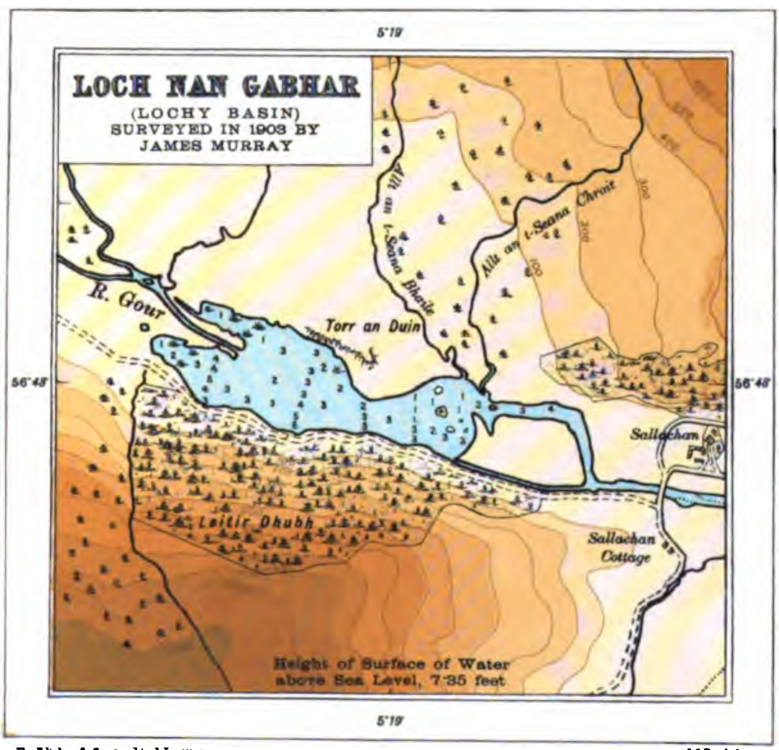

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* Denotes Articles and Papers. † Bibliographical Entry.
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PRINTED BY WILLIAM CLOWES AND SONS, LIMITED, LONDON AND BECCLES.

DECEMBER, 1906.

VOL. XXVIII. NO. 6.

The Geographical Journal

INCLUDING THE PROCEEDINGS OF THE ROYAL GEOGRAPHICAL SOCIETY.

SUMMARY OF CONTENTS.

(For Details, see over.)

PUBLISHED UNDER THE AUTHORITY OF THE COUNCIL.
EDITED BY THE SECRETARY.

LONDON:
THE ROYAL GEOGRAPHICAL SOCIETY, 1, SAVILE ROW;
EDWARD STANFORD, 12, 13 AND 14, LONG ACRE, W.C.

PUBLISHED MONTHLY.] [To Non-Fellows, Price 2s.; 27s. per annum, post free

For Notices as to the Society's Meetings and other important matters, see p. iv.

Intimation of a change of address must reach the Office of the R.G.S. not later than the 15th of the month.

For List of Council and Officers, Conditions of Admission to the Fellowship of the Society and Society Notices, see pages ii., iv., vi., and viii.

The Geographical Journal.

Authors are alone responsible for their respective statements. In MS. communications all new or unfamiliar geographical names should be written in imitation of Roman type.

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PARIS: BARRÈRE. VIENNA: ARTARIA & Co. HAMBURG: L. FRIEDERICHSEN & Co. ST. PETERSBURG: WATKINS & Co.

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ROYAL GEOGRAPHICAL SOCIETY.

Candidates for admission into the Society must be proposed and seconded by Fellows, and it is necessary that the description and residence of such Candidates should be clearly stated on their Certificates.

It is provided by Chapter V., § 1, of the Bye-Laws, that—

"Every Fellow shall, on election, be required to pay £5 as entrance fee, and £2 as annual "subscription for the current year, and thereafter a yearly subscription of £2, due on the 1st January "of each year; or he may compound either at entrance by one payment of £35, or at any subsequent "period on the following scale, provided that there shall be at the time no arrears due by him to "the Society:—

Fellows of 10 years' standing and under 15		...	£20
" 15 " " "	20	...	£16
" 20 " " "	and over	...	£12 10s.

"No Fellow shall be entitled to vote or to enjoy any privilege of the Society while in arrear."

All Subscriptions are payable in advance, on the 1st of January in each year.

The privileges of a Fellow include admission (with one Friend) to all ordinary Meetings of the Society, and the use of the Library and Map-room. Each Fellow is also entitled to receive a copy of all the Society's Periodical Publications.

Copies of the Year Book, Regulations, and Candidates' Certificates may be had on application at the Society's Office, 1, Savile Row, London, W.

ROYAL GEOGRAPHICAL SOCIETY.

NOTICES.*

Meetings in December and January.—Monday, December 10. Irrigation in the United States. By Major John L. Beacom.—**Monday, December 17.** Nine Years' Survey Work in Northern China and Mongolia. By Colonel A. W. S. Wingate. —**Monday, January 14.** An Expedition to Mt. Ruwenzori. By H.R.H. the Duke of the Abruzzi.—**Monday, January 28.** A Journey through Central Asia to Northern China. By Major C. D. Bruce.

Research Department.—Friday, December 14, at 5.30 p.m., in the Map Room. Heights of the Lakes and Mountains of Central Africa. By Captain T. T. Behrens, R.E.

Christmas Lectures to Young People.—Friday, January 4, at 3.30 p.m. Japan and the Japanese as I saw them. By Miss A. L. Murcutt.—Monday, January 7. A Lady's Journey from the Cape to Cairo. By Miss Mary Hall. Both lectures will be illustrated with numerous lantern slides. Fellows' tickets will not be available for these lectures; application for tickets should be made to the Chief Clerk, 1, Savile Row, W.

Notice to Fellows in Arrear.—The Council desire to intimate that the Society's publications will not be forwarded to Fellows who are in arrear with their subscription for six months or over.

Any Fellow resident in this country, desiring to have notice of the subjects of papers to be read at the Society's Meetings forwarded to him, can receive such notices by post on payment in advance to the Chief Clerk, at 1, Savile Row, of 2s. per session.

* See also pp. vi., viii. and x.

NOTICE.

PHOTOGRAPHS.

ROYAL GEOGRAPHICAL SOCIETY.

It would greatly add to the value of the Collection of Photographs which has been established in the Map Room of the Royal Geographical Society, if all the Fellows who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they would 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.

NOTICE.

INSTRUCTION FOR INTENDING TRAVELLERS.

Under the authority of the Council of the R.G.S.

Arrangements have been made for the instruction of intending travellers in the following subjects:—

Surveying and Mapping, including the fixing of positions by Astronomical Observations. By Mr. E. A. Reeves, F.R.A.S., Map Curator of the Society.

Geology, including practical training in the field. Under the superintendence of the Director General of the Geological Survey.

Botany. Under the superintendence of the Director, Royal Gardens, Kew.

Zoology. By Dr. R. Bowdler Sharpe, Natural History Museum, South Kensington.

Anthropological Measurements. Under the superintendence of Dr. J. G. Garson, Anthropological Institute.

Photography. By Mr. John Thomson, Author of 'Photographic Illustrations of China and its People,' and other works.

Meteorology. By Dr. H. R. Mill.

Outfit and Health. Dr. Charles F. Harford, Secretary of the Travellers' Health Bureau.

The lessons are given on days and at hours arranged between the Instructor and the pupil. Tickets for the lessons, at 2s. 6d. for each hour's lesson, must be previously procured at the Offices of the Society.

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Where no number is given, the Advertisement does not appear this month.