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JANUARY, 1894.

VOL. III. No. 1.



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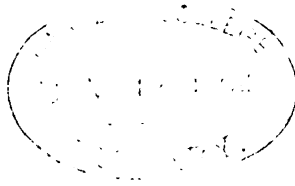
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The Geographical Journal.

No. 1.

JANUARY, 1894.

VOL. III.

THE RENEWAL OF ANTARCTIC EXPLORATION.*

By JOHN MURRAY, Ph.D., LL.D., of the "Challenger" Expedition.

WHEN we cast a retrospective glance at the history of knowledge concerning our planet, we find that nearly all the great advances in geography took place among commercial—and in a very special manner among maritime—peoples. Whenever primitive races commenced to look upon the ocean, not as a terrible barrier separating lands, but rather as a means of communication between distant countries, they soon acquired increased wealth and power, and beheld the dawn of new ideas and great discoveries. Down even to our own day the power and progress of nations may, in a sense, be measured by the extent to which their seamen have been able to brave the many perils, and their learned men have been able to unravel the many riddles, of the great ocean. The history of civilisation runs parallel with the history of navigation in all its wider aspects.

Horace and many other poets have sung the praises of the sailor who "first put forth on cruel ocean, in the frail rude bark." But in navigation, as in all other branches of human activity, there has been a slow, gradual, and laborious development from the construction and management of the simple raft by the river-side up to the ironclad and Atlantic greyhound of our own day. Many active and original minds, many stout and brave hearts, have contributed to these final results. The tempest-tossed sea is now no obstacle and no terror for the instructed mariner with a well-found ship. The "severance of the sea" has disappeared along with the ideas associated with the expression.

* Paper read at the Meeting of the Royal Geographical Society, November 27th, 1893. Map, p. 80.

Not only so, but the most profound depths of the wide mysterious ocean have in our own time been forced to yield up their hidden treasures to the persistent efforts of the modern investigator.

Is the last great piece of maritime exploration on the surface of our Earth to be undertaken by Britons, or is it to be left to those who may be destined to succeed or supplant us on the ocean? That is a question which this generation must answer.

The civilised nations at the birth of navigation were most probably in the same phase of development as the Pacific Islanders of the present day. Yet it is a most remarkable fact that at the very dawn of history we find a commercial people who were able to conduct voyages which rival those of the fifteenth century. Long before the oldest Hebrew and Greek records, the Phœnicians had settled all over the Mediterranean; they were in the *Ægean* fourteen, and at Gades on the Atlantic eleven, centuries before the Christian era; they made long voyages in the *Erythræan Sea* or *Indian Ocean*, as well as on the Atlantic beyond the Pillars of Hercules. Herodotus tells us that, about six hundred years before Christ, Phœnician sailors reported that, in rounding Africa to the south, they had the sun on their right hand. "This, for my part," says Herodotus, "I do not believe; but others may." This observation as to the position of the sun is, however, good evidence that the expedition of Necho really took place. At all events this is the first hint to be found in literature of a visit to the Southern Hemisphere, and we do not meet with any more definite and satisfactory information till the time of the Renaissance.

For all practical purposes, the views of the later Greek philosophers, with reference to the figure and position of the Earth did not differ from those of the modern geographer, except in the difference between the geocentric and heliocentric standpoints. Eratosthenes estimated the circumference of the Earth at 25,000 miles, a very remarkable approximation to the truth, and we find him speculating, eighteen centuries before Columbus and Magellan, on the possibility of circumnavigating the globe. The ancients divided the surface of the Earth into five zones. The torrid zone was uninhabitable from heat; the two frigid zones towards the poles were uninhabitable from cold, and in the Southern Hemisphere there was a temperate zone similar to that of the Northern Hemisphere in which the known world was situated. Aristotle does not say that the southern temperate zone is inhabited, but Strabo admits that there may be other worlds inhabited by a different race of men. Pomponius Mela, who lived in the first century of our era, speaks as an undoubted fact of the existence of the autochthones inhabiting continental land in the Southern Hemisphere, although this land was inaccessible owing to the heat of the intervening torrid zone. Mela held, like most of his predecessors, that the habitable world of Europe, Asia and Africa, formed a single island surrounded by the all-



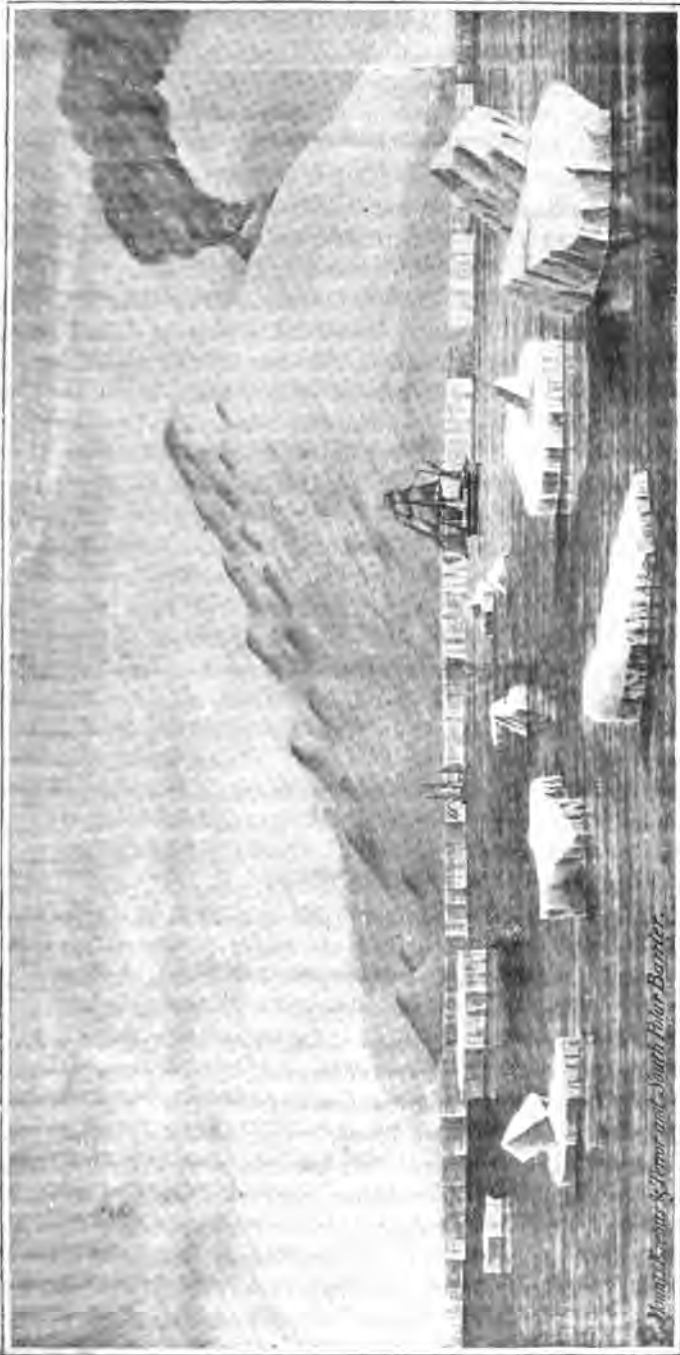
VICTORIA LAND: MOUNT SABINE AND ADJACENT COAST.

encircling sea. Marinus of Tyre, who lived in the second century, rejected this view, and returned to the less correct notion of Hipparchus, who had maintained that the known continents were united to other similar masses of land still unknown, and that the Atlantic and Indian Oceans were separated from each other, thus forming great enclosed seas such as the Mediterranean. Ptolemy adopted the views of Marinus, and consequently in his maps united the eastern coast of Africa by unknown lands or Southern Ethiopia to the Chinese coast.*

The science and learning of antiquity were swept away by the destructive incursions of the barbarians, and there is retrogression rather than progress to record during the dark and middle ages.

The Portuguese voyages along the west coast of Africa, initiated by Prince Henry, the Navigator, must be regarded as among the first fruits of the Renaissance, and the prelude to the great maritime discoveries of the 15th and 16th centuries. The views of Mela prevailed in Portugal, whereas those of Ptolemy were elsewhere supreme. By the time of Prince Henry's death in 1460, the Portuguese had reconnoitred the coast of Africa for 1700 miles, and Bartholomew Diaz reached and doubled the Cape of Good Hope in 1486. This most successful voyage produced an immense sensation. A death-blow was given to Ptolemy's view that the Indian Ocean was an enclosed sea; the fiery zone of the ancients had been crossed; the southern temperate zone of Aristotle, Strabo, and Mela had been reached, and it was inhabited. The air was filled with the noise of discovery. A few years later Columbus made his ever famous voyage across the Atlantic, Vespucci announced the discovery of a new world in the Southern Hemisphere, a *fourth part* unknown to the ancients. The Portuguese sailed to India, the Spice Islands, and even China by way of the Cape. From a peak in Darien, Balboa beheld a boundless ocean beyond the new found lands in the west, and in 1520, Magellan passed into and crossed this great ocean, which he called the Pacific, thus completing the first circumnavigation of the world. These great voyages doubled at a single bound all that was previously known of the Earth's surface. The sphericity of the Earth, the existence of antipodes, were no longer scientific theories, but demonstrated facts. The loss or gain of a day in sailing round the world, together with a multitude of other unfamiliar and bewildering facts, struck the imagination, and altogether the effect of these startling events was without parallel in the history of the world. The solid immovable earth beneath men's feet was replaced by the mental picture of the great floating globe swung in space, supported by some unseen power. This grand conception can be traced in the literature of the succeeding

* See Murray, "The Discovery of America by Columbus," *Scot. Geogr. Mag.*, vol. ix. p. 561. 1893.



MOUNTS EREBUS AND TERROR AND SOUTH POLAR BARRIER.

century. Bacon and Milton had the image of the huge spinning globe continually before them, and Shakespeare's spirit seemed

" To reside
In thrilling region of thick-ribbed ice ;
To be imprison'd in the viewless winds
And blown with restless violence round about
The pendent world."

Although many voyages were soon undertaken to the Arctic, centuries passed away before maritime exploration was directed towards the Antarctic regions. The unknown lands of Ptolemy and other geographers, though now cut off from the northern continents, still retained their place on charts down to the second voyage of James Cook, under the names of Southern Ethiopia, the Austral Continent, Magellanica, Regio Brasilio, and Regio Patalis. On a globe dated 1534, which I lately examined at Weimar, mountains, lakes, and rivers are shown on a large extent of land in the Pacific, stretching towards the South Pole. In 1642 Tasman showed that Australia and Van Diemen's Land were surrounded by the ocean to the south, but the west coast of New Zealand, which he visited, was believed to be a part of the great southern continent, and this was held by some geographers of the eighteenth century to extend as far east as the island of Juan Fernandez, to be greater in extent than the whole civilised part of Asia, and to contain fifty millions of inhabitants. Here is a part of the dedication of a collection of voyages, published in 1770, by a former hydrographer of the Navy: "Not to him—who infatuated with female blandishments, forgot for *what* he went *abroad* and hastened back to amuse the European world with stories of *enchantment* in the New-Cytherea; BUT to—the man—who *emulous* of Magalhães, and the heroes of former times, *undeterred* by difficulties, and *unseduced* by pleasure, shall *persist* through every obstacle, and not by chance, but by virtue and good-conduct *succeed* in establishing an intercourse with a Southern Continent, this historical collection of former discoveries in the South Pacific Ocean, is presented by Alexander Dalrymple."

About this time a French navigator reported the discovery of land to the south-east of the Cape of Good Hope, and a French expedition, under M. de Kerguelen, was sent out in 1772 to explore it. Kerguelen sighted land with high mountains in lat. 49° S. and long. 69° E., sent a boat on shore, and rather precipitately concluded that he had discovered the great southern continent. On his return to France he was hailed as a second Columbus, but on being sent out a second time to complete his discovery, the supposed southern continent turned out to be the almost barren island which now bears Kerguelen's name.

During his first expedition James Cook showed that New Zealand was an island, and that there was no southern continent in the Pacific north of the parallel of 40° S. Cook's second expedition, in 1772, was

undertaken with the express purpose of settling once for all this question of a southern continent; and he crossed the whole southern ocean in such a manner as to leave no room for doubt that, if such a continent did exist, it must be situated within the Antarctic Circle, and must be covered with perpetual snow and ice.

Cook reached latitude $71^{\circ} 10' S.$, in longitude $106^{\circ} 54' W.$, and here he probably saw the ice-barrier and mountains beyond. He believed there was a tract of land towards the South Pole extending further north in the Atlantic and Indian Oceans than elsewhere, and says—"It is true, however, that the greatest part of this southern continent (supposing there is one) must lie within the Polar circle, where the sea is so pestered with ice that the land is thereby inaccessible. The risque one runs in exploring a coast in these unknown and icy seas is so very great



ICEBERG AS SEEN FROM H.M.S. "CHALLENGER," FEBRUARY 23RD, 1874.

that I can be bold enough to say that no man will ever venture farther than I have done, and that the lands which may lie to the south will never be explored. Thick fogs, snow-storms, intense cold, and every other thing that can render navigation dangerous, must be encountered, and these difficulties are greatly heightened by the inexpressibly horrid aspect of the country, a country doomed by nature never once to feel the warmth of the sun's rays, but to lie buried in everlasting snow and ice. The ports which may be on the coast are, in a manner, wholly filled up with frozen snow of vast thickness; but if any should be so far open as to invite a ship into it, she would run a risque of being fixed there for ever, or of coming out in an ice island. The islands and floats on the coast, the great falls from the ice-cliffs in the port, or a heavy snow-storm attended with a sharp frost, would be equally fatal."

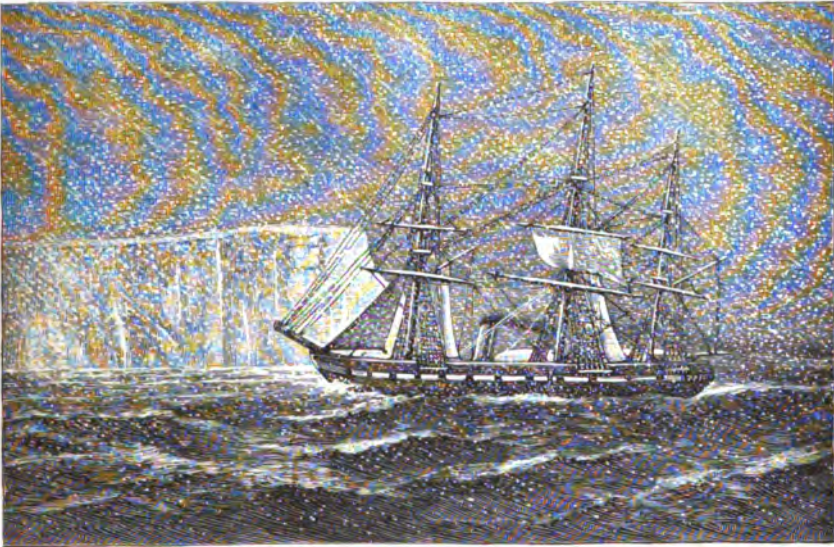
Two navigators have, however, ventured further than Cook. Weddell in 1823 penetrated to 74° S., but saw no land. Sir James Clark Ross in 1841 and 1842 reached the 78th parallel, and discovered Victoria Land. These three explorers, Cook, Weddell and Ross, are the only ones who have passed beyond the 70th parallel of south latitude.

A great many expeditions have sailed between the 60th and 70th parallels, and nearly all of them have discovered land in these southern latitudes. In 1819 Smith discovered the South Shetlands to the south of Cape Horn, and soon afterwards a brisk seal fishery among English and American sealers sprang up in these waters, the seal-skins bringing a high price in China. Bellingshausen discovered the islands of Alexander and Peter the Great; D'Urville discovered Adélie Land; the United States exploring expedition discovered Wilkes' Land; Powell discovered the South Orkneys; Biscoe discovered Enderby's Land; Balleny discovered the Balleny Islands and Sabine Land, and Dallman more recently discovered Kaiser Wilhelm Islands and Bismarck Strait to the north of Graham's Land.

The greatest, the most successful and most important expedition to the Antarctic was, however, that of Sir James Clark Ross, just referred to, between the years of 1839 and 1843. He has furnished more trustworthy information than all the preceding and succeeding expeditions put together. The chief object of the expedition was to make magnetic observations, and these were carried out with marked success. Ross, who had previously planted the flag of his country on the north magnetic pole, even sailed within 160 miles of the south magnetic pole. During the expedition Ross threw a flood of new light on the physical and biological conditions of the Antarctic. He discussed his meteorological observations, and pointed out the permanently low atmospheric pressure of the Southern Hemisphere; he took surface and deep-sea temperatures with much regularity; he became a pioneer in accurate deep-sea sounding and deep-sea dredging; he recognised that the animals from deep water were almost identical with those found at similar depths by his uncle in the Arctic, and he prophesied that a nearly uniform low temperature would ultimately be found everywhere in deep water, and that living animals would be found at the greater depths all over the floor of the ocean. In the account of his voyage we find the best expression of all the anxieties, the dangers, the sufferings, the charms and fascination, which accompany work in these bitter, appalling, and magnificent realms of ice, where snow-storms, fogs and gales alternate with brilliant sunshine.

In January 1841, after passing heavy pack-ice far to the south of New Zealand, Ross discovered Victoria Land, consisting of mountain ranges from 7000 to 12,000 and 15,000 feet in height. To the east he found open navigable water with off-lying islands, on two of which—Possession and Franklin Islands—he landed. This bold coast was

traced for 500 miles to the south, where it terminated, in latitude 78° S., in the volcanic cones of Mounts Erebus and Terror, Mount Erebus at the time vomiting forth flame and lava from an elevation of 12,000 feet. Glaciers descending from the mountain summits filled the valleys and bays of the coast, and projected several miles into the sea. It was impossible to enter any of the indentations or breaks on the coast, where, in other lands, harbours usually occur. On some days the sun shone forth with great brilliancy from a perfectly serene and clear sky of a most intense indigo blue, and the members of the expedition gazed with feelings of indescribable delight upon a scene of grandeur and



H.M.S. "CHALLENGER" AFTER COLLISION WITH AN ICEBERG, FEBRUARY 24TH, 1874.
(From a sketch by Lieut. Aldrich, R.N.)

magnificence beyond anything they had before seen or could have conceived.

From the eastern foot of Mount Terror, Ross found a perpendicular wall of ice from 150 to 200 feet in height, extending away to the east, through which, as he says, there was no more chance of sailing than through the cliffs of Dover. He traced this ice-barrier in an east and west direction for 300 miles: and within a mile of it he obtained a depth of 260 fathoms, with a fine soft mud at the bottom. In the following season Ross was not so successful; for weeks he was a prisoner in the pack-ice. Still, he reached the ice-barrier again in latitude $75^{\circ} 10'$ S., a little to the east of his position in the previous year, but no new land was discovered. In the third season Ross made explorations among the islands to the south of Cape Horn, landing on Cockburn Island, but his attempts to follow in the track of Weddell

were unsuccessful, owing to the heavy pack-ice encountered throughout the season.

It must be remembered that Ross was the only Antarctic explorer provided with ships properly strengthened and fortified, and this probably accounts for his remarkable performances in the pack-ice. The oftener I read the account of this magnificent expedition, the more do I wish that another such commander, and another such expedition, might be sent out from this country, provided with steam-power and all the appliances for investigation which the experience of the past fifty years would be able to suggest. With the same amount of good luck, priceless additions would certainly be made to human knowledge.

The *Challenger* was the first, and up to the present time the only steam-vessel which has crossed the Antarctic circle. She was wholly unprotected for ice-work. Her contributions towards the solution of Antarctic problems belong for the most part to the deeper regions of the Antarctic Ocean. During last year, some interesting observations have been furnished by the Scotch and Norwegian whalers, who visited the seas and islands immediately to the south of Cape Horn.

After this brief review of Antarctic exploration we may ask: What is the nature of the snow- and ice-covered land observed at so many points towards the South Pole? Is there a sixth continent within the Antarctic circle, or is the land nucleus, on which the massive ice-cap rests, merely a group of lofty volcanic hills? This is a question still asked and answered differently by naturalists and physical geographers. To my mind there seems to be abundant evidence that there exists in this region a vast extent of true continental land, the area of which is greater than that of Australia, or nearly 4,000,000 square miles. Of all the bold southern explorers Ross and D'Urville are the only two who have set foot on land within the Antarctic circle. I can find no record of any ship having come to anchor within the Antarctic area, or indeed south of the latitude of 60° S., although Ross met with shallow enough soundings off Possession Island, and Wilkes found 19 fathoms in Piner's Bay, Adélie Land.

Ross reports the rocks of Possession, Franklin and Cockburn Islands, on which he landed, to be of volcanic origin, and in his dredgings to the east of Victoria Land in depths from 200 to 400 fathoms, he likewise procured many volcanic rocks along with some fragments of a grey granite.* All explorers report the islands to the south of Cape Horn to be composed of volcanic rocks, but the recent soundings in this vicinity by Mr. Bruce indicate the presence of metamorphic and even sedimentary rocks, and Dr. Donald has brought home some interesting

* McCormick compares the mountains of Victoria Land to those of Auvergne, in France. His sketches are very different from those of Davis, in showing much more geological structure and much less snow and ice. See R. McCormick, 'Voyages of Discovery in Arctic and Antarctic Seas;' Vol. I., London, 1884.

tertiary fossils collected last year on Seymour Island by a Norwegian whaler.* We have thus very good reasons for assuming that in the Antarctic, facing the great Pacific Ocean, there is a chain of active and extinct volcanic cones, rising in Mounts Erebus and Melbourne to 12,000 and 15,000 feet, similar to, or rather a continuation of, that vast chain of volcanoes which more or less completely surrounds the whole Pacific, facing, so to speak, the circle of continental land looking out on that great ocean basin.

When we remember that their ships were wholly unprotected for ice, the voyages of D'Urville and Wilkes to the Antarctic circle south of Australia must be regarded as plucky in the extreme. At Adélie Land D'Urville passed through the vast tabular icebergs and reached open water within a few miles of the land, which at that point rose to a height of 2000 and 3000 feet. Here the members of the expedition landed on a small island about 600 yards from the mainland. The rocks are described as granite and gneiss, and from the description of their hardness there can be little doubt that the fundamental gneiss so characteristic of continental land was here exposed. Wilkes was unable to reach land, but in the same locality he found very shallow water, and landed on an iceberg covered with clay, mud, gravel, stones, and large boulders of red sandstone and basalt, 5 or 6 feet in diameter.

There is another way in which a great deal may be learnt concerning the nature of Antarctic land. During the *Challenger* expedition transported fragments of continental rocks were never found towards the central portions of the great ocean basins in tropical and subtropical regions. The only rocks dredged from these areas were fragments of pumice or angular rock-fragments of volcanic origin. In the Central Pacific, however, as the fortieth parallel of south latitude was approached—therefore just beyond the limit to which Antarctic icebergs have been observed to drift—a few rounded fragments of granite and quartz were dredged from the bottom of the sea; similar fragments were obtained in the South Atlantic in high latitudes, and as the *Challenger* proceeded towards the Antarctic circle in the South Indian Ocean these fragments of continental rocks increased in number till, at the most southerly points reached, they, along with the mineral

* Messrs. G. Sharman and E. T. Newton, F.R.S., palæontologists to the Geological Survey, state that the nine fossils from Seymour Island are of much interest from a geological point of view. They are weathered and somewhat denuded, indicating, probably, a long exposure upon a seashore. They belong to the following well-known forms: Five to *Cucullæa*, one to *Cytherea*, one to *Natica*, and two are pieces of coniferous wood. All these genera have a wide distribution in time, and consequently tell little as to the age of the fossils; but some of the shells present so close a resemblance to species known to occur in lower tertiary beds in Britain, and to others of about the same age, recorded by Darwin and Baker, from Patagonia, as to make it highly probable that these Antarctic fossils are likewise of lower tertiary age.

particles and muddy matter derived from continental land, made up by far the larger part of the deposit. These fragments consisted of granites, quartziferous diorites, schistoid diorites, amphibolites, mica schists, grained quartzites, sandstone, a few fragments of compact limestone, and partially decomposed earthy shales. These lithological types are distinctly indicative of continental land, and, remembering what has just been said as to their distribution, it seems wholly unnecessary to refute the suggestion that these fragments may have been transported from the northern continents.

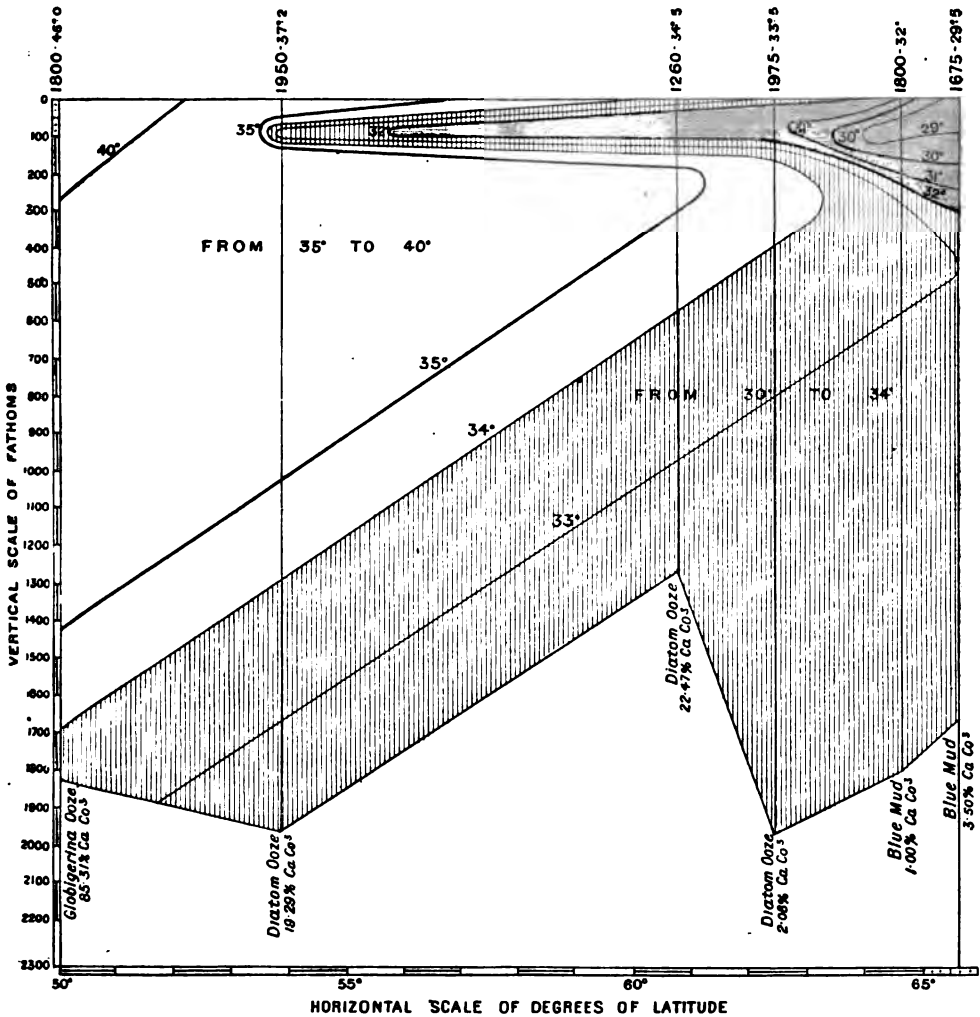
Glauconite is another mineral which was procured in the blue muds near Antarctic land. This mineral fills the shells of foraminifera and other calcareous organisms, and has been found in the muds along nearly all continental shores where the *débris* of continental rocks makes up the greater part of the deposit. Glauconite is now in process of formation in all these positions, but it is apparently wholly absent from the pelagic deposits of the great ocean basins far from continental land, as well as from the deposits around volcanic islands. Its presence in the blue muds of the far south is therefore most suggestive of an Antarctic continent.

When we come to estimate the extent of this sixth continental area, greater difficulties are presented. A knowledge of the depths of the surrounding ocean would enable the outlines to be drawn with great exactitude, but unfortunately the positions where accurate soundings have been taken are few and far between. In the South Pacific, South Atlantic, and South Indian Oceans, between the latitudes of 30° and 50° south, we have most excellent lines of soundings right round the world, and in these latitudes the average depth of the ocean is over 2300 fathoms, or about 2½ miles.* Between the latitudes of 50° and 65° south, the indications we possess appear to show a gradual shoaling, with an average depth of about 1700 fathoms, or nearly 2 miles. I have been criticised for showing on bathymetrical charts a great depth in the Southern Ocean to the south-west of South Georgia. This has been done because of a sounding by Ross, who paid out 4000 fathoms of line at this spot without finding bottom. Ross knew perfectly well how to take deep-sea soundings, and his observation seems to show that the ocean is here deeper than 4000 fathoms, and this may well be accepted till disproved by more trustworthy results; besides the temperature of the deep-water to the east of South America points to a great depth in this region. The depths obtained by the *Challenger* in the neighbourhood of the Antarctic circle were 1675, 1800, and 1300 fathoms, and judging from the nature of the deposits I think all these were within 100 or 200 miles from land. Wilkes obtained depths of 500 and 800 fathoms about 20 or 30 miles from the

* See accompanying map of South Polar area.

shore of Adélie Land, and Ross obtained many soundings of from 100 to 500 fathoms all over a great bank extending 200 miles to the east of Victoria Land; similar depths have been found to extend to some

MERIDIONAL TEMPERATURE SECTION
Between the Parallels of 50° and 65° South Lat



distance to the east of Joinville Land to the south of Cape Horn. We have no trustworthy indications of ridges, barriers, or banks extending far northwards from Antarctica. It is therefore most probable that the

northern continents are everywhere cut off from the Antarctic land-mass by a depth approaching to, if not exceeding, 2 miles. Taking all these indications into consideration I have shown on the map what I believe to be the probable position and extent of Antarctica. Like other continents it would appear to have mountain ranges with volcanoes facing one ocean, and lower hills and great lowland plains stretching towards the other ocean basins. In order to account for the distribution of terrestrial organisms in the Southern Hemisphere, some naturalists believe that there must have been in recent geological times a great extension of Antarctica towards the tropics. However this may be, all will agree that a very necessary preliminary to any profitable discussion of so difficult a subject must be a fuller knowledge of the present conditions that prevail throughout the Southern Hemisphere, such as a new expedition alone can be expected to supply.

All observers agree in representing the great Antarctic land-mass to be buried beneath a heavy capping of perpetual ice and snow. The nucleus of rock is only revealed in off-lying islands, or on the face of high and bold escarpments. The outlines and larger features of the mountain ranges are not obliterated in the high land near the coasts at all events, for peak after peak with varied contours are seen to rise, one behind the other, towards the interior.

The snow and ice which descend from the steep seaward face of the Admiralty and Prince Albert Ranges of Victoria Land, while filling up the valleys and bays, do not present an inaccessible face of ice at all parts of the coast, although this is often stated to be the case. Ross himself says: "Had it been possible to have found a place of security (for the ships) upon any part of this coast, where we might have wintered in sight of the brilliant burning mountain, and so short a distance from the magnetic pole, both of these interesting spots might easily have been reached by travelling-parties in the following spring." McCormick, a member of Ross's expedition, recommends Macmurdo Bay, at the foot of Mount Erebus, as a place where winter quarters might be found, and hints that there would be no difficulty in ascending and travelling over the land.

The ice and snow, however, which form on the slopes of the mountain ranges facing the interior of Victoria Land, descend to the lower reaches of the continent, where they accumulate in vast undulating fields and plains, hundreds of feet in thickness, and ultimately this great glacier or ice-cap is pushed out over all the low lands into the ocean, forming there the true ice-barrier, a solid perpendicular wall of ice, probably from 1200 to 1500 feet in thickness, rising from 150 to 200 feet above, and sinking 1100 to 1400 feet below, the level of the sea. When the forefronts of this great creeping glacier are pushed into depths of about 300 or 400 fathoms, large stretches are broken off, and float away as the oft-described, perpendicular-faced, horizontally-stratified, table-topped

icebergs of the Antarctic and Southern Oceans, which may be miles in length, and usually float from 150 to 200 feet in height above the sea-surface.*

No sooner do these great ice-islands—these majestic and sublime sentinel outposts—of Antarctica sail forth on their new career, than they collide the one with the other; the fragments of impact are scattered over the surface of the ocean, and, with similar fragments derived from the steeper land slopes, with salt-water ice, and accumulations of snow, they form what is known as the *pack*. This pack, when heavy and closely-set, has been erroneously called by Wilkes and other writers the ice-barrier—a name which should only be used to designate the solid continuous ice-wall that is pushed into the sea from the central regions of the continent, such as that along which Ross sailed for 300 miles.

Waves dash against the vertical faces of the floating ice-islands as against a rocky shore, so that at the sea-level they are first cut into ledges and gullies, and then into caves and caverns of the most heavenly blue,† from out of which comes the resounding roar of the ocean, and into which the snow-white and other petrels may be seen to wing their way through guards of soldier-like penguins stationed at the entrances. As these ice-islands are slowly drifted by wind and current to the north, they tilt, turn, and sometimes capsize, and then submerged prongs and spits are thrown high into the air, producing irregular pinnacled bergs higher possibly than the original table-shaped mass. As decay proceeds, the imprisoned boulders, stones, and earth are deposited over the ocean's floor as far as sub-tropical regions.

The late Mr. Croll used to speak of an accumulation of ice and snow at the South Pole 10 and even 20 miles in thickness; but from all we know of the properties of ice, and the relation of its melting- or freezing-point to temperature and pressure, it is highly improbable that such a thickness of ice will be found on any part of the Antarctic continent. If the snow-cap rests on rock of a temperature half a degree below the

* A floating iceberg will have 89·6 per cent. of its volume immersed if it have the same temperature and consistency throughout. The upper layers of these ice-islands are, however, much less dense than the deep-blue lower layers, and therefore it is most probable that the height above water is about one-seventh of the total thickness of the berg.—See Murray, "The Exploration of the Antarctic Regions," *Scot. Geogr. Mag.*, vol. ii. p. 553. 1886.

† The deep-blue colour is due to the fact that all the air has been expelled from the deeper parts of the ice-cap by the constant melting and regelation which takes place throughout the whole mass as it moves over the land. When a cannon-ball was fired into this azure-blue ice the ball did not penetrate, but large masses of ice fell away, the fractures having a conchoidal appearance like glass. When a ball was fired into the upper areolar white layers of a table-berg it penetrated without producing any visible effect. Fragments of the white areolar layers were subjected to pressure and impact on board ship, and it was observed that these fragments could be easily deformed, while fragments of the transparent azure-blue ice behaved quite differently under the same tests, resembling a purely crystalline substance.

freezing-point, then the greatest thickness of ice formed on the continent would not likely exceed 1600 or 1800 feet, and this appears to be just a little more than the greatest thickness of the great ice-barrier when it is floated off into the ocean as ice-islands. This may possibly represent the greatest thickness that can be formed under existing conditions.* A party of well-equipped observers—who should spend a winter on the Antarctic continent—would doubtless bring back valuable information for the discussion of this interesting problem—such as serial temperatures from borings in the ice-cap, both vertically and horizontally, the temperature of the Earth's surface beneath the ice, whether or not water runs away from under the glaciers, as well as observations concerning the appearance of the upper surface of the ice-fields and the motion of the ice over the land.

Our knowledge of the meteorology of the Antarctic regions is limited to a few observations during the summer months in very restricted localities, and is therefore most imperfect. One of the most remarkable features in the meteorology of the globe is the low atmospheric pressure, maintained in all seasons, in the Southern Hemisphere south of latitude 40° S., with its inevitable attendant of strong westerly winds, large rain and snowfall, all round the globe in these latitudes. The observations hitherto made point to the existence over certain parts of these latitudes of a mean pressure of 29·000 inches and under—as, for example, to the south-east of the Falkland Islands, and to the south-east of New Zealand.

On the other hand, in the Arctic regions there is in the winter months no such system of low pressure in similar latitudes, but instead there are two systems of low pressure, having a mean of 29·500 inches, which are absolutely restricted to the northern portions of the Atlantic and Pacific Oceans. Over the rest of the Arctic regions proper, the mean atmospheric pressure exceeds 30·000 inches, being, roughly speaking, about the same as the mean pressure of London. In accordance with this distribution of pressure, observations show that northerly

* See Murray, *op. cit.*, p. 535: 1886. The motion of glaciers is often compared to that of rivers and of viscous bodies; but these comparisons are not strictly correct, and may sometimes be misleading. The peculiarity of ice motion and its erosive power appear to be largely due to the fact that its melting or freezing-point varies with temperature and pressure. The pressure being unequally distributed throughout the glacier, minute crystals of ice are melted where the pressure is greatest; the resulting water occupying less space, regelation at once takes place, and where the ice is wholly compact and crystalline pressure is exerted in all directions, motion taking place in the path of least resistance. The immense thickness of ice sometimes invoked does not seem necessary to account for the erosive effects produced by glaciers. The stratified appearance of the southern icebergs is evidently due to the constant melting and regelation which go on throughout the ice-cap; in the deeper parts of the bergs these layers are not thicker than wafers, and where the ice is wholly crystalline the layers disappear altogether.

winds immensely preponderate over Arctic and sub-Arctic regions. The large number of meteorological observations made during the present century in the high latitudes of the Northern Hemisphere place these facts in the clearest light, and they are admirably represented by Dr. Buchan in his new isobaric charts which accompany the *Challenger* Report.

In the Northern Hemisphere the land almost completely surrounds the Arctic Ocean; in the Southern Hemisphere the open ocean completely surrounds the Antarctic continent, and this open ocean carries with it the low barometric pressure all round. Now if the low pressure still further deepened with increase of latitude towards the South Pole, it is certain that the prevailing winds over all these high latitudes would be north-westerly and northerly. But the observations made by Ross, the *Challenger*, and more recently in latitudes higher than 60° S., by the Dundee whalers and others, quite unanimously tell us that, in these high southern latitudes, the predominating winds are southerly and south-easterly. Thus during the winter of 1892-93, in latitudes higher than 60° S., half of the whole winds recorded by the *Diana* were south, south-east and east, being directions opposite to the winds which would certainly prevail if pressure diminished steadily to the South Pole. Such surface currents as have been observed in the Antarctic Ocean come also from south and south-east.

All the teaching of meteorology therefore indicates that a large anticyclone with a higher pressure than prevails over the open ocean to northwards overspreads the Antarctic continent. While this anticyclonic region may not be characterised by an absolutely high pressure at all seasons, it must be high relatively to the very low pressure which prevails to the northward. The southerly out-flowing winds which accompany this anticyclone will be dry winds and attended by a small precipitation. It is probable that about 74° S. the belt of excessive precipitation has been passed, and it is even conceivable that at the pole precipitation might be very little in excess of, or indeed not more than equal to, the evaporation. Even one year's observations at two points on the Antarctic continent might settle this point, and enable us to form a tolerably complete idea of the annual snowfall and evaporation over the whole continent. An approximate estimate might then be given of the annual discharge from the solid glacier rivers into the surrounding ocean. Indeed it is impossible to over-estimate the value of Antarctic observations for the right understanding of the general meteorology of the globe.

Not less interesting than the meteorology of the land-area is that of the ocean in southern latitudes. In the neighbourhood of the Antarctic circle the temperature of the air and sea-surface is even in summer at or below the freezing-point of fresh water. A sensible rise takes place about the sixtieth parallel, and a temperature of 38° Fahr. has been recorded in that latitude in March for both the air and sea-surface.

The general result of all the sea-temperatures observed by Cook, Wilkes, Ross, and the *Challenger*, in the Antarctic Ocean shows that a layer of cold water underlies in summer a thin warm surface stratum and overlies another warm but deeper stratum towards the bottom. The cold stratum extends like a wedge northwards for about 12°. At depths between 50 and 300 fathoms at the southern thick end of the wedge the temperature is 28° Fabr., and at the northern thin end of the wedge it increases to about 32·5° at 80 fathoms. The surface layer ranges from 29° in the south to 38° in the north, and the deeper bottom layers range from 32° to 35°. See diagram on p. 13.

Mr. Buchanan found that the density of the cold layer, and indeed, of all the deeper waters, was higher than that of the surface, and his admirable researches on the effects produced by freezing sea water appear to give a satisfactory explanation of the effect of these phenomena on the distribution of temperature in this ocean. It has been found that sea water on freezing is divided into two saliniferous parts, one solid, which is richer in sulphates, and one liquid, which contains proportionally more chlorides than the parent sea water.* The liquid brine thus produced is denser, and sinks into the underlying water, thus rendering the deeper water more saline and at the same time lowering its temperature. In a basin isolated from general oceanic circulation, like the Norwegian basin of the Arctic regions, there is produced in this way an uniform temperature of about 29° F. in all the deeper waters, but no trace of this state of matters is found in the Antarctic. On the contrary, at the greater depths a temperature is found somewhere between 32° and 34° F. as far south as the Antarctic circle, and not therefore very different from the temperature of the deepest bottom water of the tropical regions of the ocean.

The presence of this relatively warm water in the deeper parts of the Antarctic Ocean may be explained by a consideration of general oceanic circulation. The warm tropical waters which are driven southwards along the eastern coasts of South America, Africa, and Australia, into the great all-encircling Southern Ocean, there become cooled as they are driven to the east by the strong westerly winds. These waters on account of their high salinity can suffer much dilution with Antarctic water, and still be denser than water from these higher latitudes at the same temperature. Here, again, the density observations indicate that the cold water found at the greater depths of the ocean probably leaves the surface and sinks toward the bottom in the

* Pettersson has shown that sea-ice expands irregularly with heat, and that the latent heat is abnormal, being less than that of pure ice. He also found that the chemical composition of the brines formed in Arctic Seas by the freezing of ice out of a limited quantity of water is different from that of sea-water itself. There is, however, no certainty that this behaviour of the ice and free sea-water is due to the formation of the hypothetical cryohydrates of Guthrie.

Southern Ocean between the latitudes of 45° and 56° S. These deeper, but not necessarily bottom, layers are then drawn slowly northwards towards the tropics to supply the deficiencies there produced by evaporation and southward-flowing surface-currents, and these deeper layers of relatively warm water appear likewise to be slowly drawn southwards to the Antarctic area to supply the place of the ice-cold currents of surface-water drifted to the north. This warm underlying water is evidently a potent factor in the melting and destruction of the huge table-topped icebergs of the Southern Hemisphere. While these views as to circulation appear to be well-established, still a fuller examination of these waters is most desirable at different seasons of the year, with improved thermometers and other instruments. Here, again, a new Antarctic expedition would supply the knowledge essential to a correct solution of many problems in Oceanography. Ross describes a strong tidal current and rip between Possession Island and the mainland of Victoria, but, on the whole, we have very little information concerning the tides and surface-currents in the Antarctic.

No land animal, and no trace of vegetation—not even a lichen or a piece of seaweed—has been found on land within the Antarctic circle. On Cockburn Island, in latitude 64° S., Hooker collected twenty cryptogamic species, three of them seaweeds, and this may be regarded as not far from the southern limit of terrestrial vegetation. The fossils and fossiliferous beds above referred to distinctly indicate the existence of more genial conditions within the Antarctic in past geological times, and should be fully explored.

When we turn to the waters of the Antarctic Ocean, we find at the present time a great profusion of life, both animal and vegetable. During the *Challenger* expedition, myriads of minute spherical tetrasporæ were observed to give the sea a peculiar green colour over large areas. Diatoms were frequently in such enormous abundance, that the tow-nets were filled to the brim with a yellow-brown slimy mass, with a distressing odour, through which various crustaceans, annelids, and other animals wriggled.

As these marine algæ are the primary source of food in the sea, their great development in the Antarctic Ocean leads to a corresponding abundance of animals. Occasionally vast quantities of Copepods, Amphipods, and Schizopods were observed to give the ocean a dull red



DIATOM OOZE FROM 1950 FATHOMS IN THE SOUTHERN OCEAN. MAGNIFIED 300 DIAMETERS.

colour, and the more delicate tow-nets were at such times so filled with these animals, that they occasionally burst on being hauled on board ship. These small crustaceans are in turn the chief food of the fishes, penguins, seals, and whales, which abound in the waters of the Great Southern Ocean.

Organisms such as the Diatoms and Radiolaria, which secrete silica, and the Foraminifera and Pteropods, which secrete carbonate of lime, are, on account of their distribution, the most interesting of all the pelagic creatures captured in the surface and sub-surface waters of the ocean. Near Antarctic land the deposits at the bottom of the sea are, as already stated, mostly made up of rock-fragments and detritus from the snow-clad Antarctic continent. A little to the north the number of these particles decreases, and they are largely replaced by the dead



GLOBIGERINA OOZE FROM 1900 FATHOMS IN THE ATLANTIC.
MAGNIFIED 25 DIAMETERS.

frustules of Diatoms and Radiolaria, and then we find a pure white siliceous deposit at the bottom, which is called a Diatom Ooze. Still further to the north, when the influence of the warm northern currents commences to be felt, the Diatoms are largely replaced on the surface by the calcareous shells of Foraminifera and Pteropods, and at the bottom of the sea in these latitudes the Diatom Ooze gives place to a pinkish-white Globigerina Ooze, composed chiefly of carbonate of lime. Still further to the north, about the latitude of 40° S., the sea is often about 3 miles in depth, and in such depths where far removed from continental land, the calcareous shells are for the most part dissolved, and there is a very remarkable deposit at the bottom, composed of a fine Red Clay, manganese nodules, zeolitic crystals, magnetic and metallic spherules of extra-terrestrial origin, thousands of sharks' teeth, and the remains of whales and other Cetaceans. In these red clay areas the

trawl brought up in a single haul over one thousand five hundred sharks' teeth, some of them as large as—and not to be distinguished from—the specimens of *Carcharodon* of Tertiary age; associated with these teeth were fifty or sixty ear-bones of Ziphioid whales and other Cetaceans.* From a careful consideration of all the conditions, it seems to me that deposition is, in these places, at the minimum, and that since Tertiary times there may not have been over a few inches of deposit laid down in these red clay areas. A new expedition might thoroughly explore one of these peculiar and instructive deposits.

All over the floor of the Antarctic Ocean there is a most abundant fauna, apparently more abundant and more peculiar than in any other region of the ocean's bed. In one haul made by the *Challenger* in a depth of 2 miles in lat. 47° S., the trawl brought up (excluding Protozoa) over two hundred specimens belonging to eighty-nine species of animals, of which seventy-three were new to science, including representatives of twenty-eight new genera. This and similar trawlings show a larger number of individuals, genera, and species than any single haul from similar depths in other regions of the oceans, and I am inclined to think this is intimately connected with the large number of surface creatures which are killed in these latitudes by the mixing of waters from the tropics and waters from the Antarctic; for these organisms, on falling to the bottom, afford a larger supply of food to deep-sea animals here than in other localities.

The accompanying table exhibits the total result of the *Challenger's* nine



TOOTH OF "OXYRHINA TRIGONODON," DREDGED BY H.M.S. "CHALLENGER" IN THE SOUTH PACIFIC, 2350 FATHOMS.



BLACK COSMIC SPHERULE WITH EXTERNAL COATING BROKEN AWAY TO SHOW THE METALLIC NUCLEUS, ATLANTIC, 3150 FATHOMS. MAGNIFIED 90 DIAMETERS.



SECTION OF MANGANESE NODULE, SHOWING TYMPANIC BONE OF "MESOPLONDON" IN THE CENTRE, DREDGED BY H.M.S. "CHALLENGER" IN THE SOUTHERN OCEAN, 2600 FATHOMS.

* See Murray and Benard, *Challenger* Report on Deep-Sea Deposits, p.360: 1891.

trawlings and dredgings south of the 43rd parallel, in depths greater than 1200 fathoms: 830 animals were captured (excluding the Protozoa) belonging to 398 species, of which 326, or nearly all those described, were new to science. Of these 162 new species, and 30 new genera, were not obtained in any other region of the bed of the ocean. Among these were 8 new genera and 56 new species of Echinoderms, many of them exhibiting marked peculiarities.* Many other forms, such as some species of Serolis among the Crustacea, are limited to the deep water of the Southern Hemisphere. The absence of some groups, such as the Brachyura, in all these dredgings is likewise suggestive.

It is most probable, indeed almost certain, that the floor of the ocean, as well as all pelagic waters, have been peopled from the shallow waters surrounding continental land, and here in the deep waters of the Antarctic we appear to have very clear indications of the existence of the descendants of animals that once inhabited the shallow water along the shores of Antarctica, while in other regions of the ocean the descendants of the shallow water organisms of the northern continents prevail. This is a subject of great interest to all biologists, and can best be studied by a more efficient exploration of these southern latitudes.

ANIMALS (EXCLUDING THE PROTOZOA) OBTAINED IN THE TRAWL AND DREDGE BY THE "CHALLENGER" EXPEDITION TOWARDS THE ANTARCTIC REGIONS IN DEPTHS GREATER THAN 1200 FATHOMS.

Latitude.	Station.	Depth in Fathoms.	Number of Specimens.	Number of Species.	Number of New Species.	Number of New Genera.*
Between 43° and 50° S.	{	146	200	78	66	17
		147	200	89	73	28
		159	20	10	7	4
		160	50	30	25	10
Between 50° and 60° S.	{	157	150	79	69	25
		158	70	45	33	13
Between 60° and 65° S.	{	152	20	12	10	4
		156	100	37	32	13
S. of 65° S.	153	1675	20	18	11	5
			830	398	326	119

* One hundred and sixty-two new species and thirty new genera were not obtained outside this Antarctic area during the cruise.

* Namely, *Thamatocrinus*, *Chitonaster*, *Ophioplithus*, *Ophiocymbium*, *Spatagocystis*, *Echinocrepis*, *Genicopatagus*, and *Scotoanassa*. Alexander Agassiz says: "The slipper-shaped *Echinocrepis* and the *Galerites*-like *Urechinus* (found only in the deep water of the Antarctic area), remind us of types which flourished in the Cretaceous Seas."

This rapid review of the present state of our knowledge concerning the Antarctic should, if in any way successful, have at the same time furnished distinct indications as to the great extent of our ignorance concerning all that obtains within the South Polar regions. It should likewise have enabled you to appreciate the great advantages which would flow from successful exploration in the immediate future.

Within the past few months I have been in communication with geographers and scientific men in many parts of the world, and among them there is complete unanimity as to the desirability, nay, necessity, for South Polar exploration, and wonder is expressed that an expedition has not long since been fitted out to undertake investigations which, it is admitted on all sides, would be of the greatest value in the progress of so many branches of natural knowledge. Professor Neumayer, who has so long advocated South Polar exploration, says :—"It is certain that without an examination and a survey of the magnetic properties of the Antarctic regions, it is utterly hopeless to strive, with prospects of success, at the advancement of the theory of the Earth's magnetism." Other eminent geographers and scientific men urge the advantages which would accrue to other branches of science.*

* Professor ALEXANDER AGASSIZ writes :—"I wish you the best success with your proposed Antarctic expedition. What you propose doing is the right thing to do, and the results ought to be most interesting, judging from the little we know of the few islands which have been hastily visited. Your scheme of having the ships kept at work, sounding, dredging, &c., while the land-parties are exploring the land, is the most practical and economical way of carrying on such an expedition. It has always seemed to me such a waste of time and money to have the ships and their crews wait on the landsmen."

Professor ERNST HÆCKEL writes :—"I have heard with great interest that England has the design of setting on foot a great scientific expedition for the exploration of the Antarctic Ocean. The task is in fact as interesting as it is pressing and important. It is remarkable how much money and how many lives have been offered by Europe and North America for North Polar expeditions, while the much less known South Pole has seemed almost forgotten since Ross's time. And how many great and important problems await solution there! The British nation seems to me called upon before all others to carry out this great task, and to send a ship for several years (including wintering at a station) to the South Polar Sea. The fruits of such an expedition would certainly form a worthy sequel to those which you have attained through the incomparable *Challenger* expedition with its wealth of results. It would lay the foundation for all time. I hope and wish from my heart that the English Government views it in this light, and will grant the large supplies necessary for this expedition. I send you my best wishes for the speedy completion of the concluding volume of the great *Challenger* work. This 'standard work' will remain for all time the foundation for all biological and thalassographical investigations, in relation to Plankton and Benthos alike especially of the deep sea. The thorough investigation of the Antarctic Ocean with its fauna and flora seems to me a necessary supplement to the *Challenger* work."

Professor F. E. SCHULTZE writes * :—"You wish for my opinion on the subject of a more extensive exploration of the Antarctic region. I believe I shall be in agreement,

* Translation.

To determine the nature and extent of the Antarctic continent; to penetrate into the interior; to ascertain the depth and nature of the ice-cap; to observe the character of the underlying rocks and their fossils; to take magnetical and meteorological observations both at sea and on land; to observe the temperature of the ocean at all depths and seasons of the year; to take pendulum observations on land, and possibly also to make gravity observations at great depths in the ocean; to bore through the deposits on the floor of the ocean at certain points to ascertain the condition of the deeper layers; * to sound, trawl, and dredge, and study the character and distribution of marine organisms. All this should be the work of a modern Antarctic expedition. For the more definite determination of the distribution of land and water on our planet; for the solution of many problems concerning the Ice Age; for the better determination of the internal constitution and superficial form of the Earth; for a more complete knowledge of the laws which govern the motions of the atmosphere and hydrosphere; for more trustworthy indications as to the origin of terrestrial and marine plants and animals, all these observations are earnestly demanded by the science of our day.

How then, and by whom, is this great work to be undertaken? I can never forget my sensations when once in the Arctic I was for several hours lost in a small boat in a fog, and at one time there seemed little chance that I would ever regain the ship. Nor again can I forget

not only with all representatives of physical geography, but especially with all the biologists in the world, when I say that there is no region of the surface of our globe which is so little known, but so much deserves a thorough investigation as precisely this of the Antarctic. Allow me also to call your attention to the fact that, of all the oceans, the southern and central part of the Indian Ocean has hitherto been least explored, and that therefore it might be advisable, if opportunity offered—say, during a winter—to make an excursion to the central part of the Indian Ocean. In the hope that to the great *Challenger* expedition may be added one similar and equally rich in results for the exploration of the Antarctic, I wish success to this important undertaking from my heart."

Professor J. THOULET writes:—"There is only one way in which to answer the letter you have been so good as to write to me, namely to send you my warmest encouragement to continue the great and noble task of discovering the secrets of the Antarctic regions. May you succeed in accomplishing this glorious work, which is not only scientific but also humanitarian. . . . All who are occupied on science in the whole world earnestly wish for your success. To tell you the truth, I have never been very enamoured of Arctic expeditions: the North Pole is continental, and is in consequence the domain of irregularity, and in my opinion its conquest is not worth the efforts which it has already cost. But it is quite otherwise with the Antarctic regions, which are oceanic, and therefore subject to rule. The Arctic phenomena are complications or exceptions; the Antarctic are general phenomena, and their discovery is bound to conduce to the formulation of natural laws—the final aim of science."

* It is believed that gravity determinations might be made, as well as the deposits bored into by specially-constructed instruments let down to the bottom from the ships.

* Translation.

one night in the Antarctic when, with much anxiety, Captain Nares, his officers, and men, piloted the *Challenger* during a gale through blinding snow, ice, icebergs, darkness, and an angry sea. The remembrance of these experiences makes one almost fear to encourage good and brave men to penetrate these forbidding regions. But it is not all gloom and depression beyond the Polar circles. Sunshine and lively hope soon return.

A few months ago I bade good-bye to Nansen, and said I expected within two years to welcome him on his return from the Arctic; but I expressed some doubt if I should again see the *Fram*. "I think you are wrong," was the reply; "I believe you will welcome me on this very deck, and, after my return from the Arctic, I will go to the South Pole, and then my life's work will be finished." This is a spirit we must all admire. We feel it deserves, and is most likely to command, success. All honour to those who venture into the far North or far South with slender resources and bring back with them a burden of new observations.

A dash at the South Pole is not, however, what I now advocate, nor do I believe that is what British science, at the present time, desires. It demands rather a steady, continuous, laborious, and systematic exploration of the whole southern region with all the appliances of the modern investigator.

This exploration should be undertaken by the Royal Navy. Two ships, not exceeding one thousand tons, should, it seems to me, be fitted out for a whole commission, so as to extend over three summers and two winters. Early in the first season a wintering-party of about ten men should be landed somewhere to the south of Cape Horn, probably about Bismarck Strait at Graham's Land. The expedition should then proceed to Victoria Land, where a second similar party should winter, probably in Macmurdo Bay near Mount Erebus. The ships should not become frozen in, nor attempt to winter in the far South, but should return towards the North, conducting observations of various kinds along the outer margins of the ice. After the needful rest and outfit at the Falklands or Australia, the position of the ice and the temperature of the ocean should be observed in the early spring, and later the wintering parties should be communicated with, and, if necessary, reinforced with men and supplies for another winter. During the second winter the deep-sea observations should be continued northwards, and in the third season the wintering parties should be picked up and the expedition return to England. The wintering parties might largely be composed of civilians, and one or two civilians might be attached to each ship; this plan worked admirably during the *Challenger* expedition.

What, it may be asked, would be the advantages to trade and commerce of such an expedition? It must be confessed that no definite or very encouraging answer can be given. We know of no extensive

fisheries in these regions. For a long time seal and sea-elephant fisheries have been carried on about the islands of the Southern Ocean, but we have no indication of large herds or rookeries within the Antarctic circle. A whale fishery was at one time carried on in the neighbourhood of Kerguelen, but this right whale, if distinct from or identical with *Balaena australis*, appears to have become nearly, if not quite, extinct. Some expressions of Ross would lead one to suppose that a whale corresponding to the Greenland right whale inhabits the seas within the Antarctic ice, but we have no definite knowledge of the existence of such a species. Although "sulphur bottoms" (*Balenoptera musculus*), "finbacks" (*Balenoptera sibaldii*), and "humpbacks" (*Megaptera boops*) are undoubtedly abundant, they do not repay capture. Ross and McCormick report the sperm whale within the Antarctic ice, but there is still some doubt on this point. Though penguins exist in countless numbers they are at present of no commercial value. Deposits of guano are not likely to be of any great extent. But it is impossible to speak with confidence on the commercial aspects of such an expedition—the unexpected may quite well happen in the way of discovery.

With great confidence, however, it may be stated that the results of a well-organised expedition would be of capital importance to British science. We are often told how much more foreign governments do for science than our own. It is asserted that we are being outstripped by foreigners in the cultivation of almost all departments of scientific work. But in the practical study of all that concerns the ocean this is certainly not the case, for however closely we may now be pressed by some foreign nations, we have had up to the present time to acknowledge neither superiors, nor even equals in this branch of investigation, and if we be a wise and progressive people, British science will always lead the way in this direction. When Queen Victoria ascended the throne we were in profound ignorance as to the condition of all the deeper parts of the great ocean basins; now we have a very accurate knowledge of the conditions which obtain over the three-fourths of the Earth's surface covered by the waters of the ocean. This—the most splendid addition to earth-knowledge since the circumnavigation of the world—is largely due to the work and exertions of the Royal Navy in the *Challenger* and other deep-sea expeditions, and, the Mercantile Navy in our telegraph ships.

This country has frequently sent forth expeditions, the primary object of which was the acquisition of new knowledge—such were the expeditions of Cook, Ross, and the *Challenger*; and the nation as a whole has always approved such action, and has been proud of the results, although they yielded no immediate return. Shall it be said that there is to be no successor to these great expeditions? The prestige of the navy does not alone consist in its powers of defence and attack. It has in times of peace made glorious conquests over the powers of Nature,

and we ask that the officers and men of the present generation be afforded the same opportunities as their predecessors. There should be no observations, no experiments, no investigations, no work of any kind, no knowledge of any kind, with reference to the ocean, of which the navy has not had practical experience. And what better training for officer and man than in an expedition such as that now advocated?

A preliminary responsibility rests on the geographers and representatives of science in this country. It is necessary to show that we have clear ideas as to what is wanted, to show that a good workable scheme can be drawn up. When this has been done it should be presented to the Government with the unanimous voice of all our scientific corporations. Then, I have little doubt that a Minister will be found sufficiently alive to the spirit of the times, and with sufficient courage to add a few thousand pounds to the navy vote for three successive years, in order to carry through an undertaking worthy of the maritime position and the scientific reputation of this great empire.

Before the reading of the paper, the President, Mr. CLEMENTS R. MARKHAM, said:—This evening we have assembled to hear what will be a most interesting and, in my belief, a most important address from Dr. John Murray of the *Challenger*. All geographers are acquainted with the scientific fame of Dr. Murray, and therefore it is unnecessary for me to say more; and without further preface I have to request him to read his paper.

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

Sir JOSEPH HOOKER: There is a point which should not be lost sight of in view of further exploration of the Antarctic area, being of importance in regard to the prospects of success in future, and as an indication what should be the procedure in the case of another expedition being despatched to that region. It is this—that the successes of the two voyages that have yielded the greatest results—those of Weddell and Ross—have been due rather to accidental circumstances than to foreknowledge, forethought, or foresight on the part of their commanders. I say this with no idea of disparaging either the efforts of the courageous and experienced men who conducted those expeditions or the value of their discoveries. But what are the facts? Weddell found himself unexpectedly in the open sea in a high latitude, and with great gallantry pushed his little cutter south to the 75th degree. With Ross the case was very different; but in his case success was no less due to accident. The Antarctic expedition was not despatched primarily with a view to discovery in the Antarctic area, but to lay down the lines of magnetic force in the Southern Ocean, and especially to ascertain the position of the South Magnetic Pole, and if possible to reach it. Now it was very well known before Ross sailed that the South Magnetic Pole was somewhere near the meridian of Australia, and in the 60th or 70th degree of south latitude. It was this that directed Ross's course to a position where he, by great good fortune, met with pack-ice through which his ships could be pushed. He steered for the position of the Magnetic Pole, and after passing through much loose ice, met the main pack, about lat. 67° S. and long. 174½° E. It was a formidable pack. Neither he nor any of the Arctic officers or men, of whom there were not a few in the ships, had ever seen anything like it in the North: nevertheless Ross determined to try it, and, in doing so, the boldest held his breath for a space. In four or five days he pushed through it, and entered comparatively open water. Pursuing his course to the south-west he discovered

Victoria Land, and traced it to the 79th parallel. It presented a range of stupendous mountains, rising in many peaks to 6000 and 12,000 feet high, clad with snow and glaciers from their summits to the sea-level, where the coast was rendered inaccessible by miles of closely-packed ice and bergs. This land cut off all prospect of reaching the South Magnetic Pole, which was ascertained to be some 150 miles inland. From the southern point reached the land trended eastwards in the position of two stupendous mountains, one an active volcano, and, still further eastward, the land was impinged upon by a glacier which presented a continuous precipitous wall of from 100 to 200 feet high. This, like the land, was unapproachable for pack-ice and bergs. Ross named it the Victoria Barrier. After tracing this ice barrier for some 200 miles, the lengthening nights, the freezing of the ocean, and the impossibility of finding a wintering place compelled a rapid return. From the furthest point reached Ross hoped to have steered northward and eastward, but a close pack prevented this, and he had to emerge from his new-found sea, not very far from the position where he had entered it, in lat. $68\frac{1}{2}^{\circ}$ S., and long. $167\frac{1}{2}^{\circ}$ W. In the following year, with a view of repeating his magnetic observations and tracing further eastward the barrier he had left, he again steered south, seeking to penetrate the pack further to the eastward than in the previous year. He met it in a much lower latitude, in $61\frac{1}{4}^{\circ}$ S., and $167^{\circ} 42'$ W., and pushed his ships into it, but with very different results from his former experience; suffice it to say that instead of four days he was forty-four in penetrating that pack, his ships suffering much damage. The open water which he reached was in this meridian much more laden with pack and bergs. With great difficulty he reached the barrier where he had left it in the previous year, and added some 200 miles to its eastern extreme, when failing light and the rapidly freezing ocean compelled his return. Here again, to attain an unfrozen ocean, he had, as in the former year, to take a north-west course, rounding the main pack in about latitude 70° and longitude 180° . The result of these two seasons' exploration was the discovery of a pool of more or less open water some 600 miles in diameter, between latitudes 68° and 78° , bounded on the west by a stupendous range of ice-clad mountains, on the south by a perpendicular barrier of ice, and on the east and north-east, and for the most part on the north, by the main pack. During neither voyage did he ever anchor, or even land, for the scrambling ashore on two rocky ice-clad islets for a few minutes only can hardly be called landing. On one of these occasions, after unfurling the Union Jack and taking possession of the adjacent continent in the name of the Queen (surely the whitest if not the brightest jewel in her crown), his boat had the utmost difficulty in regaining his ship, owing to the strength of the currents. On the other the sure signs of an approaching gale required his immediate return to the ships after jumping ashore. Though it was of the greatest importance that magnetic and other observations should be taken on land or at anchor, no possibility of accomplishing either occurred during these two Antarctic cruises; nor was there a harbour to be found in which the ships could have wintered in the opinion of any experienced officer or man on board either ship.

For the third year of Ross's Commission, Weddell's route was held in reserve. This was expected to be the *bonne bouche* of the expedition; no member of the expedition doubted achieving Weddell's highest latitude, and who could say how much higher a one? What was the fact? In the longitude where Weddell reached the seventy-fifth degree, Ross, with great exertions, attained the sixty-fifth only, and this after weeks of battling for hundreds of miles with the edge of the pack, which nowhere could even be entered. It was the worst season of the three, one of constant gales, fogs and snowstorms. Officers and men slept with their ears open, listening for the look-out man's cry of "Berg ahead!" followed by "All hands on

deck!" The officers of the *Terror* told me that their commander never slept a night in his cot throughout that season in the ice, and that he passed it either on deck or in a chair in his cabin. They were nights of grog and hot coffee, for the orders to splice the main brace were many and imperative, if the crew were to be kept up to the strain on their nerves and muscles. Of discovery there was nothing, but the fact that Weddell's route was effectually closed—as Ross's by Victoria Land may very well be in the interval that has elapsed since he discovered it. Now the experiences of Weddell and Ross appear to me to prove that great as would be the results of another Antarctic expedition, its either discovering a great extent of new land, or attaining a very high latitude, may not be one of them. Had Ross not followed a course dictated by other considerations than those of geographical discovery he might have spent his first two seasons, as he did his third, in unavailing struggles with pack-ice, for knowing what had been seen of the land and ice further to the westward by D'Urville and Wilkes, and the state of the ice seen by Ross himself to the eastward, it was clearly all but certain that in neither of these directions could he have attained a high latitude. Lastly, with regard to the bearing of these two successes on the conduct of another Antarctic expedition, I think it should be well considered whether the first year of such an expedition should not be spent in coasting the Antarctic ice round the globe, laying down its position, looking out for open water, for "water-sky" over the pack, and for soft places in the pack, taking deep-sea soundings and temperatures, and current observations on every possible occasion, together with keeping the ordinary meteorological and magnetical records. And if two ships are commissioned, it is well worth considering whether in this first pioneer voyage they might not proceed separately, but simultaneously, from opposite meridians, pursuing the same course and making the same observations. Thus we should have a knowledge of the state of the ice, a double series of deep-sea soundings, and comparative meteorological observations made round the globe, results that would arm the commander of the expedition with foreknowledge and experience for further exploration in higher latitudes; and let his success in attaining high latitudes be what it may, the geographical, bathymetrical and meteorological results of the first pioneer voyage would well repay the risks and cost of the three years' exploration.

The DUKE OF ARGYLL: As I have the honour of holding at the present moment the position as President of your sister society in Scotland, I do not feel that I ought to be wholly silent on an occasion when so remarkable a paper is read by my distinguished countryman Dr. Murray. It is impossible not to be carried away by his enthusiasm. He lives in the ocean; I sometimes wonder in what region of it he principally lives. Sometimes his whole soul seems to be in a dredge at the bottom; then we find him in the upper currents; then through the vortices of those moving round the globe. I confess I feel an immense interest in the question of the Antarctic expedition. I always feel a little shame that civilised man, living on his little planet—a very small globe—should, in this nineteenth century of the Christian era, not yet have explored the whole of this little area; it seems a reproach upon the enterprise, civilisation, and condition of knowledge of the human race. I cannot say that I expect very much more interest scientifically to be got from further exploration in the northern region. We know very well the conditions of the North Polar Sea; Greenland has been thoroughly explored. But as regards the Antarctic, we have everything yet to learn. Not only will the observations to be made on such an expedition be of the greatest value as regards meteorology, but also to magnetism and biology, and especially to the science of geology. I am anxious to say a word upon this point, because it is the branch of science in which I have the greatest interest. We all know the most pressing and difficult question with

geologists now is the glacial age. Long ago it was said by a singular man of great genius, the mason Hugh Miller, that the problems of geology connected with the most recent times seemed the most difficult. That is perfectly true; the great crux of the science at the present moment arousing the greatest discussion is what was the nature, date, and cause of the glacial age. You all know there are very different schools of opinion upon that subject, and an expression has been used by Dr. Murray of the "ice-cap" and the "ice-sheet," a very common expression to use, but I believe that the Antarctic continent is the only one on which we can hope to have any exhibition of the phenomena due to the ice-sheet, properly so called. Greenland is covered with ice and snow, but we can hardly say that it constitutes an ice-cap, as Greenland contains very high and lofty mountains, and the whole snow and ice of Greenland falls like any glacier into the sea, giving birth to those great icebergs that float down south. The character of these icebergs is almost always the same, highly-pointed and pinnaced, and giving evidence of the nature of their origin, great masses of ice moving down great slopes, as at Chamouni, on a smaller scale, thrusting off broken fragments into the ocean. Now, it will be observed from the paper we have just heard that icebergs are almost always of an entirely different character in the Antarctic Ocean, not shattered, not pinnaced, not broken; that they leave the parent continent perfectly tabular, of enormous magnitude, evidently not having moved down a mountainous land, but having in some way been generated upon a comparatively flat table-land, and floated off as they advanced into the deeper sea. Now these are circumstances pointing to the fact that in that Antarctic continent, when we get to it, we should see the operation of the true ice-sheet; that is to say, enormous masses of ice not falling down the slopes of a mountain, but resting on a table-land of comparatively level country; and what we want to know above all things is what is the motion of such a mass of ice as that. I have always had a great difficulty in conceiving that there should be any horizontal motion at all on the part of a mass of ice of that kind. It is now, I think, clearly ascertained through the exertions and researches of our most distinguished men, from Agassiz and James Forbes down to our own times, the motions of glaciers such as we know in Europe or Greenland are entirely due to gravitation of masses falling down steep slopes of the mountains. But why we should have an ice-sheet in motion not due to the thrust of gravitation down mountain slopes but along a level country, is a most interesting problem of physical geography, and we want to know the facts of the case. Now, I understand from Dr. Murray's paper what, I confess, I did not know from a book I read in my early years, 'The Voyage of Sir James Ross,' that gave me the idea of a wall of ice surrounding the whole of their vast land, and forbidding the idea of landing upon the country. But I understand from Dr. Murray's paper what I have also heard from him in conversation, that there are points of that continent accessible so far as regards the mere landing. There is great hope that in the course of the year landings may be made on certain parts of the coast; if that is so we should have in the course of one, or at most two years, important observations made on the nature of this great ice-sheet, and that is an object of the highest scientific interest. I entirely concur with Dr. Murray that it is a work that can only, and ought only, to be undertaken by the British Government. I am not, however, clear that our Chancellors of the Exchequer at the present time are in a happy condition for disposing of considerable sums of money, but, after all, the expenditure upon such an expedition would be a small amount indeed compared with the enormous sums we are laying out, and, I am sorry to see, sometimes losing, upon constructions for the navy. One argument Dr. Murray used he need not have used at the assembly of a scientific society; he said that there would be no economic use in the expedition. I hope we have all arrived at that stage of civilisation in which

knowledge for its own sake is always admitted to be worthy of pursuit. We never know what may be the uses of knowledge, but knowledge is in itself of use. It is our object as a scientific society to promote everything that increases knowledge, and the interest which men must feel in the phenomena of our globe. It certainly makes us feel that this is worth a national effort. Mr. President, I am amused by that specimen of the Antarctic continent on the table, representing all we know of that vast mass of land. It reminds me of an incident that happened to me some years ago; when I called upon Sir R. Christison, the celebrated physician in Edinburgh, I observed that he had upon a shelf a little knob of something in a glass case. "What is this?" I said. "That was the top of Ben Nevis," was his reply. So this stone was the Antarctic continent, or all that we know of it.

Sir GEORGE NABES: It is evident we all agree in lamenting our ignorance of the Antarctic regions, and I am sure we are all anxious to be better acquainted with them. There is little for me to say regarding the different advantages we should obtain, but I agree with the Duke of Argyll and rather disagree with Dr. Murray as to the commercial aspect of further explorations. He has told us about the enormous life that is in the sea—well, so long as such life is there, there will be fishes and seals to feed upon it; and the voyages last year of the seal-fishermen will show that there is a commercial prospect in further investigation, as well as highly valuable scientific prospects. I would say a word or two as to the cost of Government expeditions; having commanded two—the *Challenger*, and the *Alert* and *Discovery*, I would draw attention to the fact that the officers and men composing these expeditions, had they not been employed in these ships, might have been doing nothing at Portsmouth Harbour, and the country would have to feed them in either case, pay them, and when they get old pension them. As to advantages, has not Great Britain got the credit of the *Challenger* expedition? Who would question also the advantages of Ross's expedition? And the whole world looks back upon Cook, who went forward, one may say, almost as blindly with regard to results as we should go forward now in an expedition to the south. As to the perils, we do not want to make a dash, as we say, to the South Pole, we want to go quietly and steadily on, advancing our information as we go; so long as we do that we can pick up our winter quarters there without a worse season or meeting with greater troubles than hunting on the well-known shores of South Greenland; the temperature would be scarcely lower, I do not think lower at all, there is no comparison in fact between a voyage towards the unknown region of the Antarctic to the voyages to extreme northern latitudes whence it is doubtful if there is a sure retreat. There is no doubt that down south we could, without unusual danger, land people and pick them up the following season. As Dr. Murray and the Duke of Argyll say, the ships at other times being employed in obtaining much useful information. One point I think rather remarkable—I notice that the whalers last year, of course they cannot go on exploring voyages, as they have to pay their expenses, completed their voyages, filled up with oil, and left the Antarctic on February 18th, the very height of the season, with three of the best weeks for exploring before them. I must own, having studied the different voyages, I am strongly in favour of following Weddell rather than Ross's two first voyages, and I should like to follow up the track where Sir Joseph Hooker says Ross practically came to grief, that is following up the track of the whalers last year, south of South America.

The PRESIDENT: In the whole course of my experience of forty years in this Society I only remember before this evening one paper having been read to us on the subject of Antarctic exploration, and that was read by my old messmate, Sir Richard Vesey Hamilton. I hope he will give us in a few words his opinion on the conditions of navigation in the Antarctic seas.

Sir R. VESEY HAMILTON* : Our Chairman calls upon me to say a few words, and I will not touch upon what has gone before, but briefly give you the result of my contrast in a paper on Morell's Antarctic voyage I read here about twenty years ago of the voyages made by Sir James Ross in dull sailers in comparison with what would have been effected had steam been in fashion. Sir Joseph Hooker told us he took forty-four days to go through the ice pack which a steamer would have done in four, and the conclusion I came to formerly was that steam had given the future Antarctic navigator an advantage of at least one hundred per cent. over the days of sail. I have recently brushed up my Antarctic knowledge, and I think I may say I had underestimated this advantage. I believe now that the amount of work that was done by Sir James Ross in three seasons could be done in one season with modern steam power, and I have some knowledge of ice navigation, having been three winters and five summers in the Arctic Regions. Now the greatest enemy to a sailing ship is a gale in the ice heavily packed, as we have seen from the diagrams; then the ships are in great peril, perhaps for steam as well as sailing ships; but after the gale comes a calm, when the ice opens out and the steamer would immediately make rapid progress, while the sailing ship might be unable to move for days. I have but one other remark to make; Dr. Murray says—this expedition should be entirely in the hands of the navy; but I presume he would recommend a scientific staff such as accompanied the *Challenger*. As to officers and men for the expedition, on that point, speaking as president of the Royal Naval College, in which there are 200 naval officers studying, I am certain that 150 would volunteer for such an expedition, if not the whole 200. There would not be the slightest difficulty in manning the ship with officers, as in the expedition I was in with Captain Nares in 1852. But I do not approve of officers performing inferior work.

Captain WHARTON: Dr. Murray began his remarks by speaking rather scornfully of the speculations of one of my predecessors, Mr. Dalrymple, but he has ended up by doing more or less the same himself. I am not, however, disposed to defend my predecessor, because I think there is all this difference between the two. Mr. Dalrymple's speculations were those of an unscientific mind, and Dr. Murray's is an instance, and a very good instance, of the "scientific imagination." He has given us proof that there is an Antarctic land, although Dr. Murray of course will not stick to the particular shape he has drawn out, but that there is land we can have no doubt, from the presence of these great tabular bergs and the fact that land has been sighted; also, as Dr. Murray says, tertiary fossils have been picked up recently on the shores of Cape Seymour. I have no doubt that, if any of us had any doubts before, we should now agree that an Antarctic expedition should be undertaken, and by this country. We have ever led the way in exploration in all climates and in all seas, especially the Arctic and Antarctic. Dr. Murray has very wisely, I think, given up any idea of adducing as an argument that there is anything practically valuable in the commercial sense to be got from such exploration, but, as His Grace the Duke of Argyll has already said, surely this great country can afford to spend a little money on something that is not directly commercially valuable. We have had, as several speakers have already mentioned, the *Challenger* expedition, for pure science, redounding to the credit of England throughout the whole civilised world. The other nations have envied us that expedition, the money to be able to expend

* Full details of my reasons for coming to the conclusion as to the advantage steam has given the future Antarctic navigator are given in my paper on Morell's Voyages, (*Proc. B.G.S. (Old Series), Vol. XIV. p. 145*), which probably were not over truthful, but that does not vitiate my argument.—R. V. H.

upon it, and the public spirit of the Government of the time that sent it forth; and I am sure that if it is boldly put upon the ground of advancing our knowledge generally and of maintaining the enterprise of the British seaman, there will be in the end success. Government is always notoriously hard to move in these matters, but if it is once understood to be a popular expedition, as I believe it would be, we shall have another Antarctic expedition.

Lord CHARLES BERESFORD: The Chairman has given me a very wholesome warning, when asking me to contribute to this discussion. I notice the first Sea-Lord of the Admiralty here, and as I am on full pay I must therefore make my remarks entirely scientific. All the lecturer's remarks were interesting, but one or two of them were particularly so. Dr. Murray said that this expedition should be placed in the hands of the navy, and he thus paid the navy a very great compliment. I am sure that many of my brother officers would be very glad to undertake such an expedition. Dr. Murray also suggested that the cost of this expedition should be tacked on to the Navy Vote. Now I narrowly watched the faces of two old first Sea-Lords, and looked in vain for any symptoms of pleasure at that statement. I myself do not agree with this. I think that the money should be tacked on to the Education Vote, as being more appropriate, and money appears to be more easily got for that Vote than for the navy. He made another remark, and officers who have been in such expeditions bear him out by saying that there are disagreeable dangers and a great number of perils and hardships. Well, I cannot conceive anything more in the form of a cordial invitation to this country to embark. For there is no doubt that this is a form of disagreeables that attracts Englishmen, especially when it is for the good of their country. I confirm Sir Vesey Hamilton's opinion that the young gentlemen in the naval service will be the first to volunteer for officers' and men's work, and I hope Dr. Murray's paper will be read all through the country. I am perfectly certain that Britishers generally will be only too glad to have one more addition to the knowledge of the deep, and I am certain that if this Antarctic expedition is sent we shall add to knowledge that is at this moment in its infancy, *i.e.*, terrestrial magnetism, a science of which we know very little. If this expedition is carried out on proper principles by first of all obtaining deep-sea soundings, and gradually approaching the pole, there is no doubt that it would be an enormous benefit to the country and to science in general.

Professor Sir WILLIAM TURNER: I have no claim to address the meeting on the ground of having visited the Antarctic region. Neither am I a geographer, meteorologist, nor geologist. Perhaps the only ground for my saying a few words is that I have paid some attention to those mammals, which if they existed in large quantities in the Antarctic would prove a source of much commercial profit. I refer to the cetacea and seals; but even about these animals I feel some hesitation in speaking in the presence of my friend Sir William Flower, who is universally admitted to be our greatest authority on these matters. I believe that I am speaking what is correct by supporting what Dr. Murray has said, that there does not seem to be very much prospect of the Antarctic region being commercially profitable. The admirable book of Sir James Ross undoubtedly refers to the presence of whales in those seas; but there are whales and whales from the point of view of commerce. Many of the largest whales are of very little profit. They have very thin blubber and short whalebone, and it is not worth the whaling seaman's time to capture them. The whales that are of great profit are those called the "right" whales, of which the Greenland whale, the *Balena mysticetus*, is the great representative in the northern Polar Ocean. Now we have no satisfactory evidence, so far as I can judge from what I have read in Sir James Ross's book, that the Greenland whale—or an equivalent species—is found so far south as the Antarctic Polar Sea, and I

think there is considerable doubt therefore whether an expedition sent to these seas would turn out profitable. The Dundee ships that went there did not succeed in catching a single whale; one of them undoubtedly harpooned a specimen; but it was not the right whale of the Greenland species, but a much more powerful and active animal, probably a fin-whale, for it broke the harpoon rope and got away. The experience of that expedition does not point in the direction of this ocean being well adapted for whaling purposes. The Dundee ships did obtain, I understand, a considerable number of seals, and the naturalists attached to them brought back the crania of several specimens; but I am not aware if the species have been determined. I do not know if Sir William Flower has examined them. I have not had the opportunity, and cannot therefore say what species were got. I have not heard either what the pecuniary result of the expedition has been, and if the adventurers have received an adequate return for their outlay. I agree with the remarks made by Dr. Murray and the Duke of Argyll that the expedition should be sent out not with the view of a pecuniary return, but in order that our knowledge of this most interesting part of the globe should be extended.

Sir WILLIAM H. FLOWER: With reference to the points Sir William Turner has spoken of, I may say I entirely agree with him that there is no evidence of a whale in the Antarctic corresponding to the well-known Greenland whale, which is the most valuable of all the whalebone whales of the Northern seas. The only right whale which has hitherto been found in the South is the black whale, which, if it exists in sufficient numbers, is profitable, and has yielded a great deal in former times, and was diffused pretty nearly all round the Southern Hemisphere, being once abundant off the Cape of Good Hope, Australia and New Zealand, and I have no doubt is the species that was seen in Sir James Ross's Expedition further south. That whale is closely allied to, if not the same species as, the one that formerly lived in the northern temperate ocean—the one, sir, the history of which you investigated in the old fishing towns of the Basque provinces of Spain and France, but which is now nearly exterminated in the Atlantic. I am afraid in the South it has had the same fate, having been for the last thirty or forty years extremely rare in its once favourite haunts. With regard to seals, the Dundee Expedition has added very little to the knowledge of these animals already obtained from Sir James Ross's Expedition. I am sorry to say I have seen nothing yet from that Expedition, as hardly a specimen has come to the National Museum, and those that have been brought home are mostly in a mutilated condition. So far as I can gather from the scientific men attached to the Expedition, they found exactly the four species of seals described by Dr. John Edward Gray in his zoology of the voyage of the *Erebus* and *Terror*, neither of them of such commercial value as the fur seals of the Bering Sea or those once so abundant in the Falkland Islands, South America, Australia, and New Zealand, now however nearly extinct. There is a certain commercial value in the oil and skin of these "hair seals," as they are killed in enormous quantities in the northern sea; but I must say I do not like to take any part in advocating any expedition which would go simply for the object of destroying these animals. The result even from a commercial point of view would be disastrous. It must end in extermination in a very few years if they are to be killed in the way in which seals have been killed throughout the whole southern parts of the world, and unless such precautions are taken as have been carried out in one part of the world only, in the Bering Sea by the Russians and Americans. If an expedition were sent out to collect such specimens as are required for museums, it would be of great benefit to science. Our knowledge of these animals is scarcely increased since the time of Sir James Ross, hardly anything having been added to the British Museum collection since the specimens brought home by that Expedition. The

table that Dr. Murray has shown us of the distribution of the lower forms of animal life in the Southern Hemisphere is most instructive and encouraging to future research; but I agree with Lord Charles Beresford that, as the gain would be mainly educational, the expense is as much a question for that department as for the one which has charge of the defences of the nation. Dr. Murray has put the whole argument for a renewed exploration of the Antarctic region before us in the most able and eloquent manner, and we may all hope that his efforts will not be without result.

Dr. ALEXANDER BUCHAN: Dr. Murray prefaced his remarks on the meteorological aspects of the question by saying that the teachings of meteorology, in its recent developments, lead to the results he has indicated. I desire to draw special attention to the point that the whole reasoning with regard to the barometric pressure in the interior of Antarctica is necessarily inferential. My own conviction is that it will ultimately turn out to be all that Dr. Murray has described it; but science will not rest satisfied till actual observations place the questions on solid ground. Now I understand that the outskirts of Antarctica offer close on some half-dozen points whereon temporary observatories might be placed for at least some months, with three observers, precisely as is done on Ben Nevis in our own country. Further, the two vessels it is proposed to send out could raise cairns at different points, in which would be placed barographs, thermographs, and other self-registering instruments that may be proposed. These could be visited from time to time, the instruments wound up and the papers changed, since two registrations of temperature and pressure daily would meet the requirements of the case; and since, as I am informed by the best clockmakers in London, clocks can be furnished to the expedition to go, with one winding-up, for more than a year, it is plain that the expedition would bring back to us continuous meteorological records for the three years from many points within the Antarctic continent. These records would practically lead to a very full knowledge of the meteorology of Antarctica. Taking the teachings of meteorology as a guide, it appears to be extremely probable that by far the largest proportion of the precipitation of South Polar regions takes place over the somewhat broadish margin of ice-cliffs and ice-fields which fringe the continent facing the open sea all round. In the interior of Antarctica proper, precipitation cannot but be small, and considering the large evaporation from the snow and ice-fields, the accumulations of snow and ice cannot possibly extend to any considerable depth.

The PRESIDENT: We have among us a young volunteer who has actually been to these Antarctic regions a very short time ago; I think it will be a good completion to our discussion if we hear a short account of his experiences.

Mr. W. S. BRUCE: After so many eminent authorities on Arctic and Antarctic matters have spoken, there remains little for me to say. I had the advantage of accompanying the recent expedition on board the *Balena*, one of the four whalers which left Dundee last September. Our ship, like the others, was very efficiently equipped with scientific instruments, although the expedition in the main was commercial; but the results of the scientific observations, I must confess, were most disappointing; not even the smallest amount of work I had hoped for was accomplished. Nevertheless, I have not regretted the experience, and I think the expedition has revived, in a sense, the feeling that there should be another great Antarctic expedition, and I agree thoroughly with Dr. Murray and the other speakers who said that this expedition should be of a national character. Britain is the only nation in the world that has done good work in the Antarctic, let her keep up her reputation. Lord Charles Beresford spoke of naval volunteers; I am sure there will be no difficulty in getting scientific volunteers; I for one am ready

to spend a winter at one of Dr. Murray's winter stations. In the Arctic we have an idea of what winter is, but in the Antarctic no one has wintered. A summer in the Antarctic is quite different from a summer in the Arctic. As far north as man has penetrated he has found reindeer, flowers and bees, brilliant sunshine and the country green; but in midsummer in the Antarctic no plant grows—the summer sun is not sufficient to melt the snow. The temperature observations on our voyage show that in the height of summer the average range of the thermometer is below 32°, and that in the latitude corresponding to the Shetland and Faroe Islands in the north. This is very different from Lieutenant Peary's experiences, who has written such a glowing account of the vegetation and animal life on the northern coast of Greenland. Let me point out that one of Mr. Burn Murdoch's drawings that Dr. Murray has put on the screen was Clarence Island, the most easterly island of a group that lies in latitude about 61°, corresponding to latitudes just north of Scotland; it has no green raiment in summer as our Shetlands have, but is entirely snowclad.

The PRESIDENT: After what Sir William Flower has said on the prospect of any lucrative trade connected with the Antarctic seas, we must, I think, take to heart the words of Milton in referring to one of the north-east voyages, "that it might have seemed almost heroic if any higher end than love of gain and traffic had animated the design." Let us then work for "the higher end," and refrain from the wholesale slaughter of seals.

I consider that Dr. Murray's paper and the important discussion which has followed it will form a new starting-point in the advocacy of a renewal of Antarctic discovery. We must not forget the valuable work that was done by Admiral Sir Erasmus Ommanney and the Committee of the British Association five years ago. Sir Erasmus enlisted the sympathies of the Royal Society and even of the more enlightened members of the late Government. We owe him our warmest thanks for his exertions. Nor must we forget the zealous labours of Baron von Mueller, Captain Pascoe, and our other friends in Australia. They have long worked for the good cause of Antarctic discovery, and I am confident that they will continue to exert all their influence in its favour. Our illustrious gold-medallist, Baron Nordenskiöld, the discoverer of the North-East Passage, has but now written me a cheery and encouraging letter, from which the following is an extract:—

"We shall follow the proceedings of an English expedition to those regions with the utmost interest and with our best wishes for its success. It seems to me that the most important geographical problem for the moment is a systematic exploration of the hydrographic, meteorological, geological, and biological conditions of the Antarctic regions. The Arctic regions are in this respect now tolerably well known; but almost every scientific result gained from thence has given rise to new problems of the utmost importance for the better knowledge of our globe, which can only be satisfactorily answered by corresponding discoveries in the far South."

These inspiring words will cheer us on in our task—a task from which I, for one, will never swerve until it is completed. I have pleasure in announcing to you that our Council has this day appointed a committee for the purpose of reporting on the best means of achieving the objects of Antarctic exploration. The whole question will be thoroughly examined and discussed, and it will be our business to convince the press and the public of its importance. We are of course devoted to geographical research and to the interests of science, and we look upon those objects as a chief reason for despatching an expedition. But as an Englishman I feel that the great result of all will be the encouragement of that spirit of maritime enterprise which has ever distinguished the people of this country, and the keeping alive of our glorious naval traditions. We are well assured that, as soon as the

country is with us in the advisability of despatching an Antarctic expedition, the Government will concur. We may, therefore, work on full of confidence and hope. We shall look upon this evening as our starting-point. Dr. Murray has given us the route. He has done so in a way we shall not soon forget; and I speak the sentiment of every one present in this great assembly when I offer to him our most sincere and hearty thanks for his very able and important address.

The following communications have been received by Dr. Murray on the subject of Antarctic exploration :—

Dr. NEUMAYER, of the Hamburg Naval Observatory, has sent the following notes on the problems of terrestrial magnetism and geodesy which can only be satisfactorily and finally soived by expeditions to the South Polar Region :—

There cannot be the slightest necessity for entering upon an inquiry into the value of an exploration of the South Polar region from a meteorological point of view; it is evident to every one conversant with the subject. It suffices to recall the fact that within the Antarctic circle not a single direct winter temperature has ever been observed, the meteorological observatories being too far north in the Southern Hemisphere, and those only temporarily in operation on the Auckland Islands, Kerguelen, and South Georgia; the Polar side of the atmospheric depressions in higher latitudes have consequently never been traced with any degree of accuracy. That under such circumstances very little is known about those phenomena, and about the distribution of atmospheric pressure generally beyond the 60th parallel of southern latitude, cannot be doubted. Neither from a climatological point of view, nor from the standpoint of an inquiry into the nature of atmospheric storms in higher latitudes, can the hope be entertained of being able to advance meteorological science without reliable observations in high latitudes.

It has frequently been urged that the study of the phenomena of terrestrial magnetism, especially those of magnetic storms and earth-currents, cannot be carried on unless the establishment of at least one magnetic observatory can be secured within the Polar regions for a number of years. For this purpose the preliminary geographical exploration of the South Polar regions becomes imperative. However, I do not wish to enter upon this argument on the present occasion, as it is quite familiar to everyone conversant with the topic at issue. But the necessity for a survey of the magnetic constants within the Antarctic circle is, in its importance with regard to the advancement of the theory of terrestrial magnetism, not so readily understood; and I shall therefore point out that for such a purpose a magnetic survey is quite indispensable.

In a memoir, which I addressed in May 1855 to His Majesty the late King Maximilian II. of Bavaria, on a plan of advancing our theoretical views on the distribution of magnetism over the Earth, the most prominent part formed the re-establishment (after the observatory at Hobart had ceased operation) of a magnetical observatory in the Australian colonies, which also could serve as a basis for a magnetic survey of the Antarctic regions. The principal reason given for supporting this proposal was that it would prove to be impossible to establish and maintain a theory of terrestrial magnetism unless the Antarctic regions were explored in a similar manner to the Arctic regions; all calculations, however excellent, must necessarily fail if that gap in our information were not previously filled up. The observatory was founded at Melbourne thirty-five years ago, and is at work up to the present time. But the second part of my programme has not been accomplished, and Antarctic exploration and survey is still a geographical desideratum.

I may perhaps dwell somewhat more explicitly on this important topic. We are forced to regard, notwithstanding much progress, all our theoretical investigations into the science of the earth's magnetism as of a preliminary and provisional character, because there are no reliable determinations of the magnetic elements within the South Polar circle at command. The observations of Sir James Ross lie too far back in time to form a proper basis for the calculations when combined with more recent determinations. The calculations according to Gauss's method must thus prove unsatisfactory, and the completion of the theory of the Earth's magnetism remains an unsolved problem. Although this conviction was firmly established in my mind *a priori*, I thought it necessary to enter upon the very intricate and voluminous task of recalculating the Gaussian constants with the assistance of recent observations prior to again moving in favour of an extensive plan of a scientific exploration of the South Polar regions. Since the year 1886 the computation of the 24 Gaussian constants has been in progress under my superintendence, all the more recent observations have been reduced to 1885·0. By means of the values of the newly-derived constants, the magnetic elements have been computed and compared with the actual determinations. The differences between the actual and the theoretical values showed a degree of systematic deviation which must necessarily induce one to think of a systematic connection, unknown and inexplicable, however desirable a sound explanation may be. As it was apparent that we had not to deal with mere accidents, I was determined to carry the computations still further on, and to extend the same to terms of the 5th and the 6th orders (*i.e.*, 35 and 48 constants); but prior to that, I examined the results of a computation of twenty-four constants, for which purpose I turned to account merely observations from within the Polar regions; in the Northern Hemisphere, the results of the international system of observations (1882–83); in the Southern Hemisphere, I reduced the observations of Ross, the *Pagoda*, and also of H.M.S. *Challenger*, to 1885·0. The result of the complicated computation was far from being satisfactory, and so I determined to extend the calculation, as I have above stated, again with nothing like a satisfactory result. On several occasions I have reported on the progress of these entirely privately carried out computations, to the Deutsche Geographentag at Berlin in 1889, the Naturforschen-Versammlung, Physikalische Section, at Heidelberg in the same year, and again to the Naturforschen-Versammlung, Physikalische Section, at Bremen, 1890.* Up to this time my colleague in these computations was Hermann Petersen, of Kiel; he died in September 1890.

Meanwhile I had published an elaborate treatise on the Gaussian theory, enlarged by Dr. Ad. Schmidt of Gotha, in the "Archiv. der Deutschen Seewarte," 1889, which gave promise of a better success, if taken as the basis for further investigations. Dr. Schmidt most willingly entered upon my proposition to carry on the inquiry, and during the last three years the computation has been carried on partly according to new principles. The results of the differences between actual observations and theoretical determination have been derived by calculations with terms of the fourth, fifth, sixth, and seventh orders, and may be summarised according to Dr. Schmidt's report in these words:—*Although a decided improvement of the results makes itself manifest, it is certain that without an examination and a survey of the magnetic properties of the Antarctic region, it is an utterly hopeless case to strive with prospects of success at the advancement of the theory of the Earth's magnetism.* The strength of this sentence rests upon the fact that great efforts have been made to solve, with the present means at disposal, the noble, and in its consequences not

* The various reports have been printed in the respective transactions.

to be foreseen, problem of a tenable theory of terrestrial magnetism without adequate success, and it is on the strength of that argument alone that we solicit the support of the whole scientific world in our exertions to have a scientific expedition sent to the South Polar regions.

The all-important problem of the figure of our Earth and the settlement of a number of geodetic questions make an investigation into the nature of the South Polar region highly desirable. The determination of the constant of gravity has never been carried out in that region, and but a very small number of determinations have been carried out even in the Southern Hemisphere, south of latitude 33°. The following table contains all that is known with respect to the matter at issue within the assigned region.

The results are mainly taken from Helmert's work,* enlarged by some determinations hitherto not included in geodetic works.

Name of Stations.	Geographical		Height above Sea.	Length of Pendulum vibr. seconds.		Remarks.
	Lat. S.	Long. Paris.		Reduced to Sea-level.	Reduced to 45° lat.	
Valparaiso . . .	33 2 5	74 2 W.	23 0	0.992500	0.993568	Lütke.
Paramatta . . .	33 48 7	148 40 E.	23 0	2564	3568	Brisbane-Rümker.
Port Jackson . . .	33 57 6	149 0 E.	..	2625	3625	By computation
Cape of Good Hope . . .	33 58 0	16 9 E.	10 0	2580	3673	from triangulation.
Montevideo . . .	34 54 4	58 30 W.	4 0	2641	3551	Forter.
Melbourne . . .	37 49 9	142 38 E.	18 6	2908	3561	Neumayer.
Kerguelen Island . . .	49 8 9	67 51 E.	23 1	3645	3562	Gazelle Auxiliary Expedition.
Auckland Island . . .	50 52 0	163 45 E.	4 1	4026	3490	Gazelle Auxiliary Expedition.
Falkland Islands . . .	51 31 7	60 28 W.	..	4154	3558	Duperrey (St. Louis.)
Falkland Islands . . .	51 35 3	60 24 W.	..	4077	3476	Freycinet (French Bay).
South Georgia . . .	54 31 0	38 21 W.	7 9	4468	3608	German Expedition, Dr. Schrader.
Staten Island . . .	54 46 4	66 19 W.	5 0	4501	3619	Forter.
Cape Horn . . .	55 51 3	69 50 W.	12 0	4565	3590	Forter.
South Shetlands . . .	62 56 2	62 51 W.	7 0	5176	3631	Forter.

Although Helmert † points out that there is, as far as present evidence goes, an accordance of facts between the Northern and the Southern Hemisphere with regard to the gravity determinations, we must not forget, that, in order to arrive at that result not a single determination from within the South Polar circle has been consulted, because there are none, and that matters may be altered by a regular gravity survey within both Polar regions; for also in the Northern Polar region, comparatively speaking, but few thoroughly reliable observations are available for such a purpose. But these observations can in our time be carried out so much

* Helmert, "Die mathematischen und physikalischen Theorien der höheren Geodäsie," Bd. II., § 36, Seite 241.

† See the respective passages in the above work, and further "Mesures de l'intensité de la pesanteur," Comptes-rendues des Séances de la dixième Conférence général Association géodésique internationale, etc, 27th October, 1892, p. 493.

more easily and reliably according to the relative determinations with von Steineck's pendulum apparatus than they were in former times. To inform oneself on these points, it is advisable to study the more recent determinations in European countries and in Spitzbergen by Lieutenant Gratel,* of the Austrian navy. Gravity determinations are in modern times again much cultivated as the most simple and reliable means of arriving at a knowledge of that constant; even in the hitherto, in this respect, neglected Southern Hemisphere, physicists commence to move in the matter. According to the reports of the Royal Society of Victoria (vol. iv. New Series, part ii., p. 202), a committee has been appointed for the purpose of considering the best means to accomplish a gravity survey of the southern part of the Australian continent, thus, if the project is carried out, furnishing an excellent basis for a gravity survey in the Antarctic region. It is only by means of such a scheme that we may hope to arrive at last at the important facts whereupon a final calculation on the much-discussed matter of the figure of the Earth can be carried through.

It may perhaps not be quite out of place here to mention that without a knowledge of the exact condition of the ice-cap round the South Pole it will be impossible to carry to a successful issue the calculations on the Geoid deformations, initiated by von Drygalski, and the changing of the level surfaces of the Earth by the formation of masses of ice near the poles, and the oscillations of the level of the ocean caused thereby, as first suggested by Dr. Hergesell. The thickness of the South Polar ice-cap is to be ascertained only by means of an expedition, and till then we cannot hope for a definitive solution of the questions in connection with this changeability of latitude, the simultaneousness (coincidence) of the glacial epoch in both hemispheres, etc., etc.

It may suffice to have pointed out only a few of the questions, the solution or answering of which is indispensable, before we shall be able to speak of a thorough knowledge of the fundamental factors of the science of geophysics. The Antarctic inquiry now proposed will advance this knowledge more effectually than any other kindred scientific enterprise.

INDEX OF SOME OF THE PAPERS ON THE QUESTION OF THE EXPLORATION OF THE ANTARCTIC REGIONS, RECENTLY WRITTEN AND PUBLISHED BY GERMAN AUTHORS.†

1. Dr. *Neumayer*: Über die Süd-Polarforschung, ein Vortrag gehalten vor den ersten Deutscher Geographen-Versammlung am 25ten Juli 1865 in Frankfurt a/Main. Enthalten in dem amtlichen Bericht herausgegeben vom "Freien Deutscher Hochstift."

2. Dr. *Neumayer*: Die Erforschung des Süd-Polar-Gebietes. In der "Zeitschrift der Gesellschaft für Erdkunde zu Berlin" in Mai 1872.

3. Dr. *Neumayer*: Die geographischen Probleme innerhalb der Polarzonen in ihrem innern Zusammenhange beleuchtet; ein Vortrag gehalten am 26ten Februar 1874 für den Verein zur Erforschung Central-Afrikas. Aus den hydrographischen Mittheilungen 1874.

4. Dr. *Neumayer*: Einführungs-Ansprache in der Sektion für Geographie der Naturforscher-Versammlung in Hamburg, 1876; in dem *Tageblatt*.

* Schwene, "Bestimmungen im Hohen Norden von Aug. Gratel im Sommer 1892." Mitth. des Militär Geogr. Instituts, Bd. XII., Seite 28 ff.

† Under the supposition that the various papers published in *Petermanns Mittheilungen* since 1863 are well known, in this index are enumerated only the writings on this topic by Dr. Neumayer and by some few others of greater importance.

5. Dr. *Neumayer*: Polarexpedition oder Polarforschung? ein Vortrag gehalten in der dritten allgemeiner Sitzung der 53 Versammlung deutscher Naturforscher und Aerzte in Danzig, 1880. Im *Tageblatt* und in den "Deutschen geographischen Blätter der Geogr. Gesellschaft in Bremen," 1880, Bd. III.

6. Dr. *Neumayer*: Denkschrift über einige Vorschläge zur Durchführung der in dem Prufste 31 des Programmes für den zweiten internationalen Meteorologen-Kongress in Rom angeregten Gedanken, mit besonderer Beziehung auf die Gegenden der Erde in höheren südlicher Breiten, 1879.

7. Dr. *Neumayer*: Bericht über den Stand der Deutschen Polarforschung an den III. Deutsche Geographentag zu Frankfurt a/Main, 1883.

8. Dr. *Neumayer*: Die Deutscher Unternehmen in Systeme der Internationalen Polar-Forschung. Bericht über den Stand der Deutsches Polar-Forschung an den IV. Deutscher Geographentag in München, 1884.

9. Dr. *Neumayer*: Die geographischer Probleme innerhalb der Polar-Zonen im Lichte der neueren Forschungen, ein Vortrag gehalten in der Gesellschaft für Erdkunde zu Berlin am 7 Februar 1885. Verhandl. der Ges. für Erdkunde, 1885, Heft 3.

10. Dr. *Neumayer*: Nothwendigkeit und Durchführbarkeit der antarktischen Forschung vom Standpunkte der Entwicklung der geophysikalischen Wissenschaften insbesondere des Erdmagnetismus und der Meteorologie; ein Vortrag gehalten auf dem V. Deutschen Geographentage zu Hamburg, 1885.

11. Dr. *Neumayer*: Die Nothwendigkeit der Südpolarforschung, ein Vortrag gehalten in der dritten allgemeinen Sitzung der 59 Versammlung Deutscher Naturforscher und Aerzte in Berlin am 24ter September, 1886.

12. Dr. *Neumayer*: Bericht über den Fortgang der Bestrebungen zu Gunsten der Antarktischen Forschung, erstattet auf dem VII. Deutscher Geographentage zu Karlsruhe, 1887.

13. Dr. *Neumayer*: Denkschrift betreffend die wissenschaftliche Erforschung des Antarktischen Gebietes, Juni 1888. Als Manuscript gedruckt.

14. Dr. *Neumayer*: Ein Vorschlag zur Erforschung der Süd-Polar-Regionen, Vortrag gehalten von der Geograph. Sektion der Versammlung Deutscher Naturforscher und Aerzte in Nürnberg am 14ter September 1893.

15. Dr. *Ratzel* und Dr. *Neumayer*: Resolution des IV. Deutscher Geographentages wegen der Erforschung der Antarktisches Region 1884 in dem amtlichen Berichte.

16. Dr. *Neumayer*: Die neuesten Unternehmungen und Pläne zur systematischen Erforschung der Polar-Gegenden, ein Vortrag gehalten in Kaiserslautern 16 November 1881.

17. Dr. *Neumayer*: Ein Projekt zur Erforschung der Süd-Polar-Region, mit Karte, vorgelegt dem I. Internationale Geograph. Kongress in Antwerpen, 1871. Im amtlichen Berichte.

LECTURES AND TREATISES OF A MORE RECENT DATE BY OTHER GERMAN
AUTHORS ON THE SOUTH POLAR QUESTION.

1. Dr. *Ratzel*: Betrachtungen über Natur und Erforschung der Polar-Regionen *Ausland*, 1883, Nos. 11-19; and 1884, Nos. 8 and 11.

2. Dr. *Ratzel*: Die Bedeutung der Polarforschung für die Geographie, ein Vortrag, gehalten auf dem III. Deutscher Geographen Tage z. Frankfurt a/Main, 1883. Verhandlungen des. III. D. Geographentages.

3. Dr. *Ratzel*: Aufgaben geographischen Forschung in der Antarktis, ein Vortrag gehalten auf dem V. Deutscher Geographen Tage zu Hamburg, 1855. Verhandlungen der V. D. Geographentages.

4. Dr. *Reiter*: Die Südpolar-Frage und ihre Bedeutung für die genetische Gliederung der Erdoberfläche; in der "Zeitschrift für wissenschaftliche Geographie," Bd. VI., Juni 1-30, 1888.

5. Dr. *Fricker* : Die Entstehung und Verbreitung des antarktischen Treibeises, ein Beitrag zur Geographie des Südpolar-Gebietes. Leipzig, 1893.

6. Dr. *Borgen* : Die Internationalen Polar Expeditionen : in Deutsche Geographische Blätter, herausgegeben v. der Geogr. Gesellschaft in Bremen, 1882, Heft 4, Bd. V.

7. Dr. *von Bezold* : Die Internationale Polarforschung. Aus der "Deutsche Revue," Januarheft 1883.

8. Dr. *von Drygalski* : Die Geoiddeformationen der Eiszeit. Aus der "Zeitschrift der Gesellschaft für Erdkunde zu Berlin," Bd. XXII., Heft 3 in 4, 1887: "Ueber antarktische Vereisung und der Südpolare Eisring," Seite 37 u. 38.

9. Dr. *Hergesell* : Über die Aenderung der Gleichgewichtsfächen der Erde durch die Bildung polarer Eismassen und die dadurch verursachten Schwankungen des Meeresniveaus. In Beiträge zur Geophysik im Gerland, Bd. I., Seite 59 ff.; Berücksichtigung der Australen Vereisung, Seite 100 ff.

THE BENUE AND THE ANGLO-GERMAN TREATY OF NOVEMBER 15th, 1893.

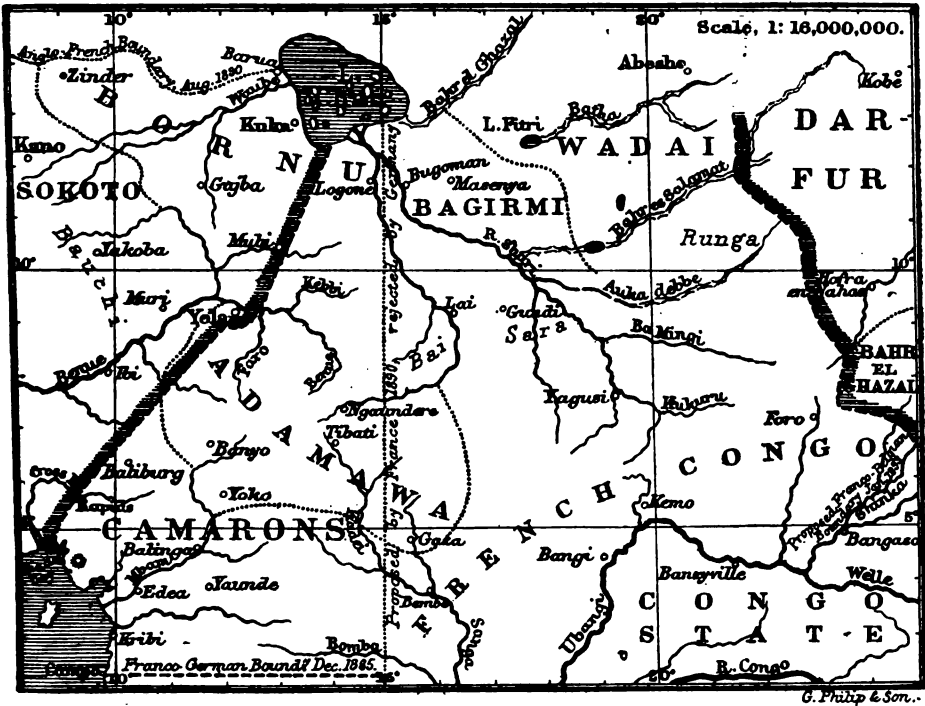
By E. G. RAVENSTEIN.

By an agreement between Great Britain and Germany signed at Berlin on November 15th, 1893, the boundary separating the British and German spheres of interest in the basin of the Niger-Benue has been more clearly defined and extended to Lake Chad or Tsade. Previous agreements, signed in 1885, 1886, 1890, and in the present year, had defined the boundary between the mouth of the Rio del Rey and the "rapids" of the Cross River, or Old Calabar. The agreement now arrived at defines the boundary as follows. Between the "rapids" and Yola it is to be formed by a straight line, except that a territory around Yola and on the left bank of the Benue, bounded by the arc of a circle having for its radius a line drawn from the centre of Yola to a point on the Benue 5 kilometers (3 miles) below the mouth of the Faro, shall be assigned to the British sphere. From the point on the Benue just mentioned the boundary follows a straight line to the intersection of the 10th parallel and the 13th meridian. Thence it is continued to the southern shore of Lake Chad, which it is supposed to strike 37 minutes to the east of the meridian of Kuka, or in longitude 14° E. The territories to the east of the line thus traced are recognised as lying within the German sphere, but "it is agreed that the influence of Germany, in respect to her relations with Great Britain, shall not extend eastwards beyond the basin of the River Shari, and that Darfur, Kordofan, and Bahrel-Ghazal, as defined in the map published in October 1891 by Justus Perthes, shall be excluded from her influence even if affluents of the Shari shall be found to lie within them.* The two Powers, moreover, agree

* The position of Wadai in the agreement remains uncertain.—Ed.

that the stipulations of the Act of Berlin with respect to the navigation the Niger and its affluents shall be mutually applied.

On looking at our sketch-map it will be seen that in this Boundary Convention, as in many others that have preceded it, no notice whatever has been taken of the physical features of the country or of existing political divisions. Adamawa, which is a tributary province of Sokoto, has thus been divided between Great Britain and Germany, and the same fate has befallen the ancient and powerful kingdom of Bornu.



The shaded lines indicate roughly the delimitation agreed upon between Great Britain and Germany.

The agreement which Herr von Stetten* concluded with the Emir of Adamawa in July last, merely permits Germany to establish trading posts within his territories, without conferring any rights of jurisdiction or recognising Germany as a "protecting" or "suzerain" power.

* Herr von Stetten arrived at Yola on July 8th, and had his treaty signed soon after. Captain Mizon only reached Yola on August 19th. Herr von Stetten, on his way down the Benue in a steamer of the Royal Niger Company, of whose officials he speaks most gratefully, met Baron C. von Uechtritz and Dr. Passarge, who are to explore the region lying to the south-east of Yola.

There still remains the more difficult settlement with France. M. Mizon, too, claims to have made a treaty with the Emir of Adamawa, whilst M. Maistre made treaties with several chiefs through whose territories he passed on his journey from the Ubangi to the Upper Benue. France, in 1890, offered to recognise the 15th meridian as the eastern boundary of the German territory of Camarons or Kamerun, but Germany declined. France not only desires to have access to Lake Chad, but also to join her possessions on the Congo with those to the north of the line agreed upon with England in 1890, that is with the French Sudan and Algeria. The task of the Boundary Commissioners, who are reported to have met at Berlin, is consequently a difficult one.*

DISCOVERY OF A MAP BY COLUMBUS.

By Dr. CARL PEUCKER.

DR. FR. R. v. WIESER, Professor of Geography in the University of Innsbrück, has discovered, in a volume of miscellaneous papers belonging to the *Bibliotheca Stroziana*, in the National Library of Florence, three remarkable sketch-maps, which we cannot hesitate to refer to Columbus himself. It is well known that the great discoverer on his fourth voyage (1502-1504) made known the whole coast of the Central American mainland, from the Gulf of Honduras to the Isthmus of Panama, and the map of this so-called Veragua Coast was then drawn by him, in conjunction with his younger brother Bartholomew. The latter, immediately after the death of the Admiral, brought such a map, together with a description of the coast, to Italy, and presented both to a certain Frate Hieronymo, who subsequently surrendered map and description to Alex. Strozzi, an enthusiastic collector of accounts of discoveries, the same to whom the National Library at Florence owes the above-mentioned collected volume. Hitherto only the description, contained in this in outline, has been known to the public, the map belonging to it having been considered as lost. Now, it is true that this extract from the text of Bartholomew Columbus is without any addition in the form of a map; the volume, however, contains another original document on the fourth voyage of the Admiral, viz., a letter of the latter from Jamaica of July 7th, 1503. On the edge of this letter Wieser has now found the sketch-maps in question—only hastily drawn with the pen—which, taken together, form a complete ring-map of the equatorial zone. They faithfully reflect the ideas of Columbus,

* France is represented on this Commission by M. Hausmann and M. Monteil, Germany by Dr. Kaiser, Dr. von Danckelman, and Dr. R. Kiepert.

have direct reference to his discoveries, and primarily to the events of his fourth voyage.

Columbus was, as is well known, firmly convinced, and this to his dying day, that he had reached the east coast of Asia, and with it the realm of the great Khan of whom Marco Polo had written such alluring accounts. Although the hoped-for passage across to the Indian Ocean had not been discovered, he had still obtained from the natives the certain information that beyond the mountains, but a few days' journey to the west, lay a second sea. This, thought Columbus, must be the "sinus magnus" of the ancient geographers, and from the far coast of the isthmus discovered the Ganges could not lie at a greater distance than a ten days' march beyond. These geographical ideas of the great discoverer are plainly reflected in the above sketch-maps, and more faithfully than on any other cartographic record of the time. On it alone do the islands discovered on his first voyage appear unmistakably as lying directly in front of that continental coast; and this latter—the region of the present Central American Republics—as "Asia," "Sinarum situs" (i.e., South China, with Tonkin), and directly connected with "India extra Gangem," or Further India. Also the main argument of Columbus for the practicability of his plan of sailing to Asia by the west, the supposition of a relatively very slight breadth of the Atlantic Ocean (founded on the calculation of Marinus of Tyre, who overestimated the extent of the Asiatic continent by more than 100° of longitude), finds clear expression in a note introduced into the sketch. Respecting the fourth voyage of Columbus also in particular, the map gives many more details than any other, more, e.g., than that of Peter Martyr, of the year 1511 (Nordenskiöld's 'Facsimile Atlas,' p. 67), or the anonymous map in the Turin Library (published in HARRISSE, 'Discovery of North America,' p. 528). The agreement of the map with the description of the coast contained in the volume does not admit of doubt, and, on the other hand, it may be regarded as out of the question that the details were put down simply from the statements of that text. The only remaining conclusion therefore (since we know that the compiler of the volume possessed a copy of the map prepared by Columbus and his brother) is that in these hasty sketches we have in fact a copy of that important and long-missing map—a precious historical relic—the only special map preserved to us relating to the fourth voyage of Columbus, and absolutely the only map which dates back to the great discoverer himself.*

* Exact facsimiles of the three sketch-maps appear in the *Mitt. des Inst. für österr. Geschichtsforschung*. Supp. vol. iv.

AMERICAN CLIFF DWELLERS.*

By CLEMENTS R. MARKHAM, C.B., F.R.S.

MR. GUSTAV NORDENSKIÖLD, the son of our Gold Medallist, Baron Nordenskiöld, is worthily following in his father's footsteps, both as regards his spirit of enterprise and his love of scientific and literary investigation. In 1890 he made a summer voyage to Spitzbergen, and he was to have taken a leading part in the contemplated Swedish Antarctic expedition. During the summer and winter of 1891, Mr. Gustav Nordenskiöld was six months in the far west, and made extensive explorations of ancient ruins of the cliff dwellers in South-west Colorado. They are remains of palace-like buildings, difficult of access, and never before thoroughly examined. Their builders must have been an agricultural, semi-civilised people, having no knowledge of metals, but highly-skilled in the manufacture of tastefully-ornamented pottery, of basket-work, and cotton cloths.

There is a special interest in these remarkable ruins, the work of a people closely allied to the neighbouring Zuñi or Pueblo Indians of New Mexico, to the Moquis of Arizona, and to the sedentary tribes in the basin of the Gila. The investigations carry us back in thought to the romantic adventures of Cabeza de Vaca, to the journey of Friar Marco de Niza and his ill-fated negro Estevan, and to the famous expedition of Vasquez de Coronado to the seven cities of Cibola, so simply yet graphically told by the soldier-scribe Castañeda. For the "Pueblos" are now satisfactorily identified with the "Cibola" of Castañeda, and the interesting story of the Zuñis, who now inhabit similar dwellings, may be read in the narratives of Cushing, and other American antiquaries.

The country of young Mr. Nordenskiöld's cave-dwellers is at some distance from the "Pueblos" of New Mexico, but there is abundant evidence of a kindred origin. He describes the country in an introductory geographical chapter. The "Mesa Verde" is a level plain, overgrown with woods of cedar and piñon; it is traversed by the gorge of the River Mancos, from which several side cañons wind in numerous curves, presenting scenery of a wild and desolate character. The cliffs forming the sides of these ravines are of a light yellow sandstone, and the ancient buildings are erected against these cliffs or in caves, specially with a view to defence. Their origin is quite unknown to the existing Uté Indians, who have no tradition respecting them. Some of these edifices have seventy or eighty rooms, and have been three and four storeys high. They have doorways, occasionally openings to admit light, sometimes

* 'The Cliff Dwellers of the Mesa Verde (South-west Colorado); their Pottery and Implements,' by G. Nordenskiöld. Stockholm and Chicago, 1893.

towers, all of worked stone, and invariably the peculiar circular chambers, called by the Spaniards *estufas*, which are also found in the *pueblos* of the Zuñis.

Mr. Nordenskiöld, assisted by some resident settlers named Wetherill, caused careful excavations to be made in the ruins, and was well rewarded. He found that the ancient cliff dwellers were proficient in the potter's art, in the manufacture of woven and plaited articles, and that they made stone hammers and clubs, knives and arrow-heads of quartzite, and other articles of bone. Their staple industry was the cultivation of maize, beans, cotton, gourds and fruits, and the turkey was domesticated among them.

Mr. Nordenskiöld has recorded his researches in a folio volume, very beautifully illustrated, which is published both in Swedish and in English. Not only does it contain plans and admirably-executed views of the various ruins, but also plates, to scale, of the crania found in the graves, of carvings on the rocks, of the ornamental pottery, stone implements, ladles and spoons made from gourds, basket-work, cotton cloth with woven patterns, and matting. Besides the geographical chapter, and those describing the buildings, there is one devoted to the previous history of the region and its discovery, from the time of Cabeza de Vaca, which is well written, and gives evidence of careful research. M. Gustav Nordenskiöld has kindly presented a copy of this interesting and admirably-illustrated work to the Society's library.

DR. VON DRYGALSKI'S GREENLAND EXPEDITION,* 1892-93.

THE expedition left Copenhagen on May 1st, 1892, on board the sailing-ship *Peru*. The passage across the Atlantic was a quick one (fourteen days), but progress was greatly hindered in Davis Straits by calms, fogs, and wide ice-fields, so that Umanak was not reached until June 27th. Every colony on the coast of Greenland is regularly visited by two or three ships, which bring provisions for the few Danish inhabitants, and various goods for the natives. These vessels arrive in July and leave in August. There exists also at this season a brisk trade between the principal ports and the smaller trade centres in their districts. The smaller places send in their stores of seal-skins and seals' blubber by small sailing-vessels. The blubber is melted down in the colonies into oil, and this, together with the skins, forms the chief return cargo of the Danish vessels. The European produce is then distributed over the remoter inhabited places. This work continues till September, after which almost all trade is suspended till January, when the winter ice-sheet is so firm and so universal that the regular use of dog-sledges becomes practicable.

As soon as the expedition had completed (in August 1892) the building of a winter station on the Nunatak Karayak, a boat-expedition was sent out along the coast of the Nugsuak Peninsula, in order to examine the glacier deposits there, and

* Report of a paper read by Dr. von Drygalski at the Berlin Geographical Society, November 4th, 1893.

to collect fossils in the neighbourhood of Kome. This glacier, which is remarkable for its enormous moraines, is fed by the interior ice-cap, a layer of over 7 feet thick melting every year.

On September 2nd the first snow fell, and on the 8th the first inland ice expedition was able to start under favourable conditions. All the countless streams which intersect the ice-cap had disappeared, and the lakes were covered with a sheet of ice which was, however, thin enough to let the water flow underneath it. Some difficulty was caused by the fact that the surface of the ice is most furrowed by the superficial streams at the end of summer. One has to pass through a labyrinth of hummocks about the height of a man. This is no hindrance to the pedestrian, but offers a great obstacle to the advance of the sledges. Another difficulty was caused by the numerous sharply-cut channels of the streams (often 20 feet deep), across which, at that season of the year, there are no snow-bridges. The thin coating of ice is also troublesome; in summer its surface is porous and friable, and gives a secure footing; but now it had become very slippery.

After a three days' march, but still within sight of the furthest promontories of land, the party began to plant our signals, using bamboo-poles driven about 5 feet into the ice. In two places sets of marks were brought down the two Karayak-fjords to the coast. The temperature during the day varied from 14° to 5° Fahrenheit; but in calm weather the cold was not noticeable, though during snow-storms they were obliged to keep to their tents. One row of poles crossed the crevassed regions of the two Karayak fjords, stretching out beyond them over the unbroken inland ice. Another row of poles led to the intermediate region between the two fjords. Altogether fifty-seven bamboo poles were set up, their positions being determined by trigonometrical measurements. This work was finished by the end of September.

During November and part of December, Dr. v. Drygalski remained alone with two Eskimo in a little plank hut, built for observations on the top of the nunatak, one hour's march from the winter-quarters, in order to examine more closely the great Karayak ice-stream. This stream is most unusually crevassed, and presents a wild chaos of ice-blocks, pillars and needles. It is useless to set up any marks there, for the whole face of the stream alters in a short space of time. One can hear and see the ice-needles fall crashing down, and clouds of ice-dust rising after the crash. Sometimes these clouds remain lying between the ice-peaks, and, under favourable conditions, they give rise to halos.

The lakes which during the summer have formed on the land at the edge of the ice, are drained through the innumerable new crevasses formed by the first sharp frost. The channels formed by this flowing away of water render it possible to penetrate (though with great difficulty) under the inland ice. Underneath it is not cold at all. In November, when the temperature outside varied from 14° to - 6° Fahr. in these caves at a hundred paces from their entrances, the temperature would be at the melting-point, and the ice-walls would be wet. It was impossible to explore the ice without climbing-irons, as there was no snow lying, and the upper surface of the ice, until late in November, was smooth, blue and bare.

In the beginning of December, Drygalski returned to the winter quarters. About this time the fjord became covered with a complete sheet of ice, which soon became safe for walking. During the two months when the sun did not appear there was for about four hours on each day fully sufficient light to admit of open-air work. Attention was given to the microscopical examination of the structure of various kinds of ice. It was found that no fundamental difference exists between the structure of the glacier-ice and that of the ice on the lakes and ponds. Both kinds consist of masses of sharply-defined separate crystals of various sizes, those of the lake-ice having a somewhat more regular form. The main form is lamellate.

The winter months—January to March—were employed in long sledge journeys as far northwards as Upernivik, and as far southwards as Jakobshavn. About 2000 English miles were covered, the conditions of the outer edge of the ice-cap being constantly examined. In April a visit was paid to the region of the Kangerdluk Fjord, the most beautiful part of Greenland as regards scenery. The fjords are deep indentations, intersecting the edges of the land, and the inland ice protrudes from every break in the dark rocks into the sea. In the end of April and in May the longest excursion to Upernivik was made, under some difficulty, caused by the sea-water, which, in many places, already flooded the ice. The basalt-formation of the Svartenhuk Peninsula breaks off suddenly near Proven, and the uniform-coloured gneiss-region of Southern Greenland begins anew. The region is, however, a complete labyrinth of small islands. The sea between these islands is very shallow, and, therefore, open water is frequent at the mouths of the rivers.

The great Upernivik ice-stream is not shut in by a rim of land, and therefore for long distances it directly reaches the sea.

A warm föhn-wind caused the ice round the winter quarters to break up suddenly in the beginning of June. In the latter half of June a second tour on the inland ice-cap was undertaken, and was far easier than the September one, as the surface of the ice was now far more even, although much water was already met with. All the fifty-seven marks were found again, and fresh measurements taken. In July and August pendulum observations were made, and in the end of July the station was closed. On August 27th the expedition started on its return journey, reaching Copenhagen on October 14th.

The motion of the ice-cap depends chiefly on the water, which in great quantities permeates it. There is no movement at temperatures lower than the melting-point, and this temperature is maintained in the lower strata by the warmth supplied through the agency of the water, which, during the short summer, makes its way down through crevasses and holes. As to the winter cold, it penetrates but slowly into the masses of ice. Thus the motion of the ice depends chiefly upon its lower layers. The interior ice-cap is a mass, the temperature of which oscillates about the melting-point. Its motion and work depend upon the mutual reactions of its solid and fluid states. This is shown by its appearance, structure and temperature.

GEOGRAPHY OF HAITI.

TIPPENHAUER's monograph* of Haiti fills a great gap in the geography of the West Indies. It is a remarkable fact that our knowledge of this island on which the first European colony of the new world—Hispaniola—flourished, is still incomplete in many respects. Tippenhauer has not only carefully collected and critically sifted all that is known about the geography of Haiti, but he has also added a good deal of new and valuable information, especially as regards the ethnology of the aboriginal and present inhabitants. The physical features, not less than the geographical position of Haiti, make it one of the most important islands of the West Indies. Mountain ranges, running parallel to the longitudinal axis of the island, occupy the greater part of its area. The most important of them is the great Cordillera de Cibao, 560 miles in length, a system of lofty mountains occupying the central parts of the island. The highest summit of the Cibao is the Pico del Yaqui

* Die Insel Haiti. Mit 30 Holzschnitten, 29 Abbildungen in Lichtdruck und 6 geologischen Tafeln in Farbendruck. Leipzig, F. A. Brockhaus, 1893.

(9690 feet). An offshoot of this range is the Sierra de Tina, which contains the Pico de Tina (10,300 feet), the highest mountain not only of Haiti, but of all the Antilles. To the south of the Cibao extends a second range, the so-called South Cordillera, with high mountains on both of its extremities, the Morne de la Selle (8900 feet) to the east, and the Morne de la Hotte (7400 feet) to the west. Other ranges are the Canal Mountains, situated between the two last-named chains, the Sierra de Monte Cristi in the northern part of the island, and the mountains of the Samana peninsula. Although these mountain ranges occupy nearly three-fourths of the whole area of the island, yet a number of large plains extend, partly along the sea-coast and partly between the mountain ranges. The most important of these are the Llanos, in the south-eastern part of the republic of Santo Domingo; the "plaine de Cul-de-Sac," east of Port-au-Prince; the Artibonite plain along the banks of the river of this name, and in the northern districts the plain of Santiago and the "Vega real" (the royal plain). The last-named is the most beautiful part of the island. Watered by the picturesque Yuna River, and covered with luxuriant pastures and groves of tropical trees, it appeared to Columbus and his companions when they first set foot on Hispaniola a real paradise, and the exclamation of the great discoverer, "vega real," became the appropriate name of this beautiful tropical district. Innumerable watercourses cut the steep declines of the Haitian mountains, but only a few of the rivers are navigable. The largest river of the island, the Artibonite, is navigable for not more than 100 miles. The next river of importance is the Yaqui del Norte, the "río del oro" of Columbus. Moreover, the Yaqui del Sur and the Yuna River have to be mentioned. Haiti has some lakes of importance, all of which are situated in the south-western part of the island. The largest of them, the Laguna de Enriquillo, is a remarkable lake of maritime origin. It was formed by the upheaval of the country during the tertiary period. Smaller lakes are the Laguna de Azuei, the Etang de Miragoane, and the Laguna de Icoatea. Geologically the island is but incompletely explored; the oldest formations, as far as we know, belong to the secondary and tertiary periods. Plutonic rocks form the summits of most of the mountains. They are surrounded by cretaceous and tertiary rocks, the latter occupying wide territories on the northern and southern parts of the island. All the territories north of the Cibao, with the exception of the Samana Peninsula, consist of these tertiary rocks. A white limestone of post-pliocene age is of special importance, as it prevails in not less than five-eighths of the whole island. Post-tertiary rocks are the so-called "coast-formation," consisting of marls, limestones, and alluvium. The alluvial deposits are rapidly increasing. A variety of valuable minerals is found on the island. Columbus noticed at once the presence of large quantities of gold, and the Indians were forced to collect it for the Spaniards. But with the disappearance of the autochthonic race, the gold production of the island rapidly decreased, and the opening up of Mexico and Peru were further reasons of its decline. The Spaniards—themselves almost entirely ignorant of gold mining—tried in vain to substitute the negro for the Indian; and at present only small quantities of gold are obtained from Haiti. Tippenhauer, however, is of opinion that the gold mines of the island are by no means exhausted; but under the present *régime* it is of course very difficult to work the old gold mines. Other metals of importance which are found on the island are silver, copper, mercury, iron, and antimony. Bay-salt is obtained at various places, and fine rock-salt is found near Neyba in the southern part of the island. Haiti has a considerable number of thermal, especially sulphurous springs. The climate differs greatly in various parts of the island. The beneficial and moderating influence of the sea-breezes is favoured by the development of the coast-lines and the configuration of the mountain ranges. The direction of the winds is usually

from east, north-east, and south-east, and consequently the eastern parts of the island have a much better climate than the western ones. For instance, the climate of Santiago is fresh and healthy, whilst Aux Cayes and Port-au-Prince suffer greatly by oppressive heat and malignant fevers.

Columbus, as is well known, discovered Haiti in December 1492. At that time the island was inhabited by two different Indian races, the Tainis and the Caribs. The former were the autochthones of the country, whilst the Caribs had immigrated from South America hardly a century before the arrival of the Spaniards. The Caribs represented the more active element of the Indian population, but both races, Caribs and Tainis, were, as regards energy and strength, far inferior to the European intruders. Hardly had the latter set foot on the island, when the serfdom of the unfortunate Indians commenced. They had to pay regular tributes of gold, or cotton, and to cultivate the soil. This was enforced by all sorts of inhuman cruelties on the parts of the Spanish colonists, the great majority of whom consisted of the most abject criminals of Spain, as an amnesty was granted to all inmates of the Castilian prisons who would emigrate to the New World. No wonder that the aboriginal population rapidly decreased. Starvation, epidemic diseases, and suicide continuously decimated the Indians. Las Casas states that the island on its discovery was inhabited by three millions of Indians, and of these, twenty-five years later, in 1517, not more than seventeen thousand remained. The rapid destruction of the Indians was followed by the equally rapid development of the African slave trade. Haiti was the cradle of this abominable traffic. Already, in 1522, the number of African slaves was so great that a revolt took place on the plantations of Don Diego Columbus, the son of the discoverer. As the negroes were much better adapted for agricultural pursuits than the Indians, the colony flourished for some time; but the rapid decline of Spain in Europe involved the ruin of Hispaniola. It was at this time that the buccaneers and filibusters formed the first nucleus of the French colony on Haiti. Tippenhauer gives a detailed account of the manners and customs of these bold pirates. In the eighteenth century the French colony flourished greatly, and the Spanish possessions also were in a better state than before. But the number of white men was very small compared with the black population, which had increased enormously. Soon after the beginning of the French Revolution, the revolts of the slaves commenced, which, as is well known, led to the ultimate defeat of the French and Spaniards. To-day the ethnology of the island is a very complicated and interesting one; the principal part of the population consists of a conglomerate of various African tribes and races. Moreover, there is a great number of descendants of Europeans and negroes. The number of Europeans living at present in Haiti is estimated by Tippenhauer at two thousand; the number of Creoles is much larger, viz., about sixty thousand, most of them living in the Dominican part of the island. Tippenhauer himself is not of pure European extraction; he describes himself as a descendant of Dithmarshen Germans and Haitian Africans. Hence we must the more appreciate his excellent and absolutely impartial description of the Haitians of to-day. It would be a mistake to regard them as a nation in the European sense of the word; but they take a foremost place among the coloured nations, that have adopted the civilisation and culture of Western Europe.

Intelligence and imagination on the one hand, and indolence and apathy on the other, are the principal characteristics of the Haitians. Amongst the lower classes, many of their old African superstitions have been preserved to this very day, and, until quite recently, cases of cannibalism have occurred in connection with a still existing demon-worship of African origin, called Vaudou.

Agriculture is the principal occupation of the negro races, and the importation

of African slaves to America was chiefly due to their high qualities for all sorts of husbandry. But although Haiti is one of the best agricultural countries of the world, agriculture is in a very backward state since the abolition of slavery. At present coffee is the principal produce of the island. Sugar—during the period of the French colony the most important product of Haiti—is still cultivated, but on a much smaller scale than in former times. Other products of importance are cotton, cocoa, tobacco, indigo, logwood, mahogany, and various kinds of fruits and vegetables. The commerce of Haiti with Europe and the United States, which is very lucrative and of great importance, is chiefly in the hands of the small white population, and Tippenhauer is of opinion that only after the prejudice against the white man has entirely disappeared, can Haiti reap the full benefit of its splendid geographical position, and of its almost unlimited natural resources.

THE PYRENEES.*

M. D'ALMEIDA's book on the Pyrenees deals with a branch of Geography which is second in interest to none, the gradual growth of knowledge concerning the physical features of a particular part of the Earth's surface. Though treating primarily of a single mountain range, the book also presents a sketch of the progress of knowledge concerning mountains generally, and of our ideas respecting them.

Having shown that the causes which would in general be likely to keep a mountain range for long within the realm of fable, such as the absence of low passes, or of longitudinal valleys reaching into the heart of the chain, its situation away from the lines of communication between nations, and the fact of its forming a political frontier between them, and lastly the sway of fashion, have all operated with special force in the case of the Pyrenees, the author reviews in succession the notices to be found in the works of the Greek and Roman geographers, the Arabian writers, and those of the Middle Ages and Renaissance. During all this time a very small stock of accurate knowledge was accumulated. The early accounts are of course vague, and contain much of fable, while errors once introduced show their characteristic vitality, and are copied again and again by successive writers. Thus the legend of a great conflagration of forests (whence the old writers derived the name of the range), giving rise to streams of molten silver, is constantly recurring, while the false direction (from north to south) given by Diodorus Siculus to the chain, was a fertile source of confusion. Strabo even, though showing much critical judgment in matters more within his ken, was misled in this respect, perhaps because of the rigid connection which he thought to exist between climate and latitude. Among the Romans the study of Geography was not much in favour, and though their officials were posted on the three main routes across the range, they did little in the way of exploration. The spirit of inquiry which was rife in the time of Pliny the Elder may be traced in the greater accuracy of his information and that of Ptolemy, but after the latter all progress ceased. In the confused account of Procopius (5th century) may perhaps be found the source of the error which consisted in uniting the Alps and Pyrenees, an error which held its ground until the present century.

The Arabian geographers did little but copy the older writers. Edrisi and Abulféda add marvellous details to their descriptions of routes, and are impressed with the inaccessibility of the range, probably because its retention in the hands of the Christians withheld facilities for personal investigation. The pilgrimages to St.

* *Les Pyrénées. Développement de la Connaissance Géographique de la Chaîne.* By P. Caména d'Almeida. Paris. Colin.

James of Compostella in the Middle Ages led people across the western extremity of the range without throwing new light on it, and Benjamin of Tudela is strangely silent as to this part of his route. The ecclesiastical writers indulged in fantastic theories from which even Albert le Grand, who excelled them all in the clearness of his views, was not wholly free. During the 16th and 17th centuries a period of total indifference supervened, and the geographers of the Renaissance exhibited a servile imitation of antiquity, which misled Ortelius, so that he placed the "Mont Pyrénée" in the Alps, from connecting, M d'Almeida thinks, the ancient legend above mentioned with the "Brenner." The vaguest ideas prevailed as to the height of the mountains, and though a solitary ascent in the interests of science was made at the close of the 16th century by M. de Candale, it remained a fact a century later that, through war and brigandage, the fear of fatigue or indifference, sixteen centuries had passed without any progress towards the scientific knowledge of the range.

We cannot here follow the author through his *résumé* of the gradual elucidation of the geological structure of the chain, and of the principles of mountain-building generally, from the older Neptunian theories, through those of upheaval held with special reference to the Pyrenees by Elié de Beaumont, to the modern views of folding and fracture elaborated by Sues. To Buffon, in spite of his rash generalisations, much is due for having communicated to others his own keen appreciation of the beauties of nature, and so led the way to more extended research; but it is to the systematic accumulation by Ramond of facts as to the arrangement of strata in the Pyrenees, and especially to his discovery of fossiliferous rocks on the highest crests, which disposed of the theory of the intimate relation between altitude and the age of rocks, that the initiation of real progress is to be ascribed. That progress has been maintained to the present day. Matters less noticed by the earlier investigators, such as the effects of glacial action, have engaged the attention of their successors, so that, though much of detail, and much relating to human life and activity remains for study, the range is no longer, as it so long was, a *terra incognita* in the heart of Europe.

A sketch-map of the chain, and a few well-chosen illustrations of its characteristic features would have added to the interest of the book, which in other respects leaves little to be desired on the score of completeness. Such aids are, however, perhaps less indispensable in a work which treats not so much of the physical features themselves as of the growth of men's ideas about them.

THE MONTHLY RECORD.

THE SOCIETY.

The Session after Christmas.—The first meeting of the new year will be held on January 15th, when Dr. J. W. Gregory will give an account of his expedition to Mount Kenia, which he ascended to a height of 17,000 feet, where he was stopped by the great glaciers which descend from the summit. The paper on January 29th will be by Dr. K. Grossmann, on his recent journey across Iceland, when he made observations of great scientific value, and took a large series of beautiful photographs, representative of the scenery and the geology of the island. On February 12th Mr. H. Lake (engineer in the service of the Sultan of Johore) will give an interesting account of the little known portion of the Southern Malay Peninsula included in the territory

of the Sultan. At the following meeting the paper will be on a recent journey of great interest on the Upper Mekong River, by Mr. H. Warington Smyth, grandson of our former president Admiral Smyth. At the following meetings we shall probably have papers by Mr. Cozens-Hardy on his recent journey in Montenegro, by Professor Lapworth on the Face of the Earth, by Mr. St. George Littledale on his last remarkable journey across Central Asia, by Captain Swayne on his several years explorations in Somali Land, by Mr. Theodore Bent on his journey to Hadramaut, by Dr. H. R. Mill on his survey of the English Lakes, by Captain Bower on his expedition to Turkistan. Other papers are promised, and will be announced when definite arrangements are made.

Educational Lectures.—On December 19th Dr. Mill concluded his series of twelve lectures on Geography applied to Commerce, given at the London Institution. These lectures have been decidedly successful; the attendance was about 200, the audience consisting mainly of teachers and young men engaged in business. The second course of Mr. H. J. Mackinder's series of lectures on the Relations between Geography and History will be given in the theatre of the Royal United Service Institution, Whitehall, opposite the Horse Guards (kindly lent by the Council of the Institution), on Thursdays (not Fridays), beginning with the second Thursday in January (the 11th), and continued weekly on the following nine Thursdays at 8 p.m. As already announced, the Christmas Lectures to young people will be given by Mr. Douglas W. Freshfield, on "Mountains," at the hall, 20, Hanover Square, on Saturday 6th, Tuesday 9th, and Thursday 11th January, at 4 p.m.

EUROPE.

Classification of the Alps.—Dr. Aug. v. Boehm, professor at the Technical High School of Vienna, who is well known as the author of a "Classification of the Eastern Alps" (Penck's *Geographische Abhandlungen*, vol. i. Part iii. Vienna, 1887), has now written for the new (14th) edition of Brockhaus' Conversations Lexikon, a classification of the Western Alps, based upon the same principles. We have now, therefore, a classification of the entire chain of the Alps,* and one substantially different from the innumerable classifications of the Alps which have been up till now before the public. The former classifications are, in some cases, superficial, in others one-sided; but all are based upon some one salient feature, as, for instance, the structure of the mountains, or, more frequently, merely upon the courses of the rivers; whereas in this work all essential features of form, height, structure, etc.—in short, the general character of the range, has been taken into account. The principle adopted is not only more natural than those formerly accepted, but is also purely geographical. The thoroughness of v. Boehm's work as regards the nomenclature of separate groups, is still more evident from his monograph on the "Steiner Alpen." The discussion is about the south-eastern part of the Eastern Alps, on the frontiers of Carinthia, Styria, and Carniola (north-north-

* A short summary of it has been published in the *Deutsche Rundschau für Geographie und Statistik*, vol. i. XV., 1893.

east of Laibach), for which v. Boehm maintains the name of Steiner Alpen to be the proper one, both historically and on the ground of orographical, structural and economic data.

The Pindus.—Professor Dr. Hilber, in his report (October 7th, 1893), of the geological expedition to Thessaly, which he undertook last summer for the Vienna Academy of Sciences, gives some interesting data, which present the key to the internal structure (till now unknown) of the Pindus mountains. The Pindus system consists of three chains, divided from one another by valleys, and formed of as many folded strata, the longer slopes being always turned to the east. The most easterly of these chains, which to the north of Peneus has several longitudinal valleys, assumes the shape of a single chain in the latitude of Kalambaka, under the name of the Kosiakas mountains, which attain to a height of about 4920 feet above sea-level, on the southern frontier of Thessaly. In several spots it is connected with the middle range, about 7050 feet high, while the western chain rises in the Tsumenka to an altitude of 7540 feet. The hilly spurs in the south-west consist of *Flysch* (hieroglyphic sandstone, marl and conglomerates), upon which, in the southern part of the western chain, are superposed thick masses of chalk limestone. The latter is intersected by veins of serpentine, which cut through the underlying *Flysch*; finally, the chalk is covered by older tertiary limestone. The bearing of the strata is north-north-west, only to the east of Penisteri appears a bend to the east-north-east. The form of these mountains is never wild and broken, but gently undulated, with summits covered with heaps of the easily disintegrated limestone. In the upper regions no traces of glaciers are to be seen. The mountains are mostly bare of forest, but, as is mentioned by the botanist Dr. v. Halaczy (also engaged on the study of the Pindus range), huge virgin forests of horse-chestnut are found upon the slopes. This appears to show that the original habitat of this tree is not, as has up till now been supposed, Asia, but the Pindus range.

Mineral Resources of the Island of Milo.—Some useful notes on the mineral resources of the Island of Milo are given by Mr. W. H. Cottrell in a recent report to the Foreign Office (Miscellaneous Series, 1893, No. 303). The Island of Milo, the most westerly of the Cyclades, has at all times been noted for its mineral resources. Geologically the island is of great interest, sedimentary, igneous, and metamorphic rocks occurring. The physical features of the surface are no less remarkable for diversity and abrupt change of formation. Thus on an area of 57½ square miles, there are extensive plains (notably that of Palcahora), low hills, and summits of considerable height. Of the latter, that called Prophet Elias is 2548 feet; Mikro bouno, 2310 feet; Kitzimpardos, 1294 feet; Kalamavras 1275 feet, and Favas, 1006 feet above the level of the sea. The mineral productions of Milo include sulphur, which occurs in thick and abundant deposits between Cape Provata and Cape Apollonion. The existence of these mines was known even in pre-historic ages. The sulphur centres are situated on the eastern side at Firlingos, Paleoreoma, and Saint Theodore. Manganese ores are more especially found on the western portion of the island known as Chalaka. Gypsum is found in the southern side of the harbour, near Patrichia and close to Mount Damianos. Lead, zinc, and copper also occur. The most important minerals, which at the present time constitute the chief wealth of Milo, are the argentiferous barytes, which occur at different places in compact masses of considerable magnitude, and the liparites and clays of a yellow and dark grey colour, which also, more or less, contain silver. The whole quantity of argentiferous mineral available at Milo is estimated at 10,000,000 tons.

The Island of Rügen.—Dr. R. Credner's work on the island of Rügen, the latest issue of the *Forschungen zur deutschen Landes- und Volkskunde*, is one of those minute investigations into physical geography, as based on geology, which find so much favour in Germany. It exemplifies the difficulty of effecting a natural separation between the two sciences, for when, as here, the physical features of a country are studied for their own sake, without reference to their effect on human history, such a division as that between historic and pre-historic changes has naturally no place, and the point of view differs little from that of the geologist. We can here give only a brief indication of the contents of the brochure. The island of Rügen, which rises from the shallow waters adjacent to the coast of West Pomerania, is remarkable for the irregularity both of its outline and relief. Besides numerous bays on the outer coasts, a deep inlet from the sea to the west penetrates to within a mile of the eastern side, while the surface consists of insular masses, themselves of very irregular relief and varied characteristics, separated by expanses of lowland which would be entirely covered by a rise of 16 feet in the sea-level. These separate masses are not the remnants of a once uniform land, but are shown by their difference of structure to be separate units, a fact recognised by the individual names applied to them (Wittow in the north, Jasmund, north-east, etc., besides Rügen proper occupying the south-west and centre). Owing to a general rise of the surface from west to east, the latter coast displays a fine series of cliffs of varied form. The chief geological formations present are the upper cretaceous, diluvium and alluvium. The first, which is most developed in Jasmund, can be well studied in the cliffs there, of which three excellent illustrations are given. It has suffered much dislocation, several distinct series of faults being traceable, and occurs in isolated masses separated by other formations. A lower and an upper glacial-marl constitute the ground-moraine of the ancient ice-sheet. The former alone shares the dislocations of the chalk, which must therefore date from an interglacial period between them. It is this epoch of disturbance which has had most influence on the present relief of the island. The elevation of the chalk masses of Jasmund and Arkona (in Wittow) not only supplied the framework, but much influenced the subsequent action of the ice-sheet and distribution of glacial material. From a comparison of the surface features with the geological structure, Dr. Credner concludes that this has been of primary importance in moulding the minor features as well, especially in Jasmund. Here the lines of ridges and hollows, and some of the river-valleys even, follow directions closely agreeing with those of the strike and axes of dislocation of the chalk in various parts, and the terrace formations frequently seen can be confidently ascribed to the effect of faulting. In many parts of the island the depth of the surface deposit precludes an accurate knowledge of the fundamental structure; but the repetition in coast and other lines of similar directions to those prevailing in Jasmund, points to similar structural causes. To the denuding action of the ice is due the removal, except in sheltered spots, of almost all the earlier glacial drift, while the deposit of fresh material resulted in types of surface corresponding to those characteristic of the whole Baltic ridge, including both level stretches and groups of hillocks. At the opening of the post-glacial epoch the sea, filling up the hollows occupied by the ice, divided Rügen from the mainland, and penetrated it by numerous inlets. The surface of the separate masses had by this time taken nearly its present form; but the edges had still to be carved by the waves and atmospheric agencies into the present cliffs. Meanwhile various arms of the sea became filled up, and sand-dunes, or boggy flats, took their place, joining the various units into the single island as it exists now.

ASIA.

Mountaineering in Japan.—The following letter has been received by Mr. Freshfield from the Rev. Walter Weston, of Kobe, Japan. It is dated September 13th, 1893:—"I am sending you by this post an account I wrote some time ago describing a country journey in the spring of this year. The crossing of the Misaka toge ("toge" = pass) and the ascent of Ena San ("San" = mountain) were both new expeditions as far as foreign travellers are concerned, and the latter, I was told, has not been previously made except in the summer time, as the natives hitherto held it to be impossible whilst the peak is covered at all with snow. The Misaka toge route is useful, as it affords a convenient and picturesque new way for foreign travellers coming up the Nakasendo, the chief highway in Central Japan, from the direction of Kobe, and desirous of crossing into the valley of the Tenriu-gawa ("gawa" = river), whose magnificent rapids are the finest in the country. I have just returned from an intensely interesting summer holiday in the Japanese Alps, which, although the weather was not of the best, gave me an opportunity of making still closer acquaintance with the grandest scenery in this lovely land. Some of my ascents were not new ones; but two were specially interesting by reason of their being the most difficult journeys I have taken in Japan. The crossing of the Harinoki toge was the first time for some years that a foreigner had made the expedition, though several parties had attempted it. So far as I can learn it has apparently only been once crossed by a foreigner during the last ten (if not fourteen) years. It is about 8000 feet. The ascent of Myojin dake ("dake" = peak, mountain) was also the first by a foreigner, the summit indeed having been only once reached by a Japanese (War Office surveyor) a fortnight or so before. It is a grand peak, much like a Chamonix Aiguille, about 10,000 feet high. I carried with me all the time the Royal Geographical Society's mercurial barometer, and also two aneroids, and hope the observations I took will be of use. I shall write an account for publication, one such as you suggested, of the whole of the Japanese Alps." Mr Weston is returning to England early next year.

M. de Poncin on the Pamirs.—M. E. de Poncin writes from Gilgit on August 26th to the Geographical Society of Paris to announce his arrival there from the Pamirs. It appears that the traveller took his departure from Gulcha in Ferghana, and crossed the Pamirs from north to south, making, on the way, some diversions from the direct route. Thus he visited the Alichur and Great Pamirs, and passing by the much discussed Chakmak, or Chakmáktin Lake, Bozai Gumbaz, &c., emerged into Hunza by the Kilik Pass. In crossing the ridge between the Great Pamir and the Chakmak Lake M. Poncin took the pass called after M. Benderski (who was the topographer of the Russian Pamir Expedition of 1883), that gentleman having, according to Russian accounts, been the first to discover the pass. To the east of this pass M. Poncin now claims to have made another discovery—that of a lake measuring $1\frac{1}{2}$ miles in length by one quarter to half a mile in breadth. M. Poncin does not mention in his letter whether this lake communicates with any of the neighbouring rivers, nor does he give its altitude; but it must be inferred to lie at a great elevation. After crossing the Kilik M. Poncin experienced difficulties with his caravan people, and had to continue his journey on foot and alone to Gilgit, where he was hospitably received by the British agent, who was to pass him on to Kashmir.

M. Dutreuil de Rhins in Central Asia.—The proceedings of M. Dutreuil de Rhins in his exploration of Northern Tibet are always watched with interest by geographers, and it is satisfactory to gather that the state of his health has improved,

and that his researches are still in progress. He writes to the Geographical Society of Paris from Keria in Chinese Turkistan on June 30th last, and gives an extract from a letter he had received from his companion, M. Grenard, who was then at Cherchen (Charchand), on the subject of the passes leading from the plains of Turkistan over to Kuen-lun (according to Chinese nomenclature) into Tibet. From what M. Grenard writes it would appear that an easy road is known to cross the mountains from the head of the Charchand River, and he had ascertained that Colonel Pevtsoff had followed it in the course of his late expedition as far as the foot of a chain called the Akkatagh (query Ak-Tagh), where his progress was blocked by swamps. If M. de Rhins has been able to enter Tibet by this route during the past summer, we may expect some interesting new geography as the result of his survey.

The Siberian Railway.—An important decision was taken at the last meeting of the Committee of the Siberian Railway. The great highway from Siberia to the Amur is passing now, as is known, round Lake Baikal, a narrow road having been cut through the cliffs, which rise from the very edge of the lake to a great height. The cost of the railway from Irkutsk to Transbaikalia, round Lake Baikal, is estimated at no less than £2,500,000, and the construction of this part of the line would undoubtedly take a great deal of time. It has been decided, therefore, to build at once the line (53 miles) between Irkutsk and Listvenichnaya, on Lake Baikal, and to establish between this port and the opposite shore of the lake a regular communication by means of steamers, specially built for the purpose, which would thus connect the Middle Siberian trunk of the railroad with the Transbaikalian during eight months of the year; while during the winter there would be no difficulty in establishing a temporary railway on the always very smooth surface of the thick ice-cover of the lake. At the same time, the success of navigation up the Yenissei has proved that the rails and other heavy materials for the railway could easily be brought from Europe *viâ* the Arctic Sea, up the Yenissei, and up its tributaries, the Chulym and the Angara, which could be easily improved for navigation at a slight expenditure. It has been decided, therefore, to build at once the trunk-line Achinsk-Krasnoyarsk (113 miles), which will connect the two great arteries of navigation, the basin of the Ob with that of the Yenissei, and facilitate the construction of the line from Krasnoyarsk to Irkutsk. The same Committee announce that on the first West-Siberian line, between Chelyabinsk and Omsk, eighty per cent. of all the earthworks have been accomplished, and the rails have been laid over a distance of 160 miles out of 495 miles. On the second division, Omsk to the Ob (326 miles), as well as on the third (Ob-Krasnoyarsk), work is in full swing. As to the Usuri line, it is announced that the first 67 miles, between Vladivostok and Nikolskoye, are opened for both passengers and goods traffic.

A New Russian Province.—The north-eastern extremity of Siberia, between the 62nd and 70th degrees of latitude and the 134th and 160th degrees of E. longitude, has been created by the Russian Government under the name of Province of Anadyr. It has a population of nearly two hundred thousand inhabitants, Yukaghirs, Lamuts, Koryaks, Kamchadales, and Chukchis.

Proposed Expedition to Lhasa.—The *Verhandlungen* of the Berlin Geographical Society states that the Swedish traveller, Sven Hedin, who is well known for his travels in Persia, has planned a journey to Lhasa. He will go disguised as a Persian merchant setting out from Leh, and following Nain Singh's route as far as Tengri-nor, where he will leave his party, and, accompanied by only one companion, endeavour to make his way to Lhasa. We are not aware that a Persian

would be more readily welcomed at the capital of Tibet than a European, and unless Mr. Hedin has some new method for evading the Tibetan officials it seems probable that the plan of his journey, so far as concerns a visit to Lhasa, will have to be altered.

The Haifa-Damascus Railway.—A recent number of *Commerce* contains an illustrated article on the Haifa-Damascus Railway now approaching completion. The writer treats his subject mainly from the commercial aspect. After exhaustive surveys for the best route, Haifa and Akka (Acre) have been chosen as the two starting-points of the new railway. Akka and Haifa are situated at opposite extremities of the only bay suitable for the large ships of modern commerce on the Syrian Coast. Akka will be used for military purposes, Haifa will be the trading terminus, but the two lines unite at the apex of the bay. From Haifa, at the foot of Mount Carmel, the railway will proceed through Belled-Es-Sheikh, where the first station will be erected, and then on through the plain of Esdraelon, leaving Nazareth well to the left. It will traverse the base of Little Hermon, and so to Shunem; then onwards through Jezreel, the Jordan Valley, and across the Jordan. It will then skirt the eastern shores of the Sea of Galilee to the plain of the Haurán, the ancient Bashan. Passing the fortress of Gamala and the towns of Kishfin and Nawa, it will reach the plain of Damascus, skirting the eastern base of Mount Hermon, and finally arrive at its terminus, Damascus. By this route, it will be seen, the railway, throughout its entire course of 149 miles, will not have to cross any range of mountains, while it will pass through some of the most fertile plains of Syria. The plains of Bashan produce even now more than 200,000 tons of cereals annually, but this quantity could be greatly increased. At present the grain is transported on camels, part going inland to Damascus, the remainder to the coast. The country is also admirably adapted for the growth of cotton, wool, fruit, olives, and for the cultivation of the silkworm. The present population of the districts through which the railway will pass is about 1,000,000. There is every reason to believe that the new railway on its completion will have a great effect on the commercial prosperity of the country.

AFRICA.

A Journey in the Angoni Country.—The following extract from a despatch from Mr. Richard Crawshay, Collector of Revenues, British Central Africa, has been kindly forwarded to the Society from the Foreign Office. It is dated:—"Deep Bay, North Nyasa, August 8th, 1893. I have the honour to report my return yesterday from a journey to the Angoni country, where I visited Mtwaro and Perembi and some of their dependents. Briefly I may say that my journey proved more successful than I had hoped: its three objects have been accomplished. I have opened up friendly intercourse with the Angoni. I have, I think, induced them to cease raiding in this neighbourhood, and I have secured a number of Angoni to work here at Nkanga (Deep Bay). I had a very good reception at the hands of the young Mtwaro (Muzikubola), who is shortly to be elected chief in place of his father. For this good reception I am largely indebted, I think, to the kindly introduction accorded me by Messrs. Stuart and Murray, of the Livingstonia Mission, who, it is not difficult to see, have acquired a strong influence over the young Mtwaro and his people (greatly to the distaste of his old Zulu councillors). Perembi, a remarkably fine specimen of a Zulu (brother of the late Mtwaro, and, I think I am right in saying, senior chief of the tribe), also received me well, but in great and "distant" state, being a chief elect, and of true Zulu blood. Our route into Angoniland lay through some of the finest country I have seen in Africa. Indeed I cannot

recollect having seen anything like it either in the Shire Highlands or on the Nyasa-Tanganyika Plateau. Leaving Lake Nyasa at Chombe (Mount Waller), where I secured some specimens of coal, we climbed the Nyika Plateau in a westerly direction, and travelled through Nyika, Henga (depopulated some sixteen years ago by the Angoni) and Tumbuka in part, skirting the eastern limit of another depopulated district, Nkamanga, and following up the Linyina, Kasitu, Lunyangwa Rivers for about two and a half days' journey. The Linyina and Kasitu are curious rivers of fair width, but very shallow, with beds of pure soft sand, and, as a rule very high banks. The Nyika Plateau is a magnificent country, and is sparsely peopled by Anyika (otherwise called Apoka), who live on tiny ledges cut into the slopes of the mountains, and occasionally in caves, and who cultivate almost exclusively peas of fine size, which grow vigorously through the entire dry season. Chidiyu appears to be the principal chief of the Anyika, and his town (composed of very widely-scattered huts on terraces or caves) is on the heights of a great mountain, Kantorongondo. This mountain cannot be less than 8000 feet, more or less, at its summit above sea-level, as Chidiyu's town is 5820 feet, and is a very long way below the top of the mountain. South of Kantorongondo, and adjoining it, is another high mountain, Mwenembwi, where dwells another Mnyika chief, Mpaula. Mwenembwi gives one the idea of being somewhat higher than Kantorongondo. I climbed Kantorongondo as far as Chidiyu's, but could not stay to go to its summit, which is nearly always hidden in clouds, and I did not touch Mwenembwi at all. However I am exceedingly anxious to see something more of these mountains, and mean to do so whenever I can find the time. I have a few flowers collected from Kantorongondo and some prodigiously long lichen. Many times when looking for flowers I had occasion to regret sorely not having brought my butterfly net. I remarked some specimens of what appeared to be the genuine British Red Admiral (*V. Atalanta*), an extraordinary "Blue," with tails, and the ubiquitous "Painted Lady." The climate in these Nyika mountains is almost European. On Kantorongondo, below Chidiyu's, the temperature at sunrise registered less than 36° (the lowest my Cape Town purchased thermometer would register), and at noon, in the shade with the sun shining brightly, 71°. The soil is generally bright red loam, and very moist. There are any number of streams, large and small, in the beds of which are tree-ferns, wild bananas, and monster trees, with their limbs heavy with long grey lichen."

M. Lionel Decle's Journey in Central Africa.—In a letter dated Urambo, July 25th, 1893, M. Lionel Decle gives a general sketch of his explorations in South Central Africa, and his journey from Cape Town to the sources of the Nile. In May 1891 M. Decle reached Cape Town with other members of the French Mission Scientifique, and at once proceeded to the Victoria Falls of the Zambesi, and the southern portion of the Barutsi country. At the beginning of 1892 he returned to Palapye after having endured considerable hardships in the Kalahari desert. The six following months were spent in Matabililand, and then M. Decle started for the Zambesi, and succeeded in finding a better route than the one usually followed. In the same year, after returning to Palapye, he visited Mashonaland, and starting from Fort Salisbury travelled along the eastern bank of the Manyami to the Zambesi, reached Zumbo in November, 1892, and proceeded down the Zambesi to Senna. From Senna he travelled to Blantyre with the intention of returning to Europe by way of Lake Nyasa and Zanzibar; but owing to the war then existing between the Germans and the Wahehe this route was found to be impracticable, and Mr. H. H. Johnston suggested that he should proceed to the north of the lake, and from there to Lake Tanganyika and Ujiji. This route was finally adopted, and M. Decle

arrived at Ujiji in June 1893. From Ujiji he travelled to Urambo through the Waha country, by a route a good deal to the north of that previously followed by travellers, and at the time of writing was on the point of setting out for Uganda, which he expected to reach in the latter end of September, thus accomplishing a journey from Cape Town to the sources of the Nile. M. Decle states that throughout his travels he has made a large number of anthropological notes and collections, and has made a careful compass survey of all the country through which he has passed, thus filling up, to a certain extent, some of the blanks that appear in maps of Africa. It is, however, unfortunate that he was unprovided with any instrument for taking astronomical observations, as these would have considerably added to the value of his work. Long practice in previous journeys in India and Japan, as a photographer, has enabled M. Decle to take a large number of photographs, which he has successfully developed, and which, together with his compass surveys, he has promised to submit to the Royal Geographical Society. Throughout the greater part of his travels M. Decle found that the cattle of the natives, as well as the buffaloes and antelopes, had been much reduced in number by the murrain at present raging throughout this part of Africa.

AUSTRALASIA AND PACIFIC ISLANDS.

Survey Work in New Zealand by the Surveyor-General (S. P. Smith).—

The annual reports on the operations of the Lands and Survey Department of New Zealand for the year ending March 1893 have recently been published. As regards the administration of the lands, a uniform system has now, by the passing of the Land Act of 1892, been introduced, whereby "nine hundred and ninety-nine-year leases for special settlement areas, based on a 4-per-cent. rental without periodical re-valuations," were substituted for "thirty-year leases on a 5-per-cent. rental with recurring valuations. The principal alteration in the Act which affects the village homestead selections is the substitution of 100 acres for 50 acres as a limit of the size of the sections." The lands still held by the Crown are practically pastoral, much broken, bush-covered, and difficult of access. The want of agricultural land is greatly felt. We are glad to observe that among the lands reserved during the year for public purposes, "the islands of Lloyd, Anxiety, Secretary, and others on the West Coast Sounds" have been set apart "for the purpose of preservation of the native fauna and flora." The State forests include all classes of "forest reservations, whether for timber, climatic, or other purposes. The area that has been reserved is considerable, but still not enough for the future wants of the colony. . . . It is in the nature of things that the finest timber grows, as a rule, on the lands best suited for settlement, and hence it is the first to disappear under the process of clearing. . . . It is grievous to think that the splendid pine-forests [between Hunterville and Pipiriki in the North Island] will in a few years disappear under the axe and fire without producing any return from the trees themselves." The total area of the State forests is now 1,136,467 acres, and the whole forest area of the colony 20,578,000 acres. Under an Act passed last year, the Crown has acquired power to purchase lands for settlement purposes from private individuals in localities where there is a demand for farms. The actual amount of land which has so far been recommended for purchase under this Act is 1026 acres. The chief surveys of the past year consisted (1) of triangulation and topographical, and (2) of settlement and other minor surveys. The latter consist mainly of subdivision of land for farms, mining-claims, road and railway surveys. The former were devoted to the subdivision of pastoral runs, but principally to filling up gaps left over from the surveys of previous years. This work is difficult

and tedious, as "the country over which the triangulation has to be carried nowadays is generally forest-clad and rough, and frequently a large amount of clearing has to be done before sites can be obtained." A considerable area in Westland was surveyed, in connection with the exploration of the head-waters of the Copeland and other rivers to ascertain if a practicable route could be obtained across the Southern Alps from that river to "The Hermitage," the hotel at the base of Mount Cook. The Copeland Valley Survey is illustrated by excellent maps and by several photo-lithographs of the imposing scenery along it. Mr. Douglas's narrative of its exploration is very interesting and graphic. "Years ago," he says, "the Karangarua and other rivers in Southern Westland were celebrated for their ground and other birds. . . . But now all this is altered. The digger, with his dogs, cats, rats, and ferrets, has nearly exterminated the birds in the lower valleys. . . . But the Welcome Flats (towards the sources of the Copeland River) put one in mind of other days—it was swarming with birds. The Kiwis (*Apteryx*) were of larger size than usual, and very light in colour, some being completely white on the belly. . . . The robins ate out of one's hand, the bell-bird sung its chorus in a style only now to be heard south of Jackson's Bay, while the blue-ducks were as tame as of yore. . . . With the exception of the Kakapo, every bush bird was represented on the flats." The result of the exploration showed that the proposed route from the valley up the Strauchon Glacier and *viâ* Baker's Saddle into the Hooker Valley was impracticable, which is much to be regretted, as some of the most splendid scenery around Mount Cook is cut off from the tourist. From the reports on the thermal springs, which occur in both the North and the South Islands, it appears that they are acquiring a great and growing reputation as the sanatoria of the Australian Colonies.

Solomon Islands.—Letters from H.M. surveying ship *Penguin* of Sept. 24th show that the survey of the little-known New Georgia group of the Solomon Islands has been well commenced. This group has the reputation of being inhabited by the most treacherous tribes, and those most addicted to head-hunting in the whole Western Pacific. Nevertheless, the continued presence of a peaceful man-of-war, a vessel which neither trades nor punishes, and whose people are here, there, and everywhere, has quickly had its usual effect, and most satisfactory relations have been established. A visit to the interior, to a commanding mountain, has been made without any misunderstandings arising, the officer, Lieutenant Somerville, wisely desisting from attempting to reach the very summit, which he was informed was "Tanbri," or sacred, and that a huge fish and a gigantic clam who resided there would make intruders rue the attempt. This officer mentions a remarkable luminous lichen with which all tree-trunks and rocks are covered, lighting up the forest with a dim mysterious light. Torn off and tied on sticks, it formed rude torches to help to find the way through the pitchy darkness of the thick forest after night set in. The shores of these islands are a perfect maze of bays, barrier reefs, islets, and intricate channels, of which up to the present absolutely nothing is known, and charts of which will be very useful.

POLAR REGIONS.

" **Projected American Arctic Exploration.**—A circular from Dr. Robert Stein, of the United States Geological Survey, informs us that he has proposed a scheme for exploring the Polar area and reaching the North Pole by a system of gradual approaches. He proposes to begin next year by establishing a station on Cape Tennyson, the south-east point of Ellesmereland, to serve as a permanent base of operations. This point of land is in regular communication with civilisation, and is, at the same time, situated in a high latitude—76° 15'. This primary station would be manned by a force of fifteen men always provisioned for two years. Here

Arctic recruits would be trained, and from it a fan of secondary stations would be pushed into the unknown area. At first the intervals between the stations will be 100 miles; with growing experience, the distance will be increased to 200 miles, and then each station will have a territory of about 40,000 square miles to furnish its supplies of Arctic game. At these secondary stations the garrison will not exceed five men. Dr. Stein's plan for next year is to establish the primary station, explore the west coast of Ellesmereland for eighty days, and perhaps plant two secondary stations at Hayes Sound and the west end of Jones Sound. As soon as the Cape-Tennyson line is in good working-order, it may be supplemented by way of Franz-Josef Land, and by a third line from Point Barrow. Dr. Stein will be satisfied if a knowledge of the whole unknown area round the Pole is gained within twenty years. The plan is similar to one proposed by Captain Howgate in 1877. Nothing is stated as to the provision of the necessary funds for so comprehensive a scheme of exploration.

An American Antarctic Expedition.—Dr. Frederick A. Cook, who was with Peary in his first expedition, submitted a proposal for Antarctic exploration to the American Geographical Society on December 1st. He proposes to buy a steam-whaler of about 300 tons, provision her for three years, and to take with him a life-boat large enough to cross the sea between the South Shetland Islands and South America. He would leave New York about September 1st, fill up with coal and provisions at the Falkland Islands, and then steam direct for Louis Philippe Land. Thence he would enter the first practicable opening in the pack and proceed south. If he can reach land he will winter there, and attempt to explore with dog-sledges. If his ship is lost, he thinks he can retreat to the Falkland Islands in his life-boat. His party is to consist of twelve or fourteen men including the crew. He calculates the cost of his expedition at £10,000. The Norwegian companion of Peary, Eivind Astrup, is to accompany Dr. Cook.

The Missing Björling Expedition.—In June 1892 two young Swedish naturalists named Björling and Kalstennius sailed from St. Johns, Newfoundland, in a small schooner the *Ripple*, manned by a crew of three men, and started for an expedition along the west coast of Greenland. After leaving the Danish settlements bound northward no news had been received, and serious fears were entertained for the safety of the party. Captain Mackay of the Dundee whaler, *Aurora*, who has returned after an exceptionally successful voyage, reports that he found the wreck of the *Ripple* on Carey Islands, at the entrance of Smith's Sound on June 17th, 1893, and on the land found the dead body of one of the Newfoundland sailors, and a number of papers written by Björling. The first paper mentions the wreck of the *Ripple* on August 17th, after having taken in provisions from the depot established on Carey Islands by Sir George Nares, the food being estimated to last the party until June, 1893. A later note dated October 12th, recounts an unsuccessful attempt to reach the Eskimo settlement at Foulke Fjord, and the resolve to leave Carey Islands for a fresh attempt to meet the Eskimo at Clarence Head or Cape Faraday in Ellesmereland. The provisions were then estimated only to hold out until January 1st, 1893, unless other supplies were found. If he could reach and winter with the Eskimo, Björling hoped to return to Carey Islands by July 1st, and he asked any whaler visiting the islands after that date to proceed to Clarence Head, on the most easterly point of which further news would be deposited in a cairn. Captain Mackay at once turned towards Ellesmereland, but was stopped by thick ice, into which he did not think it prudent to venture, and so failed to get any further information. It seems improbable that the Swedish party, of whose equipment for ice-travel nothing is known, could have made the difficult

journey to Ellesmereland, especially as one of the men was reported by Björling to be dying. It is, however, just possible that some escaped, stayed with the Eskimo for the winter, and have now found their way to the Danish settlements, although too late to communicate with this country until next summer. The hope is, however, very slight, and the sad fate of the explorers is a warning against hasty attempts of inexperienced and ill-equipped men to venture far into the Arctic regions.

Exploration around Novaya Zemlya.—Nansen's expedition has given a new interest to the exploration of the Arctic Sea. The cruiser *Nayezdnik* was despatched in 1893 to make magnetic, zoological, and hydrographic observations on the shores of Novaya Zemlya and the Arctic Sea. The Yugorski Shar has been carefully mapped and its depth measured, while the zoologist of the expedition, Mr. Knipovich, has explored the fauna of the ocean. It appeared to be very rich at depths below 195 fathoms. The fauna of Lake Kildin is still more interesting, its water being fresh at the surface and salt at a depth of a few fathoms. The deeper layers contain many relics of a marine fauna, while the layers at the bottom contain so much sulphuretted hydrogen that no organic life whatever is possible at that depth, the conditions being similar to those in the Black Sea.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Admiral Makaroff's Work on the Pacific Ocean.—The St. Petersburg Academy of Sciences has awarded the Archimandrite Makarius Prize to Rear-Admiral Makaroff for his MS. work, 'The *Vityaz* and the Pacific Ocean,' which embodies all the scientific researches made on board the *Vityaz* in 1886–89. Admiral Makaroff has utilised not only those facts which were collected under his supervision, but also all data available from other sources, and his isothermal maps of the Northern Pacific, as well as maps showing lines of equal specific gravity of water both on the surface and at a depth of 220 fathoms, have great scientific value.

GENERAL.

Festival in honour of Dr. F. Simony.—Dr. Karl Peucker writes from Vienna:—"The 31st November having been the eightieth birthday of this well-known geographer, deputations from various universities and scientific institutions of Germany and Austria waited on him to present their congratulations, while a festival was held at the rooms of the Geographical Institute of the University, in which many distinguished men and old pupils of Dr. Simony took part, though he, himself, unfortunately, was prevented by indisposition from attending. An address setting forth the latter's services to geography was delivered by Prof. Pröll. His work, as an original investigator, consists in his exploration of the glaciers and lakes of the Austrian Alps, and his researches into the forms of surface, climate, and conditions of vegetation of the upper region. His labours as a teacher lasted from 1851 to 1885, during which time he was never tired of insisting on the importance of views of scenery to supplement description on the one hand, and map-drawing on the other. The collections of the Vienna University are enriched with a vast number of pictures and drawings from his hand. A list of his larger and smaller works reaches a total of 170. His monumental work on the 'Dachstein,' in course of publication, is a fitting crown to a well-directed life's work, and shows the freshness of his enthusiasm even at his present advanced age. The celebration was concluded by an evening conversazione, at which complimentary reference was made to Simony's high personal qualities, as well as to his services to the cause of science."

OBITUARY.

Dr. Hendrik Rink.

By DR. ROBERT BROWN.

IN Dr. Rink, who died at Christiania on December 15th, the Royal Geographical Society has lost one of its most distinguished corresponding members, and science its final court of appeal on all questions touching Greenland. For more than forty years no name has been more familiar in connection with that huge trapezium of ice and snow and barren lands, and to the generation who have grown into Arctic explorers since *Grönland geographisk og statistisk beskrevet* appeared (1852–1857) no personal authority on its “inlands iis,” glaciers, geology, Eskimo, and economics was so undisputed. “*Hvumia locuta est, causa finis est*” was the rule with most of us. Yet no man was ever slower in arriving at an opinion. He had indeed a constitutional antipathy to pronouncing any moot point settled. Like Pliny he held firmly to the belief that on earth there is nothing certain except that nothing is certain, and though many sweeping theories have been formulated from his facts, he missed, as his friends often thought, the merit of linking his name with notable geographical inferences simply because the extreme impartiality of the theoretical discoverer made him undecided whether the other side had not the best of the argument. However, as the first accurate describer of the inland ice of Greenland, of the broad facts concerning its geology, and a student of Eskimo ethnography and folk-lore, so exhaustive that he has synthetically constructed the history of that race, Rink will always hold a high place in the roll of geographers. “All that has been written before these books,” a famous traveller wrote, when Rink’s works appeared in English, “is little better than waste paper. Dr. Rink is like the Greek philosopher of old—he appears on the scene of the inquiry, compared with all before him, as a sober man among drunkards.” Tall, spare—almost emaciated—with the rounded shoulders and feeble health of the scholar, fond of discussing philological abstrusities by the hour, but always in his characteristically slow tentative way, and with no adventure tales to tell, he looked more like the traditional professor than the man who had the almost unique distinction of having passed sixteen winters and twenty-two summers in the Arctic regions, of having formed part of a scientific expedition round the world until the deadly climate of the Nicobars drove him home to seek health among the Greenland snows, and of having for the greater part of his life been engaged in the direction of an extremely practical department of the Danish Government,

Born on August 26th, 1819, at Copenhagen, the son of a Kiel merchant, Hendrik Johannes Rink was educated in Sorø School in Sjælland, and in the Universities of Kiel and Copenhagen. In 1843 he won the gold medal in the former for his prize essay on a chemical question; in the latter he graduated as Doctor of Philosophy. The despatch of the Danish corvette *Galathea*, under Captain Steen-Bille, on a voyage of circumnavigation, enabled Rink, who accompanied it as naturalist, to complete a survey of the Nicobars, which in 1845 the Danes made a final but fatal attempt to colonise. Worn out with continued fever he returned in 1846 to publish his ‘Die nikobarischen Inseln’ (1847), and ‘Erindringer fra mit andet Ophold paa de nikobarske Oer’ (Schouw’s *Dansk Tidsskrift*, 1847). In 1848 he left on an expedition to Greenland which, with short intermission, lasted till 1855. During these seven years the entire outer coast and almost every fjord from the Duck Islands to Cape Farewell was examined in “umiaks,” his only com-

panions Eskimo, of whose language and legends he gradually made himself master. The first results, in addition to a number of minor papers, was "De danske Handel districter in Nordgrönland," published by the Academy of Sciences. The memoir led to his appointment as Royal Inspector (Governor) of South Greenland, a position which he held from 1855 to 1868, greatly to the benefit of the natives, among whom he introduced a mild form of home rule and various educational agencies. In 1871 the death of Herr Olrik, well known to all Arctic navigators as Inspector of North Greenland, gave the Ministry an opportunity of offering Dr. Rink the post of Director or President of the Royal Greenland Board of Trade (Kongelige Grönlandske Handel), the State Department which controls the commercial monopoly and government of the Arctic colonies. This office—which involves residence in Copenhagen—he filled for the next ten years, his pleasant house in the Platanvei being, during this period, the centre of all interested in the Far North. His library was an almost exhaustive collection of its literature, his rooms of its rude art, and his table, when the ships arrived from the north, of its simple luxuries—"kalleralik," "mattak" and ptarmigan—while his garden contained a large collection of the Arctic flora.

By 1881, however, the strain of office proved too much for Rink's health. He had married Fröken Signe Müller, a Danish lady, also a well-known writer on the lighter topics of Arctic life, whose father had been "Colonibestyrrer" of Godthaab, and their only daughter was married in Christiania. To the city he accordingly removed and lived for the rest of his life, his home in the Keysergade being, so far as the renaissance of Arctic exploration in Norway was concerned, what Baron Nordenskjöld's in Stockholm is for Sweden. Never idle, Dr. Rink's literary output, notwithstanding the slowness of his composition, was large. In addition to the works already noticed and many papers in the Proceedings of the Danish Academies and the Geographical Society which he helped to found, he published in 1866 'Eskimoiske Eventyr og Sagn,' with a supplement in 1871. A new edition of this appeared in English in 1875 under the title of 'Tales and Traditions of the Eskimo,' in recognition of the value of which the International Geographical Congress at Paris presented the author with a medal. After this date, his most important writings were in English. Among these may be enumerated 'Danish Greenland' (1877), not a translation of his 'Grönland,' but an entirely new work, illustrated by the Eskimo, and the curious 'Memoirs of Hans Hendrik,' Kane's, Hayes', Hall's, and Nares, dog-driver, written by himself in Eskimo and translated by Rink. When the Danish Commission for making geological and geographical explorations in Greenland was appointed, Rink naturally occupied a leading position among those directing its work. To several of the "Meddelelser" he contributed important treatises. Two of these, viz.:—'The Eskimo Tribes' (vol. xi. with supplement) were in English, and contained his now well-known views of the origin and migration of the Arctic peoples. He also, with the collaboration of Professor Johnstrup, edited Giesecke's MS. German Journal of his mineralogical researches in Greenland during 1806-1813, though latterly he devoted himself almost entirely to Eskimo philology and ethnography. He also published in coadjutorship with Dr. Boas some papers in the *Journal of American Folk-lore*, and perhaps the last contributions from his pen were the articles 'Greenland' and 'Eskimo' in the new edition of 'Chambers' Encyclopædia.'

Dr. Rink, it may be added, was a Knight of the Orders of Dannebrog, St. Olaf, and the Polar Star, a Justitsraad or "Councillor of Justice," of Denmark, and an honorary member of many learned societies in England and other countries, to all of which he sent communications at intervals. A list of his writings, tolerably complete up to 1880, may be found in Lauridsen's 'Bibliographia Groenlandica'

(1890), which forms the thirteenth volume of the 'Meddelelser om Grönland.' His papers in our *Journal* (Vol. XXIII. p. 145), and *Proceedings* (Vol. XXVIII. p. 272), gave the first exact account in English of the Greenland ice-cap.

Alexander Low Bruce.—We have to record with regret the death of Mr. Alexander Low Bruce, which took place at his residence in Edinburgh on November 27th last from the after-effects of influenza. He was born in 1839, and at an early age entered the business of Messrs. Younger and Co., brewers, of which firm he ultimately became a partner. For fifteen years he lived in London, but latterly in Edinburgh, where he was widely popular as a philanthropist of a very practical kind. His interest in geography was always keen, and by his marriage with the daughter of Dr. Livingstone his attention was concentrated in a special sense on Africa. Thus he interested himself particularly in the expeditions of Mr. Stanley and others, aiding them not only by generous assistance in money, but also by shrewd practical advice. The Emin Pasha Relief Expedition was indebted to him much more largely than was known at the time, and in conjunction with Sir William Mackinnon he had a large share in the formation of the Imperial British East Africa Company, of which he was a director.

Besides innumerable services in helping the progress of civilisation and the promotion of British interests in Africa, Mr. Bruce conferred a greater benefit on general geography, in being the first to act upon the idea suggested by Mr. J. G. Bartholomew of establishing the Royal Scottish Geographical Society in 1885. He warmly supported that Society and its branches in Scotland, acting as its honorary treasurer to the end. He was a Fellow of the Royal Geographical Society since 1889, and frequently visited the rooms and took part in the public meetings. Mr. Bruce was a sincere and faithful friend to many travellers and a wise adviser at all times. His strong common sense and the generous disinterestedness of his character have made a deep mark on the men who are at work opening up Africa and administering its affairs.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1893-94.

Second Ordinary Meeting, November 27th, 1893.—CLEMENTS R. MARKHAM,
C.B., F.R.S., President, in the Chair.

ELECTIONS.—*Harold J. Baker; Hon. Bennington R. Bedle; Lord Charles Beresford; Hiram Horsburg Bice; R. G. Bolton; Herbert William Bond; Lieut. Browne, R.A.; Capt. St. George Richard Burton; Dr. Duncan James Caddy; David Caudwell; Charles Clay; Henry J. B. Clements; Horace A. Cockerell, C.S.I.; Evan Henry Davies; Theo. H. Davies; David Ross Dean; Frederick de Buriatte; Alfred Warner Dennis; Prof. Sidney Dickinson; Lieut.-Col. Algernon Durand; C. H. Dolby-Tyler; Lord Percy Douglas; Captain H. W. Dowding, R.N.; Rev. James Duff; Edwin Egerton, C.B., &c.; F. M. Fisk; Captain Edward Thomas Foakes; Thomas Walker Fowler; Gordon Frazer; Rev. Henry de Beltgens Gibbins; Hugh Mackay Gordon; Dr. J. W. Gregory; Wm. Howard Murphy Grimshaw; Samuel Hardman; Capt. R. H. G. Heygate; Gray Hill; Edmund H. Hodgkinson, M.A.; Capt. Marmaduke Langdale Kelham, R.N.; Charles Thomas Kettlewell; Jno. Watson Knight; Jean Louis Paul Lebeque; James E. Liddiard; Joseph Lowrey; M. A. M. Miggi; John Smedley Norton; Jonathan C. Olubi; Edward James Pape;*

Arthur John Price; E. de Quincey Quincey; Boverton Redwood; Joseph Rindermann; Lieut. G. O. Roos-Keppel; Ernest A. Russell; Henry Charles Schunke; Major James A. Sewell; Oscar Skey; Charles Spedding; Bertrand Stewart; Robert Burdon Stoker; F. Victor P. Streich; Maximilian Strong; Edward P. Tennant; Edward A. Verschoyle; James Wales; Edward Walker; Frederick Arthur Walters; George Prangley Wilson; Herbert Werthington; Percy Wright-Anderson; Michele Angelo Zoccola.

The Paper read was:—

“Antarctic Exploration.” By Dr. John Murray.

There was an exhibition of maps, pictorial diagrams, &c., in the tea-room.

Third Ordinary Meeting, December 11th, 1893, CLEMENTS R. MARKHAM, C.B., F.R.S., President, in the Chair.

ELECTIONS.—*Thomas Pelham Bullivant; F. Bateson; F. A. Doria; Rev. Thomas Eland; John Samuel Murray Fisher; J. G. Forrester; H. Geodecker; Robert Francis Harper; T. Helme; Harry Lake; Henry Norman; Captain G. W. J. Prowse (Cornwall Light Infantry); Alfred Radford; Jacques W. Redway; Benjamin Smith.*

The Paper read was:—

“The Evolution of the Geography of India.” By R. D. Oldham.

There was an exhibition of photographs in the tea-room.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

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

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

A. = Academy, Academie, Akademie.	Mag. = Magazine.
Ann. = Annals, Annales, Annalen.	P. = Proceedings.
B. = Bulletin, Bollettino, Boletim.	R. = Royal.
Com. = Commerce, Commercial.	Rev. = Review, Revue, Revista.
C. R. = Comptes Rendus.	S. = Society, Societé, Selskab.
Erdk. = Erdkunde.	Sitzb. = Sitzungsbericht.
G. = Geography, Geographie, Geografia.	T. = Transactions.
Gea. = Gesellschaft.	V. = Verein.
I. = Institute, Institution.	Verh. = Verhandlungen.
J. = Journal.	W. = Wissenschaft, and compounds.
M. = Mitteilungen.	Z. = Zeitschrift.

On account of the ambiguity of the words *octavo, quarto, &c.*, 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.

EUROPE.

Alps.

Scrambles amongst the Alps in the Years 1860–69. By Edward Whymper. Fourth edition. London, John Murray, 1893: size 9 × 7, pp. xviii. and 468. *Maps and illustrations.* Price £2 12s. 6d. *Presented by the Author.*

This volume is a reprint, with corrections, additions, and several new illustrations

Whymper.

of the work originally published under the same title in 1871, which has long been out of print. Among additions it contains a list of the climbers of the Matterhorn, and of the fatal accidents that have occurred on the mountain, a key to the portraits in the "Club-room of Zermatt," now of historical interest, with several other new portraits, and a description of the Zermatt railway, which has so greatly altered the character of the valley and its visitors. The new maps are carefully engraved from recent authorities. In the production of the whole work—down to the snow crystals on the cover—the excellence and finish characteristic of all the author's artistic productions are everywhere conspicuous.

Alps—Mont Iseran.**Ferrand.**

Henri Ferrand. Histoire de Mont Iseran. (Extrait du Bulletin de la Société de Statistique des Sciences Naturelles et des Arts Industriels de l'Isère). Grenoble, 1893: size 10 × 7, pp. 24.

Etna.**Chaix.**

L'Éruption de l'Etna en 1892. Par Émile Chaix. Genève, R. Burkhhardt, 1893: size 9½ × 6½, pp. 28. *Plates. Presented by the Author.*

France—Perigueux.**Espérandieu.**

Musée de Perigueux. Inscriptions Antiques. Par le Capitaine Emile Espérandieu. (Publications de la Société Historique et Archéologique du Périgord). Paris, Thorin et fils, 1893: size 10 × 7, pp. 124. *Plates xi. Presented by the Author.*

The inscriptions described and figured in this book date from the Roman occupation of Gaul.

Hungary.**Havass.**

Bibliotheca Geographica Hungarica. Bibliographia librorum de regno Hungariæ, quovis sermone compositorum: itemque eorum librorum, quos scriptores Hungarici quavis lingua conscriptos et in quocunque Geographiæ argumento versantes ediderunt: cum præfatione historiam litterarum huc spectantium illustrante. Script et in Acroasi, quam Academia Litterarum Hungarica die VII. mensis Maii a MDCCCLXXXVIII. Fecerat, exposuit Rudolphus Havass, Phil. Dr., Professor. Budapest, P. Franke, 1893: size 10 × 6½, pp. xxvii. and 532.

Part I. of this bibliography, which, except for its Latin title-page and table of contents, is written in Hungarian, catalogues chronologically all known works on Hungary, and the other trans-Leithan lands. Part II. records books dealing partially with Hungary, and Part III. treats of Hungarian works on other parts of the world.

London.**Baedeker.**

London and its Environs. Handbook for Travellers. By K. Baedeker Eighth Edition. Leipzig, Karl Baedeker; London, Dulau & Co., 1892: size 6½ × 4½, pp. viii., 368, and 45. *With three maps and fifteen plans. Price 6s. Presented by Messrs. Dulau & Co.*

Mediterranean—Tides.**Grablovitz.**

Sulle osservazioni mareografiche in Italia e specialmente su quelle fatti ad Ischia. Memoria di Giulio Grablovitz (con tre tavoli). Genoa, 1893: size 10½ × 7, pp. 32.

A paper read at the Genoa Geographical Congress, giving an account of tide measurements round the coast of Italy.

Russia, etc.**Murray.**

Handbook for Travellers in Russia, Poland, and Finland; including the Crimea, Caucasus, Siberia, and Central Asia. Fifth Edition. London, John Murray, 1893: size 7 × 5, pp. x., 84, and 500. *Maps and plans. Price 18s. Presented by Mr. Murray.*

Several new railway routes have been added to the present edition of the 'Handbook for Russia,' and the information generally has been brought up to date. The new form of "Index and Directory" adopted in the modern series of Murray's Guides is a useful feature of this edition.

Surveys.

Association Geodesique Internationale. Rapports sur les Triangulations presenté à la dixième Conférence générale à Bruxelles en 1892. Par le General A. Ferrero. Size $11\frac{1}{2} \times 9$. Paged separately.

Ferrero.

This is an appendix to the Report of the Brussels Conference, and deals mainly with the errors in closing triangles. A map of Europe is added which shows in an impressive way the extent to which the network of triangulated surveys has spread over the continent.

ASIA.**Central Asia—Chinese.**

Chinese Central Asia; a Ride to Little Tibet. By Henry Lansdell, D.D. 2 vols. London, Sampson Low & Co., 1893: size 9×6 , pp. (vol. i.) xl. and 456; (vol. ii.) xiii. and 512. *Maps and illustrations.* Price 36s. *Presented by the Publishers.*

Lansdell.**Central Asia—Pamirs.**

The Pamirs; being a Narrative of a Year's Expedition on Horseback and on Foot through Kashmir, Western Tibet, Chinese Tartary, and Russian Central Asia. By the Earl of Dunmore, F.R.G.S. 2 vols. London, John Murray, 1893: size $8\frac{1}{2} \times 5\frac{1}{2}$, pp. (vol. i.) xx. and 360; (vol. ii.) x. and 340. *Maps and illustrations.* Price 24s. *Presented by the Publisher.*

Dunmore.

These works will be noticed elsewhere in the *Journal*.

Chinese Geography.

Problèmes Géographiques. Les Peuples étrangers chez les Historiens Chinois. IX. Ts'ing-K'ieou Kouo, Les Pays des Collines vertes. X. Heh-Tohi-Kouo, Le Pays aux Dents Noires. XI. Hienou-Kou Kouo, Le pays des Cuissées noires. XII. Lo-min Kouo ou Kiao-min Kouo, Le pays du peuple I-o, ou du peuple Kiao. Par Gustave Schlegel. Leyden, E. J. Brill, 1893: size $10\frac{1}{2} \times 7$, pp. 16. *Presented by the Author.*

Schlegel.**India.**

The Conversion of India, from Pansenus to the Present Time, A.D. 193-1893. By George Smith, C.I.E., LL.D. London, John Murray, 1893: size $8\frac{1}{2} \times 5\frac{1}{2}$, pp. xx. and 258. *With illustrations.* Price 9s. *Presented by the Publisher.*

Smith.

This work contains an expansion of six lectures delivered by Dr. George Smith in connection with the Graves Lectureship on Missions in New Jersey. After an introductory chapter, he deals with the Greek Attempt, including Nestorian Missions, the Roman Attempt, Xavier and his successors, and the Dutch Attempt, the East India Company's work of Preparation, Great Britain's Attempt, the United States of America's co-operation, the methods of the Evangelical Mission to India, the results of Christian Missions to India, and the prospects of the conversion of India. It should prove useful as a work of reference.

India.

Scottish G. Mag. 9 (1893): 617-632.

Roberts.

India, Past and Present. By General Lord Roberts. *With Maps.*

A comparison of India as it was in 1852 with India at the present day.

India—Burma.

Notes on an Archaeological Tour through Ramannadesa (the Talaing country of Burma). By Tau Sein-ko. *Reprinted from the 'Indian Antiquary.'* Bombay, 1893: size $11\frac{1}{2} \times 9$, pp. 10. *Plate.*

Sein-ko.**Palestine and Syria.**

Palestine and Syria. Handbook for Travellers. Edited by K. Baedeker. Second edition. Leipsic, Karl Baedeker, 1894 [1893]: size $6\frac{1}{2} \times 4\frac{1}{2}$, pp. cxx. and 444. *With seventeen maps, forty-four plans, and a panorama of Jerusalem.* Price 12s. *Presented by the Editor.*

Baedeker.

The present edition of the 'Handbook for Palestine' has been prepared, with the aid of Dr. Albert Socin, the original writer of the 'Handbook,' by Dr. Immanuel Benzinger, of Tübingen, who has recently explored the greater part of the country described. The maps and plans are fully up to the standard of this series of guides.

Yezo.**Landor.**

Alone with the Hairy Ainu; or 3800 Miles on a Pack-saddle in Yezo, and a Cruise to the Kurile Islands. By A. H. Savage Landor. London, John Murray, 1893; size 9½ × 6½, pp. xvi. and 326. Price 18s. *With Maps and Illustrations by the Author. Presented by the Publisher.*

Mr. Landor is gifted with exceptional ability as an artist, and in his adventurous journey through Yezo, already familiar to the Fellows of this Society, he took full advantage of his opportunities, many specimens of his work being reproduced in the work before us. The narrative is fresh and interesting on account of the comparatively untrodden character of the country traversed, and the curious ways of the primitive Ainu, who have never been studied more faithfully nor by a more sympathetic explorer. The book is of considerable geographical value, and of unusual general interest. Mr. Landor tells what he saw without exaggeration, and rarely allows himself to criticise or moralise. He is able from the way in which he travelled and the friendships he formed with many of the natives to correct prevailing misconceptions as to the physical and mental characteristics of a rapidly-diminishing race. Some careful anthropometrical observations are given in an appendix.

Yezo.*R.G.S. Supplementary Papers 3 (1893): 519-540.***Landor**

A Journey round Yezo, and up its largest Rivers. By A. Henry Savage Landor. *With map.*

This paper was read at an evening meeting of the Society last session.

Yezo.*R.G.S. Supplementary Papers 3 (1893): 479-515.***Milne.**

Notes on a Journey in North-east Yezo and across the island. By John Milne, F.R.S. *With maps.*

This paper was read at an evening meeting of the Society last session.

AFRICA.**Abyssinia.****Bent.**

The Sacred City of the Ethiopians; being a Record of Travel and Research in Abyssinia in 1893. By J. Theodore Bent. With a chapter by Professor H. D. Müller on the Inscriptions from Yeha and Aksum; and an appendix on the Morphological Character of the Abyssinians, by J. G. Garson, M.D. London, Longmans, Green & Co., 1893; size 9 × 6, pp. xvi. and 310. Price 18s. *Presented by the Publishers.*

This substantial contribution to archæology and geography is the outcome of four months spent by Mr. and Mrs. Bent in travelling through Ethiopia and studying its ancient monuments. A good map of the route is given, and there are numerous illustrations from photographs and sketches. The special contributions by Professor Müller and Dr. Garson are of great value. The book will be referred to in a special article.

Abyssinian Languages.**Schweinfurth.**

Abyssinische Pflanzennamen. Eine alphabetische Aufzählung von Namen einheimischer Gewächse in Tigrinja, sowie in anderen semitischen und hamitischen Sprachen von Abyssinien unter Beifügung der botanischen Artbezeichnung. Von Professor Dr. G. Schweinfurth. Berlin, Georg Reimer, 1893; size 11 × 9, pp. 84. [*Reprinted from the 'Abhandlungen' of the Prussian Academy.*] *Presented by the Author.*

Algiers.**Harris.**

"The" Practical Guide to Algiers. By George W. Harris. Fourth Edition. London, G. Philip & Son, 1894 [1893]; size 6½ × 4½, p. xvii. and 176. *Maps Plan and Plates, Price 3s. 6d. Presented by the Publishers.*

East African Empire.**Lugard.**

The Rise of our East African Empire. Early Efforts in Nyasaland and Uganda. By Capt. F. D. Lugard, D.S.O. 2 vols. Edinburgh and London, W. Blackwood & Sons, 1893; size, 9½ × 6½, pp. (Vol. I.) xix. and 563; (Vol. II.) ix. and 682. *Maps, Portraits, and Illustrations. Price 42s. Presented by the Author. Another copy, presented by the Publishers.*

This work will be noticed elsewhere in the *Journal*.

Egypt—Irrigation.**Chaix.**

L'Irrigation de l'Égypte. Par Émile Chaix; size, 9½ × 6, pp. 7.

Equatoria.**Hassan and Baruck.**

Die Wahrheit über Emin Pascha, die ägyptische Aequatorialprovinz und den Soudan, von Vita Hassan ehemaligem Arzt und Apotheker der Aequatorialprovinz, unter der Mitarbeit von Elie M. Baruck. Aus dem französischen Original übersetzt und mit Anmerkungen versehen von Dr. B. Moritz. II Teil. Emin in Kämpfe mit dem Mahdismus und seine Rückkehr mit Stanleys Expedition. Berlin, Dietrich Reimer, 1893: size 9½ × 6½, pp. viii., 246, and xviii. Price 3·50 marks. Presented by the Publisher.

This book will be referred to in a special article.

Gold Coast.**Ellis.**

A History of the Gold Coast of West Africa. By A. B. Ellis, Lieut.-Colonel 1st Battalion West India Regiment. London, Chapman and Hall, 1893: size 9 × 6, pp. xii. and 400. Price 10s. 6d. Presented by the Publishers.

A thoroughgoing history of the Gold Coast from the earliest times to 1888. The first 100 pages suffices to bring down the record of discovery and early trade to the beginning of the present century. The relations of the British colony with Ashanti are very fully treated, and a detailed account given of the war of 1873-74.

Mashonaland.**Blennerhassett.**

Adventures in Mashonaland. By Two Hospital Nurses, Rose Blennerhassett and Lucy Sleeman. London, Macmillan & Co., 1893; size 8½ × 5½, pp. xii. and 340. Price 8s. 6d. Presented by the Publishers.

No more realistic picture of life in Mashonaland than this outspoken narrative of Miss Blennerhassett's has ever appeared. The geographical value of the book will be referred to in another article

Matabili-land.**Holub.**

Die Ma-Atabele. Von Dr. Emil Holub in Wien. Abstract from 'Zeitschrift für Ethnologie,' 1893, pp. 177-206. Presented by the Author.

An ethnological study of the Matabili people.

Mauritius.**Decotter.**

Geography of Mauritius and its Dependencies. By M. Decotter. Mauritius, Engelbrecht & Cie., 1892; size 8 × 5½, pp. 78. Presented by the Author.

The French edition of this little work was published in 1891, and was noticed in the *Proceedings* for 1892, at page 132.

South Africa.**Reunert.**

Diamonds and Gold in South Africa. By Theodore Reunert. London, Edward Stanford, 1893: size 9 × 5½, pp. xvi. and 242. With maps and illustrations. Presented by the Publisher.

Gives a clear account of the distribution of gold and diamonds in Cape Colony and the Transvaal, and details of mining processes.

South Africa—Kafirs.**Muller.**

Industrie des Cafres du sud-est de l'Afrique. Collection recueillie sur les lieux, et notice ethnographique. Par Hendrik P. N. Muller. Description des objets représentés par Joh. F. Snelleman. Leyden, E. J. Brill. Not dated [1893?]; size, 14 × 11; pp. 50 of text, 6 of music, and 27 plates each with one folio sheet of description Price 30s.

The sheets of this work are sent out in a very awkward form, unbound in a portfolio. The plates, many of which are in colours, reproduce the weapons, domestic utensils, ornaments and manufactures of the Kafirs, and also contain a few portraits of types of the race. Further notice will be taken of the book in a special article on recent books on Africa.

Somaliland—Nogal. R.G.S. Supplementary Papers 3 (1893): 543-559.**Swayne.**

Expedition to the Nogal Valley. By Lieutenant E. J. E. Swayne. With map.

NORTH AMERICA.

America—Population.

Caracciolo.

How was America Peopled? An essay on the origin of the Natives of America, found by Columbus. By Henry Caracciolo. Read at the Victoria Institute, before the Literary Association, on Thursday, March 2nd, 1893: size $7\frac{1}{2} \times 5$, pp. 14.

Canada—Catalogue of Rocks.

Ferrier.

Geological Survey of Canada. Catalogue of a Stratigraphical Collection of Canadian Rocks, prepared for the World's Columbian Exposition, Chicago, 1893. By Walter F. Ferrier. Ottawa, Government Printing Bureau, 1893: size $10 \times 6\frac{1}{2}$, pp. xix. and 128.

Canada—Hudson's Bay and Pacific Railway.

Nelson.

Direct Route through the North-west Territories of Canada to the Pacific Ocean. Proposed Hudson's Bay and Pacific Railway, and New Steamship Route. By Joseph Nelson. London, The Economic Printing and Publishing Co., 1893: size $9\frac{1}{2} \times 6$, pp. 84. *With a map. Presented by Colonel J. Harris.*

Mexico.

Brinton.

The Native Calendar of Central America and Mexico; A Study in Linguistics and Symbolism. By Daniel G. Brinton, M.D. Philadelphia, MacCalla & Co., 1893: size 9×6 , pp. 60. *Presented by the Author.*

United States.

Hyde.

Geographical Concentration: an Historic Feature of American Agriculture. By John Hyde. An Address delivered before the International Statistical Institute, September 14th, 1893. Washington, D.C., Kensington Publishing Co., size 9×6 , pp. 19. *Presented by the Author.*

United States—Arizona and New Mexico.

Mindeleff.

A Study of Pueblo Architecture, Tusayan and Cibola. By Victor Mindeleff. *Plates*, pp. 12-234.

United States—Chinook Languages.

Pilling.

Smithsonian Institution. Bureau of Ethnology: J. W. Powell, Director. Bibliography of the Chinookan Languages (including the Chinook Jargon). By James Constantine Pilling. Washington, Government Printing Office, 1893: size $9\frac{1}{2} \times 6\frac{1}{2}$, pp. viii. and 81.

This bibliography embraces two hundred and seventy titular entries, of which two hundred and twenty-nine relate to printed books and articles, and forty-one to manuscripts.

United States—Colorado—Mesa Verde.

Nordenskiöld.

The Cliff Dwellers of the Mesa Verde, south-western Colorado; their Pottery and Implements. By G. Nordenskiöld. Translated by D. Lloyd Morgan. Stockholm and Chicago, P. A. Norstedt & Sons, 1893: size 15×12 , pp. 174, iv. and xi. *Plans, plates, &c. Presented by the Author.*

This important work is specially noticed on p. 46.

United States—Dakota.

Finley.

Certain Climatic Features of the two Dakotas. Illustrated with one hundred and sixty-three Tables, Charts, and Diagrams. By John P. Finley. Washington, 1893; size, $11\frac{1}{2} \times 9$, pp. 204. *Plates. Presented by the U.S. Weather Bureau.*

United States—Indians.

Stevenson.

Ceremonial of Hasjelti Dailjis and Mythical Sand-painting of the Navajo Indians. By James Stevenson. *Plates*, pp. 224-285.

These two important papers make up the bulk of the Eighth Annual Report of the Bureau of Ethnology to the Secretary of the Smithsonian Institution by Major J. W. Powell for the years 1886-87, published in 1891, but only recently received. The illustrations in colour of Indian designs, and the plans of early stone dwellings are of great value to the anthropologist.

CENTRAL AND SOUTH AMERICA.

- Argentine.** *Petermanns M.* 39 (1893): 231-237, 259-264. **Bodenbender.**
Die Pampa-Ebene im Osten der Sierra von Cordoba in Argentinien.
Ein Beitrag zur Entwicklungsgeschichte der Pampa. Von Prof. Dr.
W. Bodenbender, Cordoba.
A valuable study of the geographical conditions of the Pampas.
- Brazil—Discovery.** *Rev. S. G. Rio de Janeiro* 9 (1893): 56-69. **Carvalho.**
Descobrimento do Brasil. Conferencia pelo socio Sr. Augusto de
Carvalho.
An essay on the discovery of Brazil.
- Brazil—Tocantins.** *Rev. S. G. Rio de Janeiro* 9 (1893): 3-31. **Leal.**
As regiões de terra e agoa. Conferencia em 21 de Outubro de 1892.
Pelo Dr. Oscar Leal.
Account of a journey in the upper valley of the Tocantins in the year 1886.
- British Guiana—Cuyuni.** *Timehri* 7 (1893): 75-88. **Perkins.**
Notes on a Journey to a portion of the Cuyuni Gold Mining District. By
Henry J. Perkins.
- Bolivia.** *B.S.G. Lima* 3 (1893): 61-81. **De la Combe.**
Conferencia dada en la Sociedad Geografica de Lima, por el Coronel D.
Ernesto de La Combe, sobre un nueva itinerario de Ayacucho a Pelehuco
(Bolivia).
- Lake Titicaca.** *B.S.G. Lima* 3 (1893): 37-51. **Basadre.**
Los Lagos del Titicaca, por Modesto Basadre.
- Santo Domingo.** *R.G.S. Supplementary Papers* 3 (1893): 589-604. **Wells.**
A Survey Journey in Santo Domingo, West Indies. By James W. Wells.
With map.

AUSTRALASIA AND PACIFIC ISLANDS.

- Australasia.** **Wallace.**
Stanford's Compendium of Geography and Travel. (New issue.) Austra-
lasia. Vol. I. Australia and New Zealand. By Alfred R. Wallace, LL.D.,
etc. London, Edward Stanford, 1893: size 8 x 5½, pp. xvi. and 506.
Maps and Illustrations. Price 15s. Presented by the Publisher.
So largely has this volume been modified and augmented, that it may be looked upon
as a new work. Nearly twice the space is bestowed on the Australian colonies than in
the former edition, and numerous characteristic illustrations are introduced with happy
effect. Four chapters are given to a survey of the historical, physical, biological, and
geological geography of the Australian Continent, one to the aborigines, two to the
origin and progress of British colonisation in Australasia, and a chapter is set apart for
a careful account of each colony, which is evidently prepared from, and revised by, the
official publications of the different governments.
- Australia.** **Calvert.**
Recent Explorations in Australia (1891 Expedition). By Albert F.
Calvert. Taunton, E. Goodman & Son, 1893: size 9½ x 6, pp. 23. *Map,
plan, and illustrations. Presented by the Author.*
- Hawaiian Islands—Catalogue of Shells.** **Baldwin.**
Catalogue, Land and Fresh Water Shells of the Hawaiian Islands. By
D. D. Baldwin. Honolulu, 1893: size 8½ x 6, pp. 25. *Presented by A. T.
Atkinson, Esq.*
- Hawaiian Islands—Variations of Latitude.** **Preston**
United States Coast and Geodetic Survey. Bulletin No. 27. Results of
observations for the variations of latitude at Waikiki, Hawaiian Islands,
in co-operation with the work of the International Geodetic Association.
A report by E. D. Preston, Assistant. Washington Government Printing
Office, 1893: size 9½ x 6, pp. [14].

New Zealand.**Pennefather.**

A Handbook for Travellers in New Zealand, Auckland, the Hot Lake District, Napier, Wanganui, Wellington, Nelson, The Buller, the West Coast Road, Christchurch, Mount Cook, Dunedin, Otago, the Southern Lakes, the Sounds, etc. By T. W. Pennefather, LL.D. *With numerous Maps and plans.* London, John Murray, 1893: size 7 × 4½, pp. vi. [64] and 172. *Price 7s. 6d. Presented by the Publisher.*

With the extension of tourist travel Mr. Murray has found it necessary to extend the scope of his invaluable handbooks to new and distant lands where the old method of guidebook construction cannot readily be applied. This volume on New Zealand is accordingly of peculiar interest, and, apart from its special value to travellers in those islands, contains the best concise account of the geography of the colony which has yet appeared. It is illustrated by an admirable series of maps by Bartholomew, which are a striking advance on the usual cartography even of the best guidebooks.

New Zealand—Moas.**Hutton.**

The Moas of New Zealand. By Captain F. W. Hutton. [*Extract from the Transactions of the New Zealand Institute, 1891.*] Size 8½ × 5½, pp. 93–172. *Three plates. Presented by the Author.*

Pacific Islands.**Wawn.**

The South Sea Islanders and the Queensland Labour Trade. A record of voyages and experiences in the Western Pacific, from 1875 to 1891. By William T. Wawn, Master Mariner. London, Swan Sonnenschein & Co., 1893: size 10 × 6½, pp. xvi. and 410. *Price 18s. With numerous illustrations by the same. Presented by the Author.*

Captain Wawn for many years commanded a vessel engaged in recruiting kanaka labourers for Queensland plantations, and he here records his experiences at some length in order to justify the system.

Pacific Ocean Voyagers.**Atkinson.**

Early Voyagers of the Pacific Ocean. Papers of the Hawaiian Historical Society. No. 4. [By A. T. Atkinson.] Size 9½ × 6, pp. 16. *Presented by the Author.*

Victoria.**Sutherland.**

Geography of Victoria. By Alexander Sutherland, M.A. London, Macmillan & Co., 1893. Size 6 × 4, pp. viii. and 122. *Price 1s. Presented by the Publishers.*

A sensibly-planned little book, intended for use in the schools of Victoria, and written with all the authority of a resident who knows the colony well.

POLAR REGIONS.**Greenland.****Peary.**

My Arctic Journal, a year among Icefields and Eskimos. By Josephine Diebitsch-Peary. With an account of the great White Journey across Greenland, by Robert E. Peary. London, Longmans, Green & Co., 1893: size 9 × 6, pp. 240. *Price 12s. Presented by the Publishers.*

Although not the largest of the books on Mr. Peary's Arctic adventures, this is undoubtedly the most interesting, as it is the only authentic account of the year's residence in northern Greenland. Mrs. Peary writes simply, in narrative form, the adventures which she came through, and brings into very striking contrast the comfort of her little party with the hardships endured by other Arctic expeditions in latitudes scarcely higher. The illustrations from photographs are remarkably fine.

Spitzbergen.*Tour du Monde 66* (1893): 273–304.**Rabot.**

Jan Mayen et le Spitzberg. Par M. Charles Rabot.

M. Rabot here tells the story of his recent cruise to the edge of the Polar region with the help of a series of remarkably fine reproductions of the photographs he took at the time. Those of scenery are particularly characteristic.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

- Faunal Map.** *Annales G.* 3 (1893-94): 1-19. **Welsch.**
Explication d'une carte de la répartition des animaux à la surface du
Globe. Par J. Welsch.

This generalised account of animal distribution is illustrated by a large coloured faunal map "after Sclater, Wallace, Trouessart, etc.," and two small maps in the text. The divisions adopted are the Arctic, Palearctic, Nearctic, Ethiopian, Oriental, Neotropical, Australian, and Antarctic, the latter including Tierra del Fuego.

- Refraction.** *M. Forschungs. Deutschen Schutzgebiet* 6 (1893): 255-265. **Ambronn.**
Refraktionstabeln. Berechnet von Dr. L. Ambronn in Göttingen.

These tables are specially computed for use in tropical countries. No. 1 gives the mean refraction for given zenith-distances; No. 2 the temperature correction of mean refraction from -30° C. to $+45^{\circ}$ (-22° Fahr. to 113° Fahr.); and No. 3 gives the barometric correction of mean refraction from 550 to 800 millimetres (19.700 to 31.500 inches).

- Rivers.** *M.V. Erdk. Halle.* (1893): 207-215. **Dunker.**
Ueber die Wirkung der Flüsse auf die Gestalt und Beschaffenheit der
Erdoberfläche (Mit 4 figuren). Von E. Dunker.

A contribution to the discussion of the relation between the rotation of the Earth and the action of rivers on their banks.

GENERAL.

- America and Hungary.** *Abregé B.S. Hongroise G.* 22 (1893): 21-47. **Märki.**
Amerika und die Ungarn, von Alexander Märki.

German abstract of the original Hungarian paper by which the fourth centenary of the voyage of Columbus was commemorated in Budapest.

- Biography—Löwenberg.** *Deutsche Rundschau G.* 16 (1893): 38-40. _____
Julius Löwenberg. *With portrait.*

Columbus. _____

Christophe Colomb et Toscanelli. Par B. A. V. Paris, 1893: size $10 \times 6\frac{1}{2}$,
pp. 12. *Presented by the Author.*

Reprint from the *Revue critique d'Histoire et de Littérature*, October 9th, 1893. A criticism of the authorities on which Mr. Markham bases his views of the relations between Columbus and Toscanelli.

Commercial Geography. _____

Index to Reports of Her Majesty's Diplomatic and Consular Representatives Abroad on Trade and Subjects of General Interest. (With appendix.)
1886-1893. London, Printed for H.M. Stationery Office, 1893: size 10×6 ,
pp. 402. *Price 1s. 7½d.*

An extremely useful blue-book, indexing the contents of the Consular Reports for the last eight years, in which a great deal of useful geographical information, not otherwise available, is practically buried. The index abounds in references to railways, canals, mines, harbours, foreign countries, provinces, and towns, and all the commodities of British trade both export and import. An appendix gives the price of each of the one thousand two hundred and fifty-nine annual, and the three hundred and three miscellaneous reports which are referred to. The only drawback to the utility of the work is that it applies to Foreign Office reports alone, and does not include the Colonial Office series.

Educational.**Michow.**

Die schulgeographische Ausstellung auf dem geographischen Weltkongress zu Bern 1891. Von Dr. H. Michow. (Hamburg). Size $10\frac{1}{2} \times 7$, pp. 8.
Presented by the Author.

This account of the educational geographical exhibition at the Berne Congress is extracted from the *Pädagogische Warte* of Jena.

Gazetteer.**Lippincott.**

A Complete Pronouncing Gazetteer, or Geographical Dictionary of the World . . . originally edited by Joseph Thomson, M.D. New revised edition, amplified by a series of statistical tables. Philadelphia, J. B. Lippincott Company, 1893: size 11 × 7½, pp. 2894. Price 63s.

The first four hundred and twenty-two pages of this gigantic volume are devoted to introductory matter explaining the scope and plan, and to statistical tables of the countries of the world, and the towns and counties of the United States. Then follows in alphabetical order a series of short articles, varying from one line to two or three pages, describing one hundred and twenty-five thousand places. Much care has obviously been taken in the revision and amplification of the entries, but the editors have occasionally been misled by their authorities. Opening at random, the entry "Thurso (Caithness)" states "has manufactures of linen and woollen goods, straw-plait, leather, and netting, thriving fisheries, and exports of corn." There are really no manufactures of any kind, and the only industry, besides a little fishing, is the dressing and export of paving-stones. "Corn," presumably, means "maize," but oats and barley are the only grains grown in Caithness, and these are not exported. The population given in this case is that of the census of 1871. The populations of all the larger towns seem to have been brought up to date, and, altogether, the work is comparatively free from error for so comprehensive a book. The volume is very unwieldy, and should have been divided into two. Still, it is so far the best gazetteer available. The rules for pronunciation are interesting, and the attempt to apply them heroic, but the result is, in many cases, of dubious advantage.

Historical Cartography. Deutsche G. Blätter 16 (1893): 319-348.**Wolkenhauer.**

Zeittafel zur Geschichte der Kartographie mit erläuternden Zusätzen und mit Hinweis auf die Quellenliteratur unter besonderer Berücksichtigung Deutschlands. Von Dr. W. Wolkenhauer. Also a separate copy. Presented by the Author.

A chronological list of the principal steps in cartography from 600 B.C. to A.D. 1893.

Historical—Vopell.**Michow.**

Caspar Vopell, ein Kölner Kartenzeichner des 16 Jahrhunderts, von H. Michow. Mit 2 Tafeln und 4 Figuren: size 11 × 7½, pp. 22. (Separatabdruck aus "Festschrift der Hamburgischen Amerika-Feier 1892.") Presented by the Author.

Oriental Bibliography.**Kuhn, etc.**

Orientalische Bibliographie, Begründet von Dr. A. Müller . . . herausgegeben von Dr. E. Kuhn. VI. Band (für 1892). Berlin, Reuther und Reichard, 1893: size 9 × 6, pp. 322.

This volume completes the bibliography of works of orientalists on subjects relating to Asia and Africa, up to the close of 1893.

Rural Population.**Longstaff.**

Rural Depopulation. By G. B. Longstaff, read before the Royal Statistical Society, June 20th, 1893. 1893: size 8½ × 5½, pp. 64. Presented by the Author.

Travel.**Nottage.**

In search of a climate. By Charles G. Nottage LL.B. With thirty photographic illustrations, designed and produced in photomezzotype by the London Stereoscopic and Photographic Company, Ltd. London, Sampson Low, Marston and Co., 1894 [1893]: size 10 × 6½, pp. xvi. and 352. Presented by the Publishers.

Mr. Nottage's "search" led him to Australia, the Sandwich Islands, to which most of the book is devoted, and to the west of the United States. The illustrations are much lauded in the preface, many of them are satisfactory, but the system of grouping together a number of photographs and sketches deprives the former of their geographical value. The style is discursive and flippant, but the account of recent occurrences in Hawaii is of interest as showing the impression they made on an impartial observer.

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Germany.

German Government.

Karte des Deutschen Reiches. Scale 1:100,000 or 1.51 stat. mile to an inch. Sheets:—67, Stolp; 94, Köslin; 156, Naugard. Herausgegeben von der Kartogr. Abtheilung der Königl. Preuss. Landes-Aufnahme 1893. 394, Niesky. Herausgegeben vom topogr. Bureau des Königl. Sacha. generalstabes 1893. Price, 1.50 mark each sheet.

Germany.

Vogel.

Alphabetisches Namenverzeichnis zur Karte des Deutschen Reichs. 27 Blatt im Massstabe 1:500,000 unter Redaktion von Dr. C. Vogel ausgeführt in Justus Perthes' Geograph. Anstalt in Gotha.

This is the index to the map of the German Empire in twenty-seven sheets, of which mention was made in *The Geographical Journal* of last month.

ASIA.

India.

Constable.

Constable's Hand Atlas of India. A Series of Sixty Maps and Plans, prepared from Ordnance and other Surveys, under direction of J. G. Bartholomew, F.R.G.S., F.R.S.M., &c. Westminster: Archibald Constable & Co., 1893: Price 14s. Presented by the Publishers.

This little atlas contains sixty maps and plans, and statistical information, taken from the census of India, 1891, with reference to the areas and population of provinces and State Agencies, as well as the population of all the principal towns. Additional information, which is not included in the census tables, with regard to the approximate population of Upper Burma, British Baluchistan, Sikkim, Shan States, and Rajputana is also given. The first map in the atlas is one of the world showing all routes to India by steamers or sailing vessels, and their connection with the railways and caravan routes. This is followed by a valuable series of maps illustrating the physical geography, meteorology, ethnography, mission stations, products, military stations, railways, telegraphs, and navigable canals; this last map being given in three sections to allow of an increase of scale which makes it more handy for reference. Next comes a map of India, in fifteen sections, on the scale of seventy English miles to an inch, followed by twenty-one plans of towns, and maps of farther India, Straits Settlements, a plan of Singapore, and an index containing all the names that appear on the maps.

The maps are remarkable for the very clear manner in which they have been produced, and for the accuracy with which they have been compiled. As this atlas hardly exceeds an ordinary handbook in bulk, it is well suited for the use of travellers in India, and its small size also renders it a very handy work for reference.

India.

Johnston.

Atlas of India, containing sixteen maps and complete index, with an introduction by Sir W. W. Hunter, K.C.S.I., author of the *Imperial Gazetteer of India*. W. and A. K. Johnston. Edinburgh and London, 1894. Price 7s. 6d. Presented by the Publishers.

This atlas contains a map of the Indian Empire in fourteen sections on the scale of 60 miles to an inch. These sections have been so arranged as to conform as nearly as possible to the political and administrative divisions. The explanatory letter-press which accompanies the maps has been written by Sir W. W. Hunter, K.C.S.I., and contains a short account of the physical geography, products, and history of each section. At the end of the Atlas plans are given of Calcutta, Madras and Bombay, as well as insets of Aden and environs and Perim Island. The maps are very nicely drawn and printed in colours, all the railways have been carefully laid down, and it is furnished with a copious index.

Johore.

Lake.

Map of Johore Territory, 1893. Surveyed and compiled by H. Lake, on Johore Government Service. Scale, 1 : 189,800, or 3 stat. miles to an inch. Stanford's Geographical Establishment, London. Presented by the Author.

This is a general map of Johore, containing much new work. It has been compiled from the surveys of Mr. H. Lake. The rivers Sedilf and Kasang, with portions of the Muar, Batu Pahat and Johore, are from surveys by Dato Luar. The preliminary survey of the railway between Johore Bahru, and the village of Rantau Panjang is laid down, and has served as a check on Mr. Lake's survey. Portions where possible have been fixed by triangulation; but where this was not possible astronomical observations have been taken. Two frontier lines are shown in the north-west corner of the map, as the right to this district is at present in dispute.

AMERICA.

British North America.

Taylor.

Proposed Hudson's Bay and Pacific Railway and Steamship Route. Scale, 1 : 10,220,000, or 164 stat. miles to an inch. Prepared by Lionel P. G. D. Taylor. Hudson's Bay and Pacific Railway and New Steamship Route Syndicate, Limited, London. Presented by Col. J. Harris, F.R.G.S.

Greenland.

Drygalski.

Skizze der Reisewege der Grönland-Expedition der gesellschaft für Erdkunde unter Dr. E. von Drygalski, 1892-93. Mittlerer Massstab,

1:1,520,000 (or 24 stat. miles to an inch). Unter Zugrundelegung der dänischen Seekarte No. 147. Gesellschaft für Erdkunde zu Berlin. Sitzung vom 4 November, 1893.

AUSTRALASIA.

Australia.

Lindsay

Sir Thomas Elder's Wissenschaftliche Forschungs-Expedition in West- und Sud-Australien 1891-92. Mit unterstützung der Victoria- und Süd-Australischen Zweige der Königl. geographischen gesellschaft von Australasien, ausgeführt und geleitet von David Lindsay, F.R.G.S. Scale 1:3,000,000, or 47.5 stat. miles to an inch. *Petermanns Geographische Mitteilungen*. Jahrgang, 1893. Tafel 18. Gotha: Justus Perthes. *Presented by the Publisher.*

New South Wales.

Pittman

Geological Map of New South Wales. Scale, 1:1,000,000, or 15.8 stat. miles to an inch. Prepared under the direction of E. F. Pittman, A.R.S.M., Government geologist. Department of Mines and Agriculture, New South Wales, 1893. *Presented by the Department of Mines and Agriculture, New South Wales.*

This map has been compiled from the original map of the Rev. W. B. Clarke, and the more recent work of the officers of the geological survey branch of the Department of Mines.

GENERAL.

The World.

Johnston.

W. & A. K. Johnston's Royal Atlas of Modern Geography. Edition in Monthly Parts. Part 26. W. & A. K. Johnston, Edinburgh and London. Price 4s. 6d. *Presented by the Publishers.*

In this issue, sheet thirty-four contains the southern half of a map of India, with an inset of the South Eastern provinces of India, and plans of Bombay Island and town, and Madras and environs. Sheet forty-one is a map of South Africa with inset plans of the Cape, Cape Town and Durban. As usual with this atlas, each map is accompanied by a full index.

CHARTS.

North Atlantic Ocean.

U. S. Hydrographic Office.

Pilot Chart of the North Atlantic Ocean. December 1893. Published at the Hydrographic Office, Bureau of Navigation, Navy Department, Washington, D.C. Charles D. Sigsbee, Commander, United States Navy, Hydrographer. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Azores.

Ten Photographs of St. Michael's, Azores. *Presented by W. R. Kettle, Esq.*

This is a series of photographs taken in St. Michael's (Azores). They are well chosen to illustrate the scenery of the island, and contain amongst others, views of Ponta Delpago, the Caldeiras in the Valle das Furnas, and the village of Candelaria.

Chin Country.

Colville.

Eleven Photographs of the Chin Country, Burma. Taken by Col. H. E. Colville, C.B. *Presented by Mrs. Colville.*

This is a very good set of photographs which have been taken by Col. H. E. Colville, and illustrate the scenery and natives of the Chin Country.

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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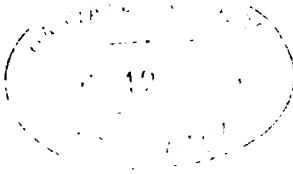
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KURDISTAN.

By Captain F. R. MAUNSELL, R.A.*

ALTHOUGH many travellers have passed through this portion of the Ottoman dominions, there is still a good deal of it the geography of which is but imperfectly known. Kurdistan is not an accurately defined province, but the expression may be used to define the extensive area inhabited by the Kurds. The north-western limit of this is the mass of rugged mountains of the Dersim country lying south of Erzingan, and filling up the space between the two arms of the Upper Euphrates previous to their junction. To the north the boundary lies along a line traced up the Frat Su Valley from Erzingan, through Erzerum and along the Russian frontier to Ararat. The greatest extent of Kurdistan is south-eastward, where it covers all the mountainous country contiguous to the Persian frontier as far south as a line drawn through Kifri, the Manisht Mountain, and Kermanshah in Persia. On the west the Kurds inhabit very little of the plain country of the Middle and Lower Tigris basin, and a line drawn from Kifri to Mosul and up the course of the Tigris to Diarbekr and on to Kharput and the Dersim country would mark the limit in this direction. On the east a considerable portion of the most fertile provinces of Persia are inhabited by Kurds; from Kermanshah northward through Sinna, and along the frontier mountains west of Urmia to Ararat marks the limit here.

It is only in Southern Kurdistan that the population is exclusively Kurdish, as north of Mosul there is a large Christian population in the country as well. These are of various sects, but principally Armenians, Nestorians, Chaldeans, and Jacobites. To the north and north-west the Kurdish element comes in contact with the more lethargic races of Osmanli descent, and in the Tigris Valley they meet the Arab tribes of the great deserts to the south-west. On the south the mass of the

* Paper read at the Royal Geographical Society, June 26th, 1893. Map, p. 163.
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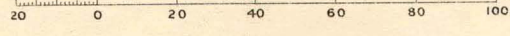


KURDISTAN

by Capt. F. R. Maunseil R.A., F. R. G. S.

1892

Scale 1: 3,000,000 or 47.5 miles-1 inch
ENGLISH MILES



Capt. Maunseil's land routes ———
river routes - - - - -
Altitudes in feet

Significations

- Baghaz* Defile
- Chai* Stream
- Dagh* Mountain
- Dere* Valley
- Gedik* Col
- Pinar* Spring
- Çeul* Lake
- Jebel* Mountain
- Kale* Castle
- Keui* Village
- Keupri* Bridge
- Kilissa* Church
- Kuh* Mountain
- Ova* Open Plain
- Rud* River
- Su* River
- Tepe* Hill
- Tura* Mountain

Manisht Mountain divides them from the grazing-grounds of the Faili Lurs.

The Kurdish subjects of the Shah are not looked upon with much favour, as they in common with the rest of Kurdistan profess the Sunni faith, while Persians are for the most part Shias, which means a very sharp and bitter dividing-line.

Not many years ago Kurdistan was a separate province, and Kurdish begs ruled in Amadia, Julamerk, Rowanduz, Suleimania, and other strongholds; but this state of things has now been altered, and the country is for the most part under the direct control of Turkish officials. There still remain mountain districts such as Dersim, Bohtan, and Modikan which form natural strongholds, and owing to the difficulty of getting at them the tribes remain almost entirely independent.

The original Kurdish organisation was undoubtedly tribal, and the prevailing habits of the tribes still remain nomadic and pastoral; but in a country and climate of so varied a nature there are many local circumstances which alter this.

On the upland plateaux lying between Lake Van and the Russian frontier, the winter climate is remarkably severe, and the Kurds have to remain in villages all that season, the distance being too great to migrate to a warmer plain-country. In the summer, however, the nomadic instinct shows itself, and the population of all the Kurdish villages turn out into their black tents, pitched either a short distance away, or on some convenient grazing-ground in the neighbourhood. The Armenian population on the contrary keep to the valleys, and are strictly agricultural and sedentary. On the steep impracticable slopes and deep ravines of the Dersim country the Kurds are perforce obliged to be sedentary.

In Central and Southern Kurdistan, the tribes have easy access to the plain country on either bank of the middle course of the Tigris, and here a large number are true nomads, living in tents all the year round. In the winter and early spring they pasture their flocks on the extensive plains on the Tigris right bank between Mosul and Jezire. These grounds have to be rented from the powerful Arab tribe of Shammar Tai, who roam over the country south-west to the Euphrates. As spring opens and the snow gradually clears off, they cross the river and ascend the hills. It is probably July before the snow permits them to encamp on the summits of the great ranges of Central Kurdistan. The formation of the country favours them, as the ascent to the higher ranges is fairly gradual, and they do not commence the ascent until the grass on the lower levels is consumed or withered.

In the religion of the Kurds, especially of the nomads, there exist under the outward forms of Mohammedanism traces of Pagan doctrines which probably descended to them from very early ages. Principal among these is the worship and making of vows paid at the tomb of some local

celebrity. One of these, the Ziaret or Shrine of Khalil Aghwar near Zakho, was of particular interest, as it lay on the road taken by the nomads in their annual wanderings. The tomb was hidden in the brushwood and under a heap of stones. Round it enclosing a space about 50 yards square was a low stone wall on which were set at intervals small green and white flags. Inside the wall was crowded with offerings, either propitiatory or otherwise, which the nomads had placed there as they passed by. Some of their black tents, tent-matting and cloths, tent-poles, and a couple of their brightly-painted cradles were among the articles I noticed, each of which was of considerable value to these people. On the branches of the trees which overhung the shrine were numerous rags and scraps of clothing which passers-by had tied there, each person imagining that by so doing they were leaving their ills and ailments there behind them. Round about was a fine grove of oaks which were well grown, as these trees are never touched for firewood. These isolated groves are often met with throughout Kurdistan, and are always treated with veneration, and the wood left untouched. As a general rule there is no control over the cutting of firewood, and much of the country which would otherwise be well wooded is almost denuded by reckless cutting and burning.

A heap of stones by the roadside to mark the spot where a murder was committed is also a roadside incident in some places, and each passer-by is supposed to add an additional stone to the pile. There are among the tribes a certain number of saints or holy men who possess considerable religious influence, and to whom the superstitious tribesmen pay almost idolatrous honours.

During my journey last summer I entered Kurdistan from the north, and left Erzerum on August 20th, 1892.

The road to Van round the north-east corner of the lake was taken, and lay over a bare and treeless country, but well watered and with plenty of pasture-land. The Bingeul Dagh, or Mountain of the Thousand Lakes, is a favourite grazing-ground in summer. This is a somewhat remarkable mountain and contains no prominent peak, but at the summit the sharply defined cliff which borders the old crater can be traced, and the rest is a long gradual slope cut up with numerous stream valleys edged with low basalt cliffs. At one period this region must have been a remarkable centre of volcanic disturbance. In this neighbourhood, also showing traces of having been at one period active volcanoes, are the Sipan Dagh, a solitary peak shaped like a truncated cone rising on the north shore of Lake Van, and the Nimrud Dagh on the west shore, which has a crater nearly 8 miles in diameter which contains now a number of hot springs and lakes. The Tendurek Dagh to the north-east also shows traces of lava streams and a large crater, and Ararat itself is also of volcanic origin. The

basaltic ravines on the slopes of the Bingeul and Sipan Mountains and the numerous fragments of obsidian which can be picked up close to the Sipan Dagh are further evidence of this. In the Hartoshi Mountains and the upper basin of the Great Zab River numerous sulphurous springs are to be met with. Some are hot springs, some give off sulphuretted hydrogen, and in others the pure sulphur can be gathered from incrustations round the edge of the springs. This is much prized by the Kurds for the manufacture of powder. In the country between Erzerum and Van the Kurds prefer the mountain districts, where they can pasture their goats and sheep, and only cultivate sufficient barley and wheat for their present wants. The Armenians are most industrious cultivators of the soil, and collect in large villages in the valleys. In Bulanuk some Kurdish villages that I passed through were half underground and were the merest hovels. Sledges were used also to bring home the harvest, although it was summer-time and the ground was almost level and fit for carts. Sledges drawn by two bullocks are used also to a certain extent in the Kawash and Karchikan districts on the south shore of the lake during the summer, but there the slopes are steeper and more difficult. All round the shores of Lake Van the soil is fertile, the supply of fresh water very abundant, and fruit gardens and vineyards abound. Van, Aganz, Akhlat, Vostan, and Adeljivas are all famous for their gardens, which produce apples, pears, plums, cherries, apricots and walnuts.

A very curious feature noticed near the Armenian villages of Chevirme and Heramik in the Khanus Su Valley were the ancient cemeteries close to them. In these, over each tomb, were a number of stone blocks carved roughly to represent a horse ready saddled and bridled. The largest reached to about half the natural size of a horse, and were of various sizes down to about 2 feet high.

From Van I followed the south shore of the lake to Bitlis. The waters contain carbonate of potash, which is dried out in pans near the town and collected in cakes about an inch thick for use as a substitute for soap.

Wheat harvests in the Van province are as a rule very prolific, and grain sometimes rots for want of storage room or means of transport to a profitable market. This province suffers perhaps more than any other in this region from want of efficient means of communication with the coast and the outer world. The neighbouring rich province of Azerbaijan in Persia has scarcely any outlet either for its produce except by long and tedious caravan routes.

The Lake of Van, as is well known, has no outlet, and it is difficult to discover any traces of one. At the small bay of Ziwa on the south shore there is a single ridge, which rises steeply 600 feet out of the lake, separating its waters from one of the tributaries of the Bohtan River, which joins the Tigris. In the Guzel Dere, farther west, the watershed

is slight, and also at the head of the Bitlis Valley, but with these exceptions the wall of rocky ranges along the south shore seems to be complete. The most acceptable theory as regards the formation of the lake is that at one time the Mush plain extended eastward as far as Van, but that an overflow of lava from Nimrud volcano blocked up the valley to the south of the mountain, and so the lake came into existence.

Leaving the lake shore at Shamunis, I turned down a by-path to Bitlis across the hills following the Guzel Dere, which runs generally parallel to the Bitlis River. South of Shamunis the track crossed a ridge rising only 150 feet above the lake level, and entered a wooded valley with a fine mountain torrent fed by numerous streams from the high ranges on either hand. At 6 miles from the lake we left the stream, which made a sweep round to the westward and flowed into the lake near Ortap, and passed through Khotum, a small village only 100 feet above the lake. South of this we crossed a very slight watershed, and passed a spring which was the source of the Keser Su, a stream going south to the Bohtan Su, so that in this direction the watershed between the lake and the Tigris basin is slight. The number of streams in these mountain valleys is very great, and this spring alone formed a stream 50 yards wide and 18 inches deep of clear water coming out of the base of a small cliff.

These mountain valleys are well wooded with low oaks and junipers for the most part, but walnut, ash, elm, and poplar are found by the stream banks. The hill-slopes on the south shore of the lake are almost entirely denuded of trees for firewood for Van, and even the roots are dug up out of the ground for this purpose. Coal is known to exist a short distance to the eastward of Van, but is not worked at all, although its use would be of the greatest service to the saving of the forests and progress of agriculture.

From Bitlis I went south to Sairt and Jezire, descending quickly through a rough wooded country from the level of the Armenian highlands to that of the Tigris basin. The road follows the narrow rocky valley of the Bitlis Su, winding through a forest of low oaks with a thick undergrowth. On either side rise abruptly steep limestone hills, wooded except along the summits. Four miles south of the town are some valuable mineral springs by the roadside which produce water very similar to that of Vichy. A mile farther on is a calcareous deposit 60 yards long and 30 feet high formed by the deposit from another mineral spring on the hillside. This entirely blocks the space between the steep slope on one side and the cliff forming the river-bank on the other, and the road passes through by a short tunnel or archway 15 feet high and 12 feet broad, said to have been cut by Semiramis. As the descent to the plain is accomplished, the country can be divided into zones varying in climate and productiveness as the altitude gets less. There is first the plain country of the Tigris basin, especially on

the left bank, extending to Mosul and the Great Zab River, which grows fine wheat crops and, where irrigated, maize, millet, cotton, and hemp. The next zone is from 2000 to 4500 feet, and is perhaps the most fertile. It is formed of the lower outliers from the main ranges and is cut up by numerous valleys and streams, and the hillsides are covered with oaks principally of the gall-bearing and valonia kinds.

The many small streams are utilised to grow rice on the hill-slopes; there are numbers of vineyards and fruit-orchards, and tobacco, maize, and corn crops are very productive. The highest zone is the summits of the mountains, which are quite bare of trees, and the general level of those in the district, south of Lake Van, is from 9000 to 10,000 feet above sea-level. These summits form, in many instances, great rolling downs, like the Pamirs on a small scale, from which the snow never entirely disappears. They constitute the grazing-grounds, in summer, for numerous nomad Kurd tribes. In July 1888 I spent a fortnight among the nomads of the Hartoshi Kurds in their "yaila" or summer quarters east of Jezire. The black tents were dotted along the banks of one of the many streams that came from the melting snows. The soil was a rich loam, probably of volcanic origin, and directly the snowdrifts disappeared the ground was covered with a carpet of short grass, thickly studded with flowers of great variety and brilliancy. Among others I noticed an Alpine gentian with a deep-blue flower, a small blue hyacinth, several kinds of iris and polyanthus, which were very plentiful. The difference of climate between here and the Tigris Valley was very marked. On June 27th, on the river-bank near Jezire, the temperature rose to 106° towards mid-day, while on July 4th, at an elevation of 7900 feet, the ground in the early morning was covered with hoar-frost, and the thermometer marked 30°. The dress of the Hartoshi Kurds in this region is a very distinctive one, and suitable to these sudden changes of temperature. The handsomest portion consists of the short jacket or pelisse, embroidered with gold lace down the front, and worn open, with the back covered with long black goats' hair of a very fine texture. A white conical felt cap is worn with a turban of black and red cotton wound round it. The sleeves of the shirt are open, and hang down almost on the ground when walking. There is an inner waistcoat and a jacket with open hanging sleeves worn under the pelisse, usually made of bright coloured silk. Wide trousers are worn, tucked into a pair of high boots of red or yellow leather, which reach half way up the leg. Most of the cloth is made from goats' hair, and is very strong and durable. A species of wild silk called "gez" is found in the hills near Jezire, and is a good deal used by the Kurds also.

Jezire is an important centre for the Kurdish tribes, both settled and nomad, who inhabit the mountain districts to the north and east. The nomads are obliged to cross at the boat bridge here in their annual

migrations in search of pasture, and the sheep-tax is levied as they cross. They dispose of wool and goats' hair on the way through, and these, with oak galls from the neighbouring forests, form the principal exports. Sheep are exported in large quantities also, and are driven westward along the caravan route to Aleppo, Damascus, and Beyrut. The mountain districts of the Bohtan and Hakkari to the north-east and east of Jezire form a wooded region of great fertility; but the population is at present insufficient, and much of the country lies idle and almost depopulated.

From Jezire I turned aside to Shakh, a small village some 8 miles to the east, where I was told there were extensive ruins and inscriptions. After 6 miles, we crossed a large mountain stream called the Nurdush, and began a steep ascent to the village, the track winding up over a succession of small terraces irrigated by canals. The walnut and mulberry trees here were particularly fine, and the pathway in places was choked with trailing vines and briar roses. Almond, fig, olive, and pomegranate trees also appeared, and on the terraces were grown patches of Indian corn, wheat, melons, and hemp. A little cotton was seen on the higher slopes. Few scenes could be prettier than this winding ascent through large leafy trees, hedgerows of roses, myrtle and pomegranate, with vines twining overhead.

It was soon evident that we were approaching the site of some important city, as for some 2 miles to the east, along the summit of a spur, were scattered extensive remains of masonry walls, with towers at intervals. The Kurds have many traditions about this place, and the guide said that seven distinct walls could be traced which used to encircle the town. At the top of the ascent we entered the village of Shakh through a gateway in a strong masonry wall, which evidently formed part of the line of fortifications on this side. The modern village is built on the edge of a cliff projecting over the Nurdush stream 300 feet below. On the opposite bank rises a bare rocky wall of grey limestone. Running north is a side valley lined with cliffs, down which comes a large stream. I ascended this for nearly a mile and a half, and found a number of chambers cut in the side of the cliff, which had apparently been used for dwellings. One of these measured 20 feet long, 15 feet broad, and 10 feet high, with a door and window, all cut in the hard limestone, and still in excellent preservation. Near the head of the valley was the remains of a strong masonry wall which used to defend this defile.

Higher up the cliff to the east was a large arched opening leading into a chamber 60 feet long, 30 feet broad, and 30 feet high. This the Kurds called the council-chamber. Up the main valley of the Nurdush, 2 miles distant, were a number of other rock-cut chambers, some 6 feet long and 4 feet high, evidently used as tombs. The stream valley above Shakh is lined by cliffs rising, in a series of pinnacles, 1000 feet

above the stream, and crowning these on either hand were the remains of two forts, the Kala Baginuk and the Kala Kelhuk, which were built to defend the passage. Along the base of the cliff, on the right bank, could be traced the line of an aqueduct 3 feet wide and 2 feet deep, cut in the rock for nearly $1\frac{1}{2}$ miles, now broken in several places, but which was used to lead the water round the end of the rocky spur on that side. In former times this must have been a place of considerable importance, and I think it may be taken as the site of the Roman city of Bezabde, the capital of the Zabdicene province. This has never been definitely fixed; but hitherto it has been supposed to be in the neighbourhood of Fenduk, higher up the Tigris. Rock-cut dwellings exist in the neighbourhood at Hassan Kaif, in the Bohtan Su Valley near Sairt, and the Tigris Valley near Fenduk, but none of these are as numerous or as well constructed as those here.

On leaving Jezire, I descended the Tigris on a raft made of a light framework of timber and reeds, made buoyant by a number of inflated sheepskins fastened in rows underneath. A raft of eighty skins gave sufficient room to pitch my tent and for the men to work the two long oars. Progress was very slow, as the speed of the current was usually depended on, and at this season, in September, it was very slight. The oars were used principally for steering.

Rafts of one hundred and fifty to two hundred skins are used by traders to carry wool and wheat down the river from Jezire to Mosul and Baghdad. On arrival at Baghdad the rafts are broken up and the wood sold, while the raftsmen return by road, carrying the skins on mules. This is a very primitive method of carrying goods, and the sculptures at Nineveh show that it was in use when that city was at its prime.

South-east from Jezire, along the foot of the hills, is a fine plain, and this depression extends up the Khabur valley as far as Amadia. Southward of this, following the course of the Great Zab until it joins the Tigris, comprises one of the most productive districts of Central Kurdistan. Near Amadia this is known as the Bahdinan District, and crossing it are a series of steep limestone ridges, which rise to about 4000 feet, and enclose well-watered valleys of great fertility, wooded with oak, elm, pistachio, juniper, and other trees. This belt of hills continues into Southern Kurdistan to the districts round Suleimania, where the ridges run nearly parallel in a north-west and south-east direction, and where the valleys are equally fertile and well watered. On the south-west edge of these ridges lies a belt of undulating gravelly hills between the Diale and the Great Zab. The limestone disappears and sandstone overlying conglomerate formations takes its place. Numerous strata of gypsum are met with, particularly round Mosul and extending south-east to Kifri, and also along the western edge of the Pusht-i-Kuh mountains farther south. At various points in this zone are petroleum and bitumen

wells, the principal being at Hammam Ali, a short way south of Mosul, where the bitumen oozes out of the calcareous rock in long threads, at Erbil, Kirkuk, Duz Khurmatli, Kifri, Mendali, and at various other points along the Pusht-i-Kuh to near Shuster in Persia. These will be seen to follow a well-defined belt running south-east from Mosul, and no doubt, if properly exploited, would yield valuable results. Also on the left bank of the Tigris, at the El Fatha defile, a short way below the junction of the Lesser Zab, are bitumen deposits which extend for some 5 miles along the bank. The strata of whitish calcareous rock run nearly horizontal on the bank, which is here from 10 to 12 feet high, and from between the strata the bitumen oozes out in considerable quantities, said to be greater in summer than in winter. It floats down the stream and pollutes it for a good way down.

Through Southern Kurdistan a description of part of my journey will show the nature of the country and the mode of travelling in it. Starting north from Baghdad on May 1st, I reached the small town of Kasr-i-Shirin, just over the Persian border on the high road to Kermanshah. My party was small, and consisted of my dragoman and myself, with a couple of muleteers, and four mules for baggage and tent. It was found better to engage the muleteers from one large town to another and not for the whole journey, as they knew the roads better.

From Kasr-i-Shirin I turned aside in a north-westerly direction, and, after crossing a country of undulating gravelly hills producing good wheat crops, at 12 miles crossed the line of round masonry towers which mark the frontier of Turkey. The small party in these towers was constantly on the alert, and sometimes had to retire into their fortress and stand a siege against a band of Kurdish raiders; 12 miles further we reached the edge of the Diala River, then in high flood, and had to halt to improvise some method of crossing. The flat river valley contained some rich alluvial soil, watered by several canals, and grew wheat and rice. Several tumuli were visible, and in one village houses were being constructed from bricks dug up from one of these. These old bricks, when obtainable, are far preferable to the sun-dried ones of the present day. Each mill had its watch-tower to protect the corn in it from raiding parties. After some time a man was found who undertook to ferry us across the river, and with a dozen sheepskins and some reeds set to work to make a raft. In about an hour's time it was ready, and was nearly 7 feet square.

It took the party and baggage over in three trips, but the current was rapid, and the raft was carried down stream a long way at each crossing, which made the work very tedious. It was pushed along and steered by a man swimming behind. The river flowed over a wide stretch of shingle in several channels, some of which we forded, and the main one remained, about 300 yards wide. Two attempts had to be made before the horses and mules would face the stream; but eventually they were

induced to follow a muleteer who swam beside the horse who acted as leader of the caravan, and guided him across. One mule less experienced than the others was swept down for nearly a mile, and was only saved by being drifted on to a shingle bank, where he got foothold and reached the shore. On the other bank we camped with some of the large nomad tribe of Jaf Kurds, whose winter grazing-ground this was, but most of whom had already left for their summer pastures on the Kuh-i-Chahil-Chashma, on the Persian frontier. From the river the track lay over a bare undulating country, mostly a gravelly soil, but crossed by numerous low ridges, and sandstone and gypsum formations.

After a march of nearly 20 miles I reached Kifri on the Baghdad and Mosul road, and from here I turned north-east towards Suleimania, the capital of Southern Kurdistan. I had some difficulty in procuring guides, as the road was said to be closed by raiding parties of the Hamawand Kurds, a tribe who possess a number of well-mounted horsemen. These move rapidly from one point to another on the great trade routes, swoop down on caravans, and disappear as soon as a superior force is brought against them. After much argument I obtained two zaptiehs, men of the local gendarmerie, to act as guides, and left on the morning of May 11th. For the first few miles the road led over some sharp ridges of sandstone, with strata of gypsum and conglomerate. An excellent cement for building is obtained from the gypsum, and houses in Kifri and Mosul are largely built from it.

The country soon opened out into an undulating plain, crossed by a great number of small gravelly ravines, with low ridges of sandstone appearing at intervals. Round Kifri is a fine wheat-growing district, and water is to be found in the streams all the year round. Just now the rivers were partially in flood, and were difficult to cross. The country was almost deserted, and we passed only two small villages during the day. In these the inhabitants turned out immediately on our approach, carrying any weapons they possessed, as they thought horsemen coming down the road must be a party of Hamawands, such a thing as a peaceful traveller being unknown. Also in a bush by the roadside I noticed a leg sticking out, and found it belonged to a small boy who had crept in there, imagining he had securely hidden himself from the dreaded Hamawands, whom he thought were approaching. Late in the afternoon the Ak Su was reached, flowing in a narrow valley bordered by gravelly hills. The zaptiehs knew nothing of the way, and the water was in flood and very muddy, so that the ford was obliterated. I tried to lead the way over where I imagined I could trace the ford, but my horse was rolled over by the force of the stream, and I swam to the opposite bank. The ford was discovered at length a short way down, and, after a march of 35 miles, we halted with some nomads of the Jaf Kurds we found by a stream bank. There was

still an abundance of grass to be found on the plain, and they were pasturing their flocks here.

Starting at daybreak the next day, I found the zaptiehs had disappeared in the night, and it was only after some difficulty I induced one of the nomad Kurds to show me the way on to Suleimania. This day comprised another long march over a grassy country similar to the last without meeting with a single soul or seeing a house. Towards evening the guide led us towards a small village called Gcuk Tepe, which lay behind some rising ground. I was riding with my dragoman some distance ahead of my baggage, and on reaching the top of the hill the village became visible a short way off at the other side of a ravine. Here again we were taken for Hamawand raiders, and the villagers turned out with great promptitude and opened fire.

Matters were beginning to look serious, as these villagers were armed with Martini-Peabody rifles, when some minutes later the mules arrived on the scene, and they realised then that we must be travellers, and ceased fire. We camped there for the night, it being the only village for miles, the headman explaining his conduct by saying the usual method of attack by the Hamawands was to advance at a gallop and rush the place, so that unless fire was opened at once there was no chance of driving them off! Next morning, a short distance after leaving the village, we crossed the Karadagh, the first outlier of the ranges of Southern Kurdistan, and entered a pretty wooded country, with a number of small streams. The sandstone and conglomerate formation was now left, and a series of parallel ridges of hard limestone with strata in some instances perfectly vertical, intervened. A few small Kurdish villages were met with, scarcely distinguishable from the surrounding country in consequence of the thick grass which grew on the flat roofs of the houses.

We made a short march of 12 miles, and halted at the village of Temar, which was hidden away in a small side valley by a stream. The soil was very rich, and the slopes round this little village were dotted with vineyards and fruit-orchards, growing pears, apples, peaches, apricots, and plums. There were a number of mulberry-trees also, and a good deal of coarse silk is produced, but not in the quantities that might be expected if proper methods of sericulture were pursued. The forest trees were species of oaks (*Quercus valonia* and *Q. infectoria*), which produced galls much used for dyeing, and also the pistachio, from the berries of which a kind of soap is made. Walnut trees are very plentiful in the frontier ranges between Suleimania and Sinna; wheat, rice, and tobacco were also cultivated in small patches round the village, the rule being to grow only sufficient to supply the bare necessities of the place, as the market of Suleimania is very small, and to reach Baghdad is a long and difficult journey for caravans. Leaving Temar and crossing another steep limestone ridge we descended into the Shehrizur Plain,

and reached Suleimania on the other bank of the Khanjiru stream. This plain extends south-east nearly to the Diala River, a distance of some 30 miles. It is well watered, and naturally extremely fertile, while at various points can be noticed tumuli, the sites of villages in ancient times; but now the population is very small in comparison to the productiveness of the soil, and only a very few Kurdish villages are to be seen down its length. The population of Suleimania is almost exclusively Kurdish, and it is a typical town of this part of Kurdistan. There are about two thousand five hundred houses, nearly all single-storeyed huts with flat roofs, with few buildings of any size. The narrow winding streets of the bazaar, with the stalls on either hand, were shaded from the sun by an arrangement of branches and leaves stretched across overhead. The articles displayed for sale reflected the tastes of these warlike Kurdish mountaineers, always fond of something bright and showy in their accoutrements and a good weapon by their side. The principal manufacture is saddles and horse furniture, shoes and leather work generally, the leather being cleverly dyed in various brilliant colours. A curious assortment of flint-locks and guns, swords, knives and daggers of all shapes, round shields of bullock hide, belts with a row of pouches for powder and bullets, and felt saddlecloths embroidered with coloured worsteds, made a very interesting display. A fair quantity of Manchester piece goods, cotton kerchiefs, etc., could be seen; but to a Kurd a Martini rifle or a good horse, looted from some Arab on the plain, are of more value than very many yards of cloth. Of eatables there was the universal Kurdish drink of curdled milk called "yaurt" cheese, raisins and several kinds of dried fruits, chiefly plums and apricots. The Jewish quarter of about one hundred houses lies outside the town a short distance off to the south.

From Suleimania I returned to Baghdad, which is the highest point to which British river steamers navigate the Tigris, and so was enabled to return home. Travelling in this country is almost entirely done on horseback; in fact, there is no other way of getting over these rough mountain roads. The pack-mules are very fine, and will go along almost any track, and the baggage is entirely entrusted to them. A small tent is a necessity, as sometimes in the mountains villages are not met with for days, and the varying climate at the different altitudes is trying to Europeans.

Before the reading of the paper, General STRACHEY, Vice-President, who occupied the Chair, said: Before proceeding with the regular business of the evening I would call attention to the very long list of gentlemen who are seeking election to the Society, which I think should satisfy you all that the reputation of the Society and the desire to join it are not any less than they have been for many years past, I might rather say they have increased. I will now ask Captain Maunsell to read his paper. I may just briefly mention to you that it is the account of the portion of a journey along the north-west frontier of

Persia, where that country joins on to Turkey, a region of which comparatively little is known, and I do not doubt that you will find Captain Maunsell's account of it is of considerable interest.

After the reading of the paper the following discussion ensued :—

Sir HENRY HOWORTH: I feel rather embarrassed in being called upon to speak about a paper of which I have no geographical knowledge, and on which the only things I have to say are on the side of history and ethnography, of which there is of course much to be said. I may remind you with regard to that wonderful martial figure on horseback shown on the screen, that the most famous Kurd that ever lived, and the only one who made himself an historical position, was Saladin, the opponent of our great Richard I. One of the interesting features of the ethnography of this country is its extraordinarily persistent character. If you detach from the map a few names which are purely Turkish you detach from it also nearly all traces of more recent populations. Going back to those very early times when the Assyrian kings made their famous expeditions into this area they undoubtedly fought against the ancestors of the Kurds. With regard to their language, like some other races under pressure from a foreign yoke, they have changed it, but they have retained their nationality, appearance and other characters. Before they began to speak a dialect of the Iranian language, the Kurds no doubt were the aborigines of this country, whose language is represented by the inscriptions at Van, deciphered by Professor Sayce. One of the interesting things in an area like this is to find that not only the race is persistent but has persisted almost exactly in its primitive form—I am speaking of the Kurds, and excepting in the north the Armenian race, whose advent also we can completely date. Now if we detach this Armenian race we have from Tiflis right down to the spurs of the mountains out of which the affluents of the Tigris rise one continuous race, to which Herodotus gave the name of Allophyllian; the southern part of it has adopted another language as I have said, but in the north it retains its old language the Georgian, but in other respects, in the whole of this area from Tiflis to the plains inhabited by the Arabs, they form one continuous people. The misfortune of mountain peoples separated into small valleys is that they have no annals, and the history of the Kurds has been the history of mountaineers, harassed, destroyed, trampled upon by every invading horde that has passed over this district. No more terrible page in all history is there than the story of the Mongol conquest of this district and the adjacent district of Luristan. Nowhere was there so much bloodshed, and nowhere was there an area so completely depopulated. The Seljuks, when they came into this area, performed the same part. It is a curious thing that in Kurdish history the only prominent figure is the famous martial chief against whom the early crusaders fought. We can carry back the history of this country to a very early date. The very earliest accounts we have of the Assyrian campaigns north of the Tigris show that the whole of these mountains was occupied by one people divided into a great number of small tribes, each with a chief living in his castle, exactly as the reader of this most graphic and excellent paper has pointed out they do still. I must be allowed in conclusion to say, if I am not impertinent, that both history and ethnography are under deep obligation to a traveller so well equipped as Captain Maunsell, whose description was so graphic, and whose paper contains so much that is interesting and valuable, and I would also submit that these ethnographical and historical sides of geography may be somewhat germane to the discussions you hear here.

Mr. HOLMWOOD: Although I am on duty very near to the scene of the paper read to-night, I have learnt all I know in a geographical sense about Kurdistan

from what we have just heard, and really have nothing whatever geographically to say that can interest this meeting. Speaking generally, the whole of Asia Minor is more or less in the same condition as Kurdistan in regard to its development. I do not think we shall ever see the proper opening up of these immensely fertile plains, extending nearly from the west coast of Asia Minor to Armenia and Kurdistan, until not only we have a more civilised government (although Turkey has done very much recently in the way of increasing the efficiency of her government), but also until we have much larger populations. In Asiatic Turkey, where my duty lies in increasing British interests and commerce, I see what I saw in East Africa, that the great bar to developing these countries, one which never existed throughout the history of the development of India, is its very sparse population. In Africa we know the slave trade has brought the populations to their present very low ebb. In Turkey undoubtedly the wars have reduced the men to a comparatively small number, but I believe that as government increases in civilisation, and, above all, as the railways which now communicate with the interior whose extensions, already commenced, will reach fully half way, from Smyrna to Baghdad, we shall have these Armenians settled in the plains, where their natural taste for agriculture will induce them to populate and cultivate the country, leaving the Kurds, who are nomads, and always will remain so, with their flocks and herds in their own mountains. I have much pleasure in saying these few words in response to the request of the President, and am very sorry I can say nothing whatever geographically to interest you who know probably much more than I do about the country that has been described this evening.

MR. DOUGLAS FRESHFIELD: I am very sorry that we have not more of the recent travellers in Kurdistan here to-night. I wish we could have heard Colonel Clayton, who recently contributed to the *Alpine Journal* an excellent description of the mountains round Lake Van, and the probably volcanic causes of the present condition and want of exit of that lake. I wish still more that an accident had not prevented Mrs. Bishop, one of the most recent travellers in the out-of-the-way parts of that region, from being present. As to my own knowledge of Kurdistan, the first thing I heard to interest me in the country came from a traveller whose talent touched upon genius, the late Gifford Palgrave, who described Kurdistan and the Kurds to me when I was in Constantinople in 1868. You may remember an interesting article, republished in Palgrave's 'Ulysses; or, Scenes and Studies in Many Lands,' in which he dealt with the future of the Kurds. He believed that they might supply the nucleus of a nation, which, if supported by English politicians, might be made the backbone of resistance to Russian advance in that part of Asia. I saw the Kurds principally on their northern frontier, near Erivan, and about the slopes of Ararat and the highlands just inside the Russian frontier, where the Kurds come in the spring. There is nothing more picturesque than the Kurdish women in their bright dresses. The men are said to be great robbers; but I like robbers, if they do not rob me, and, so far as I had anything to do with them, they were extremely hospitable. Their country, as seen from a high perch on Mount Ararat, is in most striking contrast to the Caucasus, which is broken up into hill and dale, like Switzerland. The excellent paper read to-night probably describes Kurdistan very well as a Little Pamir. The effect it gives you is of a country raised up nearer to heaven than most countries, high bleak tablelands separated by hills rising up in isolated blocks. Leaving it on the north, you go over a low grass pass, and suddenly descend into valleys where you may fancy yourself in the Jura among pine woods, bright running streams, and villages. I do not know that I can add anything more than these rusty and rather vague reminiscences to the paper you have heard

to-night. I am quite sure that much remains to be done in this region, particularly in the way of archaeology. There must be, as along the whole of the frontier of the Eastern Roman Empire, lost cities with inscriptions to be deciphered, and older remains than Roman to be discovered.

General STRACHEY: I have to ask you to return your thanks to Captain Maunsell for his very interesting paper, and to the gentlemen who have spoken to-night.

NOTE ON CAPTAIN F. R. MAUNSELL'S MAP.—The instruments used by Captain F. R. Maunsell, B.A., were a 6-inch sextant, an artificial horizon, a half-chronometer watch, an aneroid, and prismatic compass. The following are the places at which the error and rate of the watch were determined:—Samsun, Sivas, Erzerum, Mosul, and Busra; longitudes being taken at fifty-nine different stations. As a rule only one star was observed, but in several cases both sun and star were taken. A large number of aneroid observations were recorded, from which the heights shown have been determined. In the compilation of the map, outside the routes traversed by Captain Maunsell, use has been made of the most recent and reliable material.

THE GEOGRAPHY OF MAMMALS.*

By W. L. SCLATER, M.A., F.Z.S.

NO. I.—INTRODUCTORY.

It has long been evident to naturalists that the ordinary political divisions of the Earth's surface do not correspond with those based on the geographical distribution of animal life. Europe, for instance, the most important of all the continents politically speaking, is for zoological geographers, as well as for physical, but a small fragment of Asia. Again, the strip of Africa which borders the Mediterranean and extends to the Sahara agrees closely, as regards its animal life with Europe, and is altogether different from the great mass of the African continent. Proceeding to America we find that physical geographers, as well as political, divide the two great masses of the New World at Panama. But those who study distribution have ascertained that Central America and Southern Mexico belong zoologically to South America, and they are consequently obliged to place the line of demarcation much further north.

Let us, therefore, dismiss from our minds for the moment the ordinary notions of both physical and political geography, and consider how the Earth's surface may be most naturally divided into primary regions, taking the amount of similarity and dissimilarity of animal life as our sole guide. In order to endeavour to solve this problem, let us select the mammals, as the most highly organised and altogether the

* Map, p. 168.

best-known group of the animal kingdom, and examine the geographical distribution of this class of animals over the world's surface.

Mammals are divided by naturalists into eleven large groups, called "Orders." As regards their distribution, however, these orders fall into two very different categories, according as they live on land or in the water—terrestrial and marine. For out of the eleven orders, one of the principal divisions of the carnivora—the pinnipeds or seals, and two other orders in their entirety—(the cetaceans or whales, and the sirenians or manatees) are specially adapted for existence in water. Land is, therefore, a barrier to their extension, whereas, on the contrary, in the case of the ordinary terrestrial mammals, land is the means by which they extend their ranges, and seas and rivers form their restraining boundaries.

We will for the present put aside the marine mammals, and address ourselves to the discussion of the distribution of the nine terrestrial orders, namely:—

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|-----------------|-----------------|
| 1. Primates. | 6. Ungulata. |
| 2. Chiroptera. | 7. Edentata. |
| 3. Insectivora. | 8. Marsupialia. |
| 4. Carnivora. | 9. Monotremata. |
| 5. Rodentia. | |

Now, as is generally agreed by naturalists, one of the most certain and best ascertained points in the classification of mammals is, that these nine orders can be grouped primarily in three natural divisions (which may, in fact, be considered as sub-classes) of nearly equal value. These three sub-classes are, as named by Professor Huxley—the *Prototheria*, embracing only the order Monotremata—the *Metatheria*, equivalent to the order Marsupialia, and the *Eutheria*, which includes all the remaining orders from the Edentata to the Primates. Let us, therefore, consider the distribution of the members of these three sub-classes on the Earth's surface. When we come to examine the distribution of these groups on the map, we shall find that the monotremes are wholly confined to Australia and New Guinea; that the marsupials predominate in Australia, and are only met with elsewhere in South America (one or two species of opossum occurring in North America, but being probably only recent intruders from the south); and that the typical mammals or *Eutheria* occupy the rest of the world.

Again, after examining the distribution of the seven orders of typical mammals, we remark the following significant facts:—

1. The absence of insectivores in South America.
2. The great prevalence of edentates in the same country; the sloths, armadillos, and ant-eaters constituting three out of the five known families of this order, being entirely confined to South and Central America.

Taking these main facts as our guide we may divide the land-surface of the Earth as follows, into three divisions:—

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|--|---|---|---|-------------------|
| (1) Land where marsupials prevail; no <i>Eutheria</i> , except rodents and bats; monotremes. | } | Australia, New Guinea, and the adjacent islands. | } | <i>Notogæa</i> . |
| (2) Land where <i>Eutheria</i> and marsupials occur; no insectivores; many edentates; no monotremes. | } | America south of the Isthmus of Tehuantepec. | } | <i>Neogæa</i> . |
| (3) Land where <i>Eutheria</i> only occur; few edentates, no marsupials nor monotremes. | } | Europe, Asia, Africa, Asiatic Islands down to Wallace's line, and North America down to the Isthmus of Tehuantepec. | } | <i>Arctogæa</i> . |

The fault of this division is that it leaves the great mass of land in the Northern Hemisphere undivided and rather unmanageable. But this northern land is easily separable into four sections, although it must be understood that these four sections are not of equivalent value to the two other primary divisions. Thus we obtain a division of the land-area of the globe for mammals into six areas, which are called Regions, and may be shortly defined and named as follows:—

NOTOGÆA.	{	Australia, New Guinea, and adjacent islands up to Wallace's line.	}	I. <i>Australian Region</i> .
NEOGÆA.	{	Central America, south of the Isthmus of Tehuantepec, the West Indies, and South America.	}	II. <i>Neotropical Region</i> .
ARCTOGÆA.	{	Africa, south of the Atlas, and Madagascar	}	III. <i>Ethiopian Region</i> .
ARCTOGÆA.	{	South Asia, Philippines, and Islands of Indian Archipelago down to Wallace's line, and Celobes.	}	IV. <i>Oriental Region</i> .
ARCTOGÆA.	{	North America, down to the Isthmus of Tehuantepec.	}	V. <i>Nearctic Region</i> .
ARCTOGÆA.	{	Europe, Africa north of the Atlas, and Northern Asia.	}	VI. <i>Palaearctic Region</i> .

We will now take a brief survey of the principal features of these six regions—as shown in the accompanying chart—and their most characteristic mammal-forms.

1.—AUSTRALIAN REGION.

Extent.—Australia, New Guinea, and Moluccas up to Wallace's line, New Zealand, and the numerous islands of the Pacific.

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Characteristics.—Absence of nearly all eutherian mammals, except a few rodents and bats; presence of six distinct families of marsupials with one hundred species, and the only two known forms of monotremes.

2.—NEOTROPICAL REGION.

Name.—*νεὸς*, new, and *τρόπικος*, *i.e.*, tropical land of the New World.

Extent.—America, south of the Isthmus of Tehuantepec, and the West Indies.

Characteristics.—Monkeys of the families *Cebidæ* and *Hapalidæ* absence of frugivorous bats, and presence of vampires; abundance of the porcupine family; absence of insectivores and civets, also of elephants; presence of tapirs; no ruminants except deer and lamas; presence of sloths, ant-eaters, and armadilloes; opossums.

3.—ETHIOPIAN REGION.

Name.—*Αἰθίορες*, ancient name for negroes.

Extent.—Africa, south of the Atlas; Arabia up to the Persian Gulf and Madagascar.

Characteristics.—Chimpanzee and other monkeys; absence of bears and deer; presence of lion, African elephant, hyrax, rhinoceros, hippopotamus, wart-hog, numerous antelopes, giraffe, manis, ant-bear—general richness in large and highly-organised ungulates.

4.—ORIENTAL REGION.

Extent.—Southern Asia, south of the Palæartic Region, and islands of Indian Archipelago down to Wallace's line, including Celebes.

Characteristics.—Orangs, gibbons, and other peculiar monkeys, flying lemur, tiger, and other cats, Indian elephant, rhinoceros, Malayan tapir, manis.

Generally, it may be said that the peculiar forms of the Oriental Region are fewer than in the Ethiopian Region, and that the Oriental Region has bears, deer, and tapirs, which are wanting in the latter.

5.—NEARCTIC REGION.

Name.—*νεὸς*, new, and *ἄρκτος*, *i.e.*, northern district of the New World.

Extent.—North America, down to Isthmus of Tehuantepec.

Characteristics.—General mammal-fauna, very like that of the Palæartic Region, but mixed up with endemic forms and intruders from the south. Bears, beavers, sheep, and deer similar; prong-buck, pouched mice and musquash peculiar; racoon and opossum, probably derived from the south.

6.—PALÆARCTIC REGION.

Name.—*παλαιὸς* ancient, and *ἄρκτος* north, as embracing the whole northern area of the old world.

Extent.—Land north of a line to the south of the Atlas, and running eastward through south of Palestine and Persia, along the Himalayas, through Central Asia and the centre of China to the Pacific.

Characteristics.—Absence of monkeys, lemurs, and frugivorous bats; abundance of carnivores—ounce, lynxes, wolves, foxes, bears, weasels, glutton; rodents—marmots, beavers, pikas; ungulates—sheep, deer chamois, and musk-deer; no elephants nor hyrax.

This division of the Earth's surface into six regions was first proposed by Mr. P. L. Sclater, F.R.S., in an essay on the distribution of the class of birds read before the Linnæan Society in 1857 (9). It was further elaborated and upheld by the same author, in an address given to Section D of the British Association at the Bristol Meeting in 1875 (10), and in a Paper published in *The Ibis* in 1891 (11). Mr. Sclater's system was adopted by Mr. Wallace in his standard work on 'Geographical Distribution' (13), and was there shown to be applicable to the other principal groups of terrestrial animals. Moreover, the names then bestowed on the six great primary regions are now in general use among naturalists in all countries. Mr. Wallace, who has devoted many pages to the discussion of this subject,* has come to the conclusion that, admitting that these six regions are not precisely equal in rank, and that some of them are more isolated than the others, they are in geographical equality, compactness of area, and facility of definition beyond all comparison better than any others which have been suggested for the purpose of facilitating the study of geographical distribution.

Notwithstanding Mr. Wallace's strong support, however, Mr. Sclater's system has not been universally accepted. Professor Huxley (6) in 1868 proposed to separate the world into two divisions—Arctogæa and Notogæa, the former containing the Nearctic, Palæarctic, Ethiopian, and Oriental Regions of Mr. Sclater, and the latter the Neotropical and Australian Regions. He adopts the Sclaterian Regions Nearctic, Palæarctic, Ethiopian, and Oriental as subdivisions of Arctogæa, and only stipulates for the formation of a Circumpolar province independent of the Nearctic and Palæarctic Regions. Notogæa Professor Huxley divides into three provinces (1) the Austro-Columbian (=the Neotropical), (2) the Australian (=the Australian Region minus New Zealand), and (3) the New Zealand province.

From this it will be seen that Professor Huxley's scheme does not diverge materially from the Sclaterian system; the chief points of differ-

* 'Geographical Distribution of Animals,' vol. i., chap. iv.

ence being (1) the uniting together of the Australian and Neotropical Regions into Notogæa; (2) the formation of independent Circumpolar and New Zealand provinces. With regard to the first point, almost the only bond of union between the Australian and Neotropical Regions, so far as mammals, at any rate, are concerned, is the presence of Marsupials in both regions. But the Marsupials of Australia seem to have but a very remote connection with those of South America, and there is at present no palæontological evidence of the former occurrence of the Australian forms, or of forms allied to them, outside of Australia itself.* On the other hand the presence of fossil opossums (*Didelphyidæ*) in the Eocene beds of France, shows that the South American forms were formerly more widely spread.

Professor Huxley also cites the Parrots (*Psittacomorphæ*) "as helping, together with the three-toed *Ratitæ*, to bind together the widely-separated portions of the south world." But on referring to the account of the distribution of the Parrots in Salvadori's recently published catalogue (8), it will be found that out of the six families into which he divides the group, five are practically confined to the Australian Region, and that the remaining one is widely spread throughout the tropical regions of both hemispheres. The most recent arrangement of this family, therefore, gives little support to Professor Huxley's arguments.

Looking, again, to the distribution of the *Ratitæ* (wingless birds), we find the Neotropical form (the rhea) more closely connected with the ostrich, the Ethiopian form, and that they both differ considerably from the emus, cassowaries, and kiwis, the three Australian representatives of this order. Thus, then, there seems to be scarcely any ground for connecting the Neotropical and Australian Regions under the name "Notogæa."

Before discussing the other differences between the Sclaterian and Huxleyan schemes, it will be as well to mention the diverging views of some other naturalists. Of these the chief is Prof. Heilprin, of Philadelphia, who in his 'Geographical and Geological Distribution of Animals,' "in accordance with a suggestion by Prof. Newton," has proposed to unite the Nearctic and Palearctic Regions into a single realm—the "Holarctic"—and to separate the Pacific Islands from Australia as the "Polynesian Realm." Again, Mr. J. A. Allen, of New York, in his recently published Papers (1 and 2), has shown considerable independence of thought in this matter. In the introduction to the later of the two Papers quoted, which deals chiefly with the distribution of North American mammals, Mr. Allen gives an account of

* Recently Señor Ameghino has described from the Santa Cruz beds of Patagonia, which are probably of Eocene age, certain fossil mammals which he has referred to the Daryun Dal, one of the Australian families. If these relationships should turn out to be correct, it will indicate further evidence of some connection between South America and Australia, though at a considerably remote epoch of geological time.

the influences which, in his opinion, mainly determine the geographical distribution of life, dwelling first on the great importance of temperature and moisture, and afterwards on the inter-relation of land-areas, which, he says, is "co-eval and perhaps more than co-ordinate with climate in its influence upon the distribution of life." Next, Mr. Allen treats of the seven primary life regions, or "realms" as he terms them, into which he proposes to divide the Earth. These are:—

1. *An Arctic Realm*, occupying all the country in both hemispheres north of the isotherm 32° F., this boundary corresponding very closely to that of the northern limit of trees.

2. *A North Temperate Realm*, occupying the whole of the northern hemisphere between the isotherms of 32° and 70° F.

3. *An American Tropical Realm*, consisting of Tropical America.

4. *An Indo-African Realm*, consisting of Africa, except the northern border, and Tropical Asia and its islands.

5. *A South-American Temperate Realm*, embracing extra-tropical South America.

6. *An Australian Realm*, equivalent to the Australian Region of Sclater.

7. *A Lemurian Realm*, containing Madagascar and its islands.

Mr. Allen's views on Distribution have been criticised and answered by another American naturalist, Mr. Gill (4), who proposes a division of the Earth into nine "realms." These, as will be seen, although not differing in many cases from regions adopted by former authorities, are distinguished by an entirely new set of names, as follows:—

(1) The Anglo-gæan (= Nearctic Region).

(2) The Eury-gæan (= Palearctic Region).

(3) The Indo-gæan (= Oriental Region).

(4) The Afro-gæan (= Ethiopian Region).

(5) The Dendro-gæan (= the tropical half of the Neotropical Region).

(6) The Amphi-gæan (= the temperate half of the Neotropical Region).

(7) The Austro-gæan (= Australia, New Guinea, and the adjacent islands).

(8) The Ornitho-gæan (= New Zealand).

(9) The Neso-gæan (= Polynesia).

Dr. Bowdler Sharpe (12) has also recently published his views on the zoo-geographical areas, as worked out from the distribution of birds. Dealing here only with the division of the Earth into regions, we notice that, although he makes many complimentary allusions to Mr. Allen and his views, he adopts in all its entirety the Sclaterian system, with the exception that he constitutes an Arctic sub-region to include the more northerly parts of both the old and new worlds.

Finally Professor Newton, who has recently published his views on

this subject as regards birds (7), adopts the methods of divisions proposed by Mr. Sclater with the two following exceptions. In conformity with the suggestion already made to Professor Heilprin, he unites the Palæarctic and Nearctic Regions under the title "Holarctic," and he also separates New Zealand from Australia as an independent region.

The chief questions in dispute, therefore, seem to be as follows:—

(1) Whether the Palæarctic and Nearctic Regions are to be recognised as separate?

(2) Whether Madagascar and New Zealand are to be separated as independent regions from the Ethiopian and Australian Regions respectively?

(3) Whether the Ethiopian and Oriental Regions should be joined to form one region?

(4) Whether there are any good grounds for dividing the Neotropical into two separate regions.

The only way in which questions of this sort can be definitely settled is by constructing lists of the families and genera of the various classes of the terrestrial faunas of the regions in dispute, and then carefully comparing them, in order to determine the percentage of peculiar species and of absentees. The difficulty of doing this satisfactorily is twofold.

(1) The absence of any definite boundaries to most of the regions, and hence the difficulty in determining how many of the border-forms, which have obviously intruded from the neighbouring regions, should be counted.

(2) The uncertainty as to the limits of the genera. This uncertainty has been greatly increased of late years by the action of some zoologists in proposing a multitude of unnecessary generic terms.

When these two factors have been settled and the lists constructed, a further difficulty is met with, and this is one which depends very much on the individual fancy of the author, namely, as to the percentage of peculiarity which should be required to constitute a region.

Taking the first question in dispute, we find that Mr. Allen, in his paper already quoted (2), gives a tabulated list of the genera of his North Temperate realm, dividing them into North American and Eur-Asiatic (= Palæarctic) forms, and putting the individual genera into three categories, namely, those circum-polar, or common to the Nearctic and Palæarctic Regions (numbering 32); those peculiar to each region (*i.e.* 29 to Nearctic and 41 to the Palæarctic); and, finally, those which range further south into the Neotropical Region on the one hand, and into the Oriental and Ethiopian Regions on the other.

Working from these tables we find that 38 per cent of the Nearctic genera and 42 per cent. of the Palæarctic genera, are confined to their respective regions, while 42 per cent. in the case of the Nearctic and 34 per cent. in the case of the Palæarctic, are common to the two regions.

These last percentages include, however, several quite wide-spread genera which can hardly be called circum-polar—such as *Sciurus*, *Sciuropterus*, *Lepus*, *Lutra*, *Canis* and *Felis*.

These figures show that there is, as has indeed never been disputed, a great amount of similarity between the Nearctic and Palæarctic faunas, but not enough to justify the junction of these two great land-masses into one "region" or "realm."

As for the so-called "Arctic realm," which consists of the land bordering the Polar Ocean and Hudson's Bay and the great peninsula of Greenland, "beyond the limit of arboreal vegetation," together with the similar Arctic portion of the old world, Mr. Allen states, no doubt correctly, that it contains a "homogeneous hyperborean fauna of circum-polar distribution." But looking to the extreme poverty of life in these inclement latitudes, as Mr. Allen well puts it, I think it quite unnecessary to elevate this wretched fraction of the Earth's surface into one of its principal constituent life-regions. The plan adopted by Mr. Sclater and Mr. Wallace, of regarding it as a borderland between the Nearctic and Palæarctic Regions is in my opinion far preferable.

The question of the recognition of Madagascar and New Zealand as independent regions will be further discussed in the articles on the Ethiopian and Australian Regions respectively, as will also the propriety of dividing the Neotropical into two separate regions. A few words, however, may be said here with regard to Mr. Allen's proposal to join together the Oriental and Ethiopian Regions into one "Realm."

According to the estimate given below (Table I.), the total number of genera found in the Oriental Region is one hundred and thirteen, and of these thirty-nine are not found elsewhere. Of the balance—seventy-four—eight only are common to the Oriental and Ethiopian Regions, and are not found in any other region,* whereas twenty-eight more, also known to the Oriental and Ethiopian Regions, are likewise found in the Palæarctic Region. Furthermore, out of the eight genera above mentioned, although they are not now found in the Palæarctic Region, four of them are known to have existed there during the Pliocene period. This shows, I think, very conclusively that what small resemblance there is between the mammals of the Oriental and Ethiopian Regions is due to a similarity in their origin, rather than to any sort of direct connection between the two regions.

To sum up the subject I add a table of the numbers of orders, families, and genera of mammals found in the six different regions, together with the number of genera confined to them (endemic), the number of those just crossing the regional borders (quasi-endemic), and the number of those of extended distribution in each region.

* These are *Manis*, *Rhinoceros*, *Elephas*, *Golunda*, *Atherura*, *Viverra*, *Mellivora*, and *Nycteria*.

In the second table these numbers have been reduced to percentages, which give in some respects a better idea of the relative specialisation of the mammal-fauna of each region. On examining these tables it will be seen that the Ethiopian Region stands second in point of number of genera confined to it, coming next to the Neotropical Region.

The lists of genera from which this table has been worked out are based on those adopted in Flower and Lydekker's (3) standard work on mammals, with a certain number of additions and corrections. In consequence of this the figures in the case of the Nearctic Region will not be found to exactly correspond with those quoted from Mr. Allen above (2). It must, of course be understood that the figures are merely approximate.

TABLE I.—APPROXIMATE NUMBERS OF FAMILIES, GENERA, AND SPECIES OF MAMMALS IN THE SIX REGIONS.

Regions.	Families.				Genera.				Species.
	Endemic.	Quasi-endemic.	Wide-spread.	Total.	Endemic.	Quasi-endemic.	Wide-spread.	Total.	Total.
1. Australian .	7	4	11	22	51	6	27	84	284
2. Neotropical	10	5	13	28	103	15	12	130	501
3. Ethiopian .	10	2	30	42	99	3	48	150	577
4. Oriental .	2	1	33	36	39	10	64	113	557
5. Nearctic .	2	0	20	22	21	2	43	66	192
6. Palearctic .	0	0	32	32	25	4	74	103	448

TABLE II.—NUMBERS GIVEN IN TABLE I. REDUCED TO PERCENTAGES OF TOTAL NUMBERS OF FAMILIES AND GENERA.

Regions	Families.			Genera.		
	Endemic.	Quasi-endemic.	Wide-Spread.	Endemic.	Quasi-endemic.	Wide-Spread.
1. Australian	31	18	50	60	7	32
2. Neotropical	35	17	46	79	11	12
3. Ethiopian	23	4	71	66	2	32
4. Oriental	5	2	91	34	8	56
5. Nearctic	9	0	90	30	3	65
6. Palearctic	0	0	100	24	3	71

The groups entirely confined to each region are classed as "endemic;" those that merely cross the frontiers as "quasi-endemic;" all others are considered as "wide-spread."

The percentages, it will be observed, on account of the omission of fractions, do not exactly make up one hundred in every case.

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DESCRIPTIVE NOTES ON THE SOUTHERN PLATEAU OF BOLIVIA AND THE SOURCES OF THE RIVER PELAYA.*

By CHARLES M. S. PASLEY.

THE area of the southern plateau, or “Pampas Peladas,” of Lipez is about 11,000 square miles. It is situated to the east of the highest range of the Andes, and of the various ranges whose eastern slopes form the headwaters of the Rivers Pilcomayo and Pelaya, and between the “Salina Grande,” or Great Salt Pampa, which forms the central plateau in lat. 20° S., and the mountains of Lipez and Quetëña in lat. 22° S.

In many places these pampas have the appearance of old lake-beds extending southward from Lake Aullagas, showing evidences that the Lake of Titicaca at one time extended to these regions. On the hill-sides in many places the evidences are very distinct, the rock being

* This article has been in hand for more than a year. It has been kept back in the hope that a suitable map would be received from Mr. Pasley. As no map has come to hand, it has been considered desirable to publish the article without further delay.

eaten away by the action of the water for a considerable distance, giving the appearance of a "blanket," or horizontal vein; but these marks disappear entirely in some parts, owing to the action of weather and to slides of earth from the hills. In the northern part of the plateau, in the vicinity of the Salt Pampa, there are small hills and patches of "travertin," otherwise known as calcareous rock, containing shells, etc.; this is termed by the natives "caliche," the term used on the Pacific Coast for the crude nitrates that are found in Tarapaca. This rock is used for building purposes; the blocks form substantial walls, while the Indians burn it in small kilns of their own make and extract the lime. Further south the pampa is perfectly bare and nearly level, presenting to the eye a vast stretch of brown earth, varied by patches of salt. This earth in the rainy season, between December and March, is changed to mud, and thus is impracticable for traffic; and in winter it is alternately baked and frozen.

During the heat of the day the effect of the mirage is frequently seen here, all the distant hills, and even the small hills at the distance of a mile, appearing to be in the air; and as the railroad* from Antofagasta crosses the pampa, I have seen the curious spectacle of a locomotive and train apparently flying through the air.

Further south again, where the pampa commences to rise, it is broken by low hills or undulations, and is covered with "tola," a short, hardy, resinous shrub, somewhat like the sage-brush of North America, and very valuable for fuel. "Paja brava" also grows there, a spiky grass which affords pasture for large herds of llamas.

The principal feature in these pampas is the Rio Grande de Lipez, which rises in the south, in the mountains of Nuevo Mundo, having an important tributary, which rises more to the south-west, in the hills of Suniquira. After leaving the hills in several small streams, which unite at the edge of the pampa, and flow round a small, conspicuous hill called Galeras, that river has a sandy bed, and in the winter months disappears and flows underground, in "manantiales," as they are termed. The river reappears again some 20 miles lower down as a fair-sized stream, sluggish, and well stocked with ducks and other water-fowl. Its water is very salt and quite undrinkable, but I found the ice formed from it in June was when melted good enough for cooking purposes and for watering the animals. The river as it approaches the salt pampa divides into several branches, and forms a small delta before finally disappearing in the salt. In the rainy season it becomes a large river, sometimes rising 7 to 8 feet, overflowing its banks, and spreading to

* This railroad from the Pacific coast, built by the Huanchaca Mining Company, has lately been extended to the town of Oruro. It has nearly 620 miles of line, with a gauge of 2 feet 6 inches, and thus is the longest narrow-gauge line in the world. It also possesses the highest bridge, the San Pedro bridge being 325 feet high.

a great distance, leaving, as it retires, numerous lagoons, which however soon disappear.

There are many other small streams that drain into these pampas and lose themselves in the sand, the principal of these being the Rivers Catani, Collpa, and Caniza. They are insignificant in the dry season, and torrents during the rains: nearly all the other watercourses are dry in the winter. In nearly all the hills that surround the pampa there are good springs of water, several being thermal, especially in the hills to the south; and in nearly all parts of the pampa, at a depth of from 4 to 6 feet below the surface, sufficient water can be obtained for drinking purposes, but near the salt pampa the water is brackish.

The ranges bordering the pampa on the west include many hills of great altitude, the highest of these being Tapaguilcha (18,960 feet), the volcano of Ollague, and that of San Pedro, nearer to the coast. All of these ranges are of an eruptive formation of recent date, the eruptive rocks being principally trachytes and andesite. I have also seen inside some of the mines diorite and porphyritic granite. There is very little slate on the western side of the pampa.

The volcano of Ollague has its principal crater on its southern side about 1000 feet below the summit; this emits a considerable volume of smoke and steam. The summit of the mountain is nearly always covered with snow; the sides of the hill are covered with masses of sulphur and iron-stained rock, and the blending of the red and yellow colours and the white cap of snow give the mountain a very beautiful appearance. It is accessible on its eastern side, but I had to abandon all ideas of making the ascent as I was unable to obtain Indians, owing to the whole week being one of religious feast days; and I was told that it was dangerous to attempt the ascent alone on account of the numerous sulphur-beds, the fumes from which overcome a man in a few moments. All the other hills in the neighbourhood are of the same appearance as Ollague, one side of the hill of Ascotan being apparently all sulphur.

Between the mountains of Ollague and Ascotan is the Lake of Ascotan, with an area of from 60 to 70 square miles. It is more of a bed of borate of soda than a lake, although numerous pools of salt water occur, and water is found at 3 feet below the crust. This crust is so firm that the old cart road to the coast passes over it, and the borate of soda varies in depth from 2 to 7 feet, and, I was informed, in some places extends to 20 feet deep. At the side of the lake was an establishment for refining and preparing the bi-borate or borax of commerce, but it was abandoned at the time of my visit, on account of the Chilian revolution and civil war. The railway passes at the western side of the lake and crosses to the north.

The volcano of San Pedro, from the crater of which a slight smoke occasionally issues, shows evidence of a very recent eruption, for the streams of lava and rock which have run over the pampa at the base of

the hill look as if they had only just stopped. I tried to find out their date from the Indians in the vicinity, but the original owners of the "ranchos" or huts had all left at the time of the war with Chili and the building of the railroad, so that no traditions remained as to the date of the eruption, as is the case in many parts of South America.

At the foot of San Pedro is a small hill, not over 150 feet above the plain, of conical shape called Puruma; this has a large crater which seems to have been the most active at the time of the eruption; there was a slight sulphurous smell over it, but no smoke.

These volcanoes and the borax lake are not shown in my map, being to the westward of the area in the map.

The mountains of Lipez at the south of the pampa are the highest group of this district, the mountain of Nuevo Mundo being 19,670 feet high, and Jacquegua about 1000 feet lower. Nuevo Mundo is shaped like a pyramid on three sides, and to the south joins on to the mountain of Jacquegua; I was told that Nuevo Mundo was inaccessible, but found that it was not so; I tried to ascend it, but as it was in the worst month of the year, July, was unsuccessful.

I started at daybreak from a small hut at the base of Jacquegua, and had no difficulty in climbing except for the very rarefied air. When the sun rose about 7 A.M., the thermometer was 9° Fahr. below zero at a height of 17,000 feet. At 2 P.M., we reached the divide that joins the Nuevo Mundo to Jacquegua; this I crossed, but in places had to go on all fours, as the tremendous wind that was blowing made it impossible to balance oneself in bad places. We were two hours crossing from one mountain to the other, owing to the wind; on a fine day I could have done this in half an hour. When we were about 400 metres (vertical) from the summit and about 1 mile of climbing, the two Indians accompanying me refused to go further, as it was late and they were nearly frozen to death. I could hardly blame them, and the prospect of passing the night at a height of 18,000 feet was not agreeable to myself; so that I had to give up the ascent, although the rest of it was easy, as I could see the rock up to the top, owing to the wind having swept the snow away and left the top completely bare. At the highest point reached, 18,430 feet, the thermometer showed 2° Fahr. at 4 P.M. In order to avoid the precipices, I had to walk about 12 miles, but I afterwards found out a much easier way, about half that distance, and in the summer, with more daylight, I could have easily accomplished the ascent. It was 9 P.M. when I reached the Indian hut on my return.

I saw nothing but "viscachas" the whole day, being above the line of vegetation, and apparently life of any description. The view from Jacquegua was beautiful; the weather being perfectly clear, I could see the "cordillera" for 300 miles to the south and for a considerable

distance to the west. The hill is of trachyte formation and has numerous veins of mineral, mostly silver, running through it.

On the northern side of Nuevo Mundo is a flat-topped hill, called the Mesa de Plata or "Silver Table," which is celebrated for its wealth of silver ores, which have been very extensively worked by the Spaniards, and more recently by a Bolivian Company which failed. The Spaniards worked on one lode, open workings from the surface to a depth of 500 feet, the lode being 50 feet wide in places. As these workings were not properly secured, the side fell in and buried a number of workmen, tradition says from 300 to 600; this accident caused the mines to be abandoned.

Further to the east is a huge broken up range called the Serrania de Guadalupe. This includes the mountains of Moroco, 18,000 feet, and Boneta, 18,380, and various others over 16,500 feet in height. The Boneta is called that name owing to the shape being more or less like the old-fashioned bonnets. All of these hills resemble Nuevo Mundo in their formation, but have slate on the eastern side. They form a large mineral district, with silver predominating, but with an abundance of antimony and copper; while lead, bismuth, gold, tin and quicksilver are also found. But there is very little work done, owing to the distance and expense of transport and the amount of water in the mines.

Ten years ago all the transport of ores and metals was performed by mules and donkeys; from this district, and as far north as Chayanta, the road was by the Argentine Republic to the port of Rosario. Now the railroad from the Pacific Coast has changed everything, opening up other mineral districts, and causing these to be abandoned. One old gentleman who had left off mining, after losing £30,000 in his mines, took me to see his machinery, which was lying in a shed at his mine. He had two vertical Tangye boilers, and three Cameron pumps. He showed me his bills of lading, from which it appeared that he had spent £7000 in freight from Rosario. I could not help thinking that his pluck ought to have had a better reward; his mine was of no account whatever.

The veins of this district run from east to west, in formations of andesite and trachyte. On the slopes of these hills the vegetation exists higher on the eastern than on the western side, owing to the winds, the prevailing direction of which is from west and south-west. Thus on the eastern side grass grows in sheltered places at a height of 16,500 feet, and the tola shrub a little lower, while on the western side the limit is about 1000 feet lower. The line of snow, or perpetual congelation, may be said not to exist, as I have seen the summit of Nuevo Mundo completely bare of snow, and as all other hills were bare at the same time, I do not think it was owing to the wind. As a general rule the snow remains on Nuevo Mundo all the year round above the height of

18,800 feet; on the Boneta and Chorolque and Jaquegua above 18,000 feet, or merely on their summits. On the hills of the western cordillera it seemed to be about 17,000 feet, and this is the height fixed by Pentland for the north of Bolivia.

Between the Nuevo Mundo and the hill of Mesa de Plata is the village of San Antonio, now nearly abandoned, only five families living there. It owed its existence to the mines, and at one time had about one thousand inhabitants. It boasts a large church and two or three fine houses, built by the Spaniards in the year 1645. It is 15,600 feet above sea-level, and is therefore one of the highest villages in the Andes.

On the plains, at the foot-hills of Boneta, is the town of San Pablo, the capital of the province of Sud-Lipez, and the residence of the provincial authorities. On my arrival the sub-prefect gave me a most cordial welcome, and apologised for not being able to invite me to his house, as the roof had fallen in, and he was taking refuge in his kitchen. The town consists of one street, very irregular, with a few alleys running off to isolated houses. There are about two hundred houses; but the population of the town is only one hundred and fifty, as most of the houses belong to the Indians, who live outside the town, and only come in for the religious feasts, or for the priest's visits to the church, which occurs two or three times a year. An enterprising Portuguese, who, I am afraid, had more capital than brains, thinking that this town would become a mineral centre, built a large house, with warehouses, etc., and consequently became bankrupt; but I benefited by his expenditure, as his house made very comfortable quarters during my stay.

The Indians of these districts are very hardy, and like all in Bolivia, are great walkers; their wealth invariably consists in the herds of llamas. These, when full grown, are worth £1 each, and some Indians own as many as a thousand. These animals may be said to entirely support the Indians, as their clothes, meat, sacks, means of transport, etc., are obtained directly from them. The ponchos and shawls made from the vicuña wool are often very fine, and are worth from £5 to £12 each. In the winter, from May to September, the Indians travel to the valleys, taking salt with them, which they exchange for maize and other products of the warmer regions.

On the slopes of the mountains of the above district there are many curious plants; some of these have valuable medicinal properties, which the old women understand very well; others are very poisonous, and cause a great mortality amongst the flocks of sheep and the donkeys; but the llamas seem to know and avoid them. The worst of these plants is known by the name of "viscachera"; there are two other plants of similar appearance, with apparently no difference, but they are harmless; they look like a bunch of broken wires, and are always mixed up with

other grasses. The "manzanilla" is another poisonous plant, with a leaf somewhat similar to the scented geranium, and has a dark yellow flower; this is of course very different to the manzanilla. In the summer months a great variety of small flowers spring up close to the ground, generally orange coloured; two of these seemed to be leafless, but on digging them up, the leaves appeared close under the flower.

The "keñua," a tree highly prized for fuel, grows as high as 16,000 feet in sheltered spots in the ravines, and grows abundantly between 14,000 feet and 12,000 feet. The principal fuel is the "yareta," a plant of the carrot family, as I am informed by Professor Philippi of Santiago, Chili. It grows in masses on the rocks, and looks like moss-covered boulders; some of the masses I measured contained 9 cubic yards of hard, resinous material. Another kind is much softer and less resinous, and grows on the pampas, but in small masses, seldom covering a square yard; but it is considered valueless for fuel.

In a few places where there is water for irrigation, the Indians cultivate barley in small patches; but this never ripens. The only flower that I knew was the calceolaria, which I found growing under some rocks on the sheltered side at the height of 15,000 feet.

I have made a small collection of plants of these high regions, which I have sent to Professor Philippi of the Botanical Gardens in Santiago.

The animals that live in these altitudes are mostly known, with the exception of some mice which inhabit the pampas, and I think live on the roots of plants. One of these I watched for several minutes; it was marked with brown and grey stripes running the length of the back, with whitish belly and the head dark. As I was armed only with a rifle I could not kill it, and the Indians either could not or would not trap one for me. The commonest animal is the wild guinea-pig, of which there are a great number; they are also a great nuisance, burrowing deep, and making the pampas very difficult for mules to pass. The natives call them rabbits.

On the hill-sides where it is rocky there are plenty of "viscachas," or Peruvian hares; they are capital eaters and are very tame. I saw four of these domesticated and as tame as ordinary pet rabbits at home. The chinchilla is scarce, and I never saw one, as they are nocturnal. The Indians trap them, driving them out of their holes with ferrets. Another of the burrowing animals of the pampas has a peculiar cry, and is, I believe, similar to the "tuco-tuco" of the South, but the cry was much shriller. I never saw the animal, and could never find out exactly from whence the noise came. Of the larger animals the "vicuña" is the most abundant. There are also "guanaco" and a few deer of moderate size and of a grey colour.

There are large flocks of ostriches (*Struthio Rhea*) smaller than those of Patagonia. I found several of their nests, and the eggs formed

a welcome addition to our scanty larder. Out of eight nests that I found, the largest number of eggs in one nest was eleven; further south I have heard of much larger numbers, but the Indians assured me that they never found over fifteen in a nest. I do not know whether this is on account of the altitude or the cold; the thermometer being often 2° to 4° F. in the months of February and March, which is the hatching season, although I found eggs up to the end of May.

There are several kinds of ducks, also a kind of goose called by the Indians "huallata." Flamingoes live in the small lagunas and streams. I found several kinds of teal and a few herons, though these latter appeared very distinct from the English kind. Of the smaller birds there is a great variety of the finch tribe; some of these are song-birds, one especially called the "hilguera," a blackbird about the size of a linnet, the notes somewhat resembling those of a thrush but much weaker. There are plenty of condor and other carrion birds, also a few small eagles and hawks.

To the south of the Lipez mountains rises a river, which is known by various names, as it generally bears the name of the district with the prefix of Rio Grande; but as half the rivers of Bolivia have this name it is somewhat confusing. The river flows eastward through rocky and picturesque ravines, occasionally widening out and having less velocity. In these favoured spots the land is cultivated, and is generally very fertile wherever irrigating ditches can be made. The crops are principally alfalfa, wheat and barley, and "quiñua," which resembles spinach when young. It grows to the height of 3 or 4 feet, and the seed is in masses of very dark crimson. The river contains a fair amount of water in the dry season, and in the rainy months is large and sometimes rises 12 to 18 feet in a few hours, and sweeps away trees and does considerable damage to the farms on its banks. As it flows past the village of Estarca, it is joined by the River Cucho; from this junction as far as the neighbourhood of Tupiza, where the river of that name joins it, it is called the Rio de Sinpacha, from the name of a town on the northern bank, while lower down it is called the Rio San Juan. From Estarca downwards the river-bed contains gold, and there are gold placers for leagues on the banks at both sides. Lower down the land is cultivated everywhere, maize being the principal product, and "chicha," the native drink, is the principal industry.

Above Estarca there are several gold-bearing quartz veins, but these are not worked; they are all owned by natives of the district, who are waiting until some unsuspecting "Gringo" (i.e. foreigner) shall come along and offer them the millions of dollars which the veins are supposed to be worth. I have seen some large nuggets taken from the river; one of these weighed over five ounces.

The town of Tupiza is the principal town of the district, and the capital of the province of Sud-Chichas, and was once of considerable

importance, being the seat of the Custom House, and the point of arrival and departure of most of the products of Southern Bolivia. Since the railroad from the Pacific Coast has been established, the current of traffic by way of the Argentine Republic has almost entirely disappeared, and now Tupiza has fallen into decay. It has about two thousand inhabitants.

Further north, on the Rio Grande de Cotagaita, is the town of Cotagaita, a small agricultural town of very little importance, but the capital of the province of Nor-Chichas. The river—which rises in the mountains of Chocaya and Chorolque, flows eastwards, and is joined by the Rio de Tumusla—is nearly as large as the other Rio Grande, which it meets in the district of Cinti, and forms the Rio Pelaya, the largest tributary of the Pilcomayo. The Rio de Cotagaita is very similar to the Rio de Sinpacha, being a gold-bearing stream, and has similar cultivated lands on its banks.

In the Quebradas and on the river-banks there are small forests of trees, principally of the acacia family, these being called “churqui.” The wood is used in the mines and for making charcoal. I have noticed eight different kinds of these trees, being distinct in the appearance of their flowers and bean fruits. Another tree which is very plentiful is the molle. There are algaroba trees, but these are scarce. Fruit trees are cultivated apparently with difficulty. The variety in the cacti is very striking; from the giant species, some of which are 30 feet high, to the very smallest forms. The Indians use the wood of the larger species for doors and furniture, it being easily worked; they also gather the fruits and take them to the mining districts.

Nearly all the plants that I saw bore brilliant flowers, and in the summer months the hill-sides were literally carpeted with red and yellow flowers. In the valleys there is an endless variety of plants and birds, and I can only regret that I am not a naturalist to enjoy them as they ought to be enjoyed.

There are plenty of humming-birds, not, however, of very brilliant plumage; with a few exceptions, they are all of the larger kinds. The parrots are the liveliest birds, for their noise as well as their colours. There are several kinds of jays, and I saw a few cardinals.

The insects are rather disappointing; the greatest number and also the greatest variety are obnoxious, being principally venomous flies. Of these, the “nina-nina” is the most interesting; it is a large blue fly about the size of a hornet, with yellow wings and very long legs; it is said to be a general benefactor, killing the largest spiders and small snakes, its sting being very severe. I have heard that in some cases it has killed men, but it never attacks human beings unless meddled with. I once saw one kill a chicken when the youthful bird endeavoured to eat it; it seemed to drive its sting into the bird's brain.

Of the spiders, some of the most unpleasant members of that family have their homes in these valleys, one sort being as much as 4 inches across, the body being the size of a walnut; the Indian name for it is "apasauka."

Another disgusting insect is the vinchuca, the bite of this insect being very poisonous. I was bitten on the face and neck by one, and the irritation and the lump did not disappear for two months after; it is about an inch long, and looks somewhat like a beetle with a shield-shaped back. The beetles seem to be few and are of the most hardy kinds and dull colours. I did not see any tarantulas.

Of the butterflies I recognised nearly all as being closely allied to the English kinds, such as heaths, sulphurs, tortoiseshells, whites and blues.

The hills of these districts are all shales with occasional intrusions of andesite, these latter being mineral hills, containing veins of silver, lead or copper.

The principal feature of the provinces of Chichas is the mountain of Chorolque, a beautiful mountain not far from Cotagaita. It rises to a height of 18,600 feet, and towers above the surrounding country. I climbed to the top of it on a beautiful day, and I could see to the eastward for 200 miles; the atmosphere being very clear, I could easily distinguish the hills of Potosi, about 150 miles away. Of course, like nearly all the big hills of Bolivia, it contains mines, these being of tin and bismuth, and the chemist at the mines informed me that he had found tin, bismuth, silver, gold, copper, quicksilver, lead, zinc, iron, wolfram, antimony, and manganese in this hill.

The climate in the valleys is mild, the cold at night being moderate, but the heat sometimes intense. One is constantly changing from summer to winter when travelling in these mountainous districts, and the difference between the temperature in the sun and in the shade is very remarkable, owing, no doubt, to the rarity of the atmosphere and the absence of radiation.

The Indians who live on the haciendas are always directly under the control of the authorities residing in the small towns of the district, but the greater number live in communes, and are directly under a chief, or cacique, who is chosen for lifetime. They obey his orders only, and very rarely dispute his authority. The cacique is responsible for his tribe to the sub-prefect of the province, and all of these Indians pay a poll-tax of about fifteen shillings per head to the Government yearly, in return for which they have several privileges. No person can interfere with them or their lands, and they are exempted from military service, except in case of war. They also have to mend all the roads of their district. The largest item of the revenue is collected in this manner; the proprietors, etc., are very free from taxation, it being these latter who make the laws.

The Indians are very superstitious, and are Roman Catholics, nearly every small group of houses having a tiny chapel with an image of the Virgin or a saint inside; these are sometimes very curious, being made of mud or wood and being very rudely carved.

They are very suspicious of strangers; and on first acquaintance refuse to do anything or sell anything, always saying that they have nothing even when it is before one's eyes. I found that by treating them well and not doing the same as all the natives do, *i.e.* cheat them, they will in a few days do anything one wishes, and bring everything that they can, such as forage, etc. It is very inconvenient when one is in a hurry; but as nobody is ever in a hurry in this country, and everybody is poor but won't work because they have what is necessary, one can only be patient or swear, the latter being the most frequent recourse of the Anglo-Saxon.

The district lying north of the river of Cotagaita is of the same mountainous description, the two mountains of Tasna and Ubina being the principal features.

TWO BOOKS ON CENTRAL ASIA.

THE journey described in Lord Dunmore's two volumes * was undertaken last year for purposes of sport and pleasure by the author and his friend Major Roche. They travelled from India by the ordinary route through Kashmir and Ladak, to Yarkand, and thence made a tour on the Pamirs, which was brought to a close at Kashgar, where the travellers separated, the author returning to Europe by the Russian road through Ferghana and Transcaspia, and his companion (it is inferred) by way of Gilgit, to India. The book is written in a lively and interesting way, and contains two useful maps. There are also many illustrations, some of them good, though the greater part can hardly be said to give a faithful representation of the scenes they are meant to depict.

In his preface Lord Dunmore tells us that the book "has no pretensions beyond being a faithful daily record of the wanderings of Major Roche" and himself. Still the author frequently treats of matters that are usually considered to lie within the domain of the geographer, the surveyor, and even, in some instances, of the historian. When dealing with these subjects he is not always so happy as when he adheres to his original purpose of describing the events of his tour. If the journey had been made over unknown ground and in a new country we should have welcomed with gratitude Lord Dunmore's attempts to furnish us with some preliminary knowledge of the geography of the region he had visited. But he does not appear always to distinguish between new

* 'The Pamirs.' By the Earl of Dunmore. 2 vols. London, John Murray, 1893.

geography and old, or to sufficiently appreciate the fact that a traveller untrained to geographical work, and possessing but a meagre "scientific" outfit, should be very cautious in his attempts to correct the results of the researches of the professional surveyors and more or less trained geographers in whose footsteps he is following. The consequence is that the book contains statements which cannot be accepted as accurate. Though the last visitor to the Pamir region, Lord Dunmore's descriptions should not be regarded as superseding those of former travellers.

The indications for altitude are given throughout the journey with little misgiving, apparently, as to their trustworthiness. They are based on the readings of ordinary aneroids, and cannot consequently be accepted as geodetical measurements. There is nothing in the book to show that the instruments used had even been tested for any particular ranges of altitudes, or that the results taken from them were based on corresponding observations at fixed stations. Even if these precautions had been taken, the heights deduced would have shown the altitudes much too high, as any reader of Mr. Whympers's work on that imperfect machine, the aneroid, would be aware; but from all the author tells us to the contrary, his altitudes are merely the readings of the aneroid scale, and have not been subjected even to local corrections. Previous travellers—Colonel Trotter, R.E., and Dr. Scully for instance—had used mercurial barometers, and had based their observations on a system (arranged for before leaving India) of corresponding observations at selected stations, whose heights had been fixed by the trigonometrical survey, and each result was properly calculated and corrected for deducing the final altitude after returning to India. Other explorers had used boiling-point thermometers, and had calculated in the same way the differences on fixed stations; work of this description, and in some cases even heights fixed directly by the trigonometrical survey, cannot be superseded by means of crude aneroid readings. These remarks apply to the whole of the route traversed by Lord Dunmore, from Kashmir to Khokand, but they do not refer to his authority for giving the heights of mountains seen only from a distance, which he could have had no means of measuring, and more especially for altering the elevation of perhaps the highest and most noteworthy mountain of the Pamirs from 25,350 feet to 25,800 feet. This peak, variously called Mustagh-ata, Tagharma,* etc., was fixed trigonometrically by Colonel Trotter, from the plains of Kashgar, in 1874; and it is difficult to conceive on what grounds Lord Dunmore adds 450 feet to the height given by Colonel Trotter on his map.

Another subject on which Lord Dunmore seeks to upset the well-reasoned conclusions arrived at by previous explorers and geographical critics, is that of the origin of the Oxus. He is of opinion that the

* It is not the Tagharma peak, however.

Aksu, or Murghábi, springing from the basin of the Chákmák Lake, or Oi Kul, is the real head-stream of the Oxus, and gives as his reasons: (1) that the course of the Aksu, from its source to Kila Wámar in Roshan, is some 10 miles longer than the Panjah from its source (close by that of the Aksu) to the junction of the two rivers at Wámar; and (2) that the name *Oxus* is derived from the Turki *Ak-su*, hence the Aksu River should be the parent of the Oxus. Neither of these reasons can be accepted as adequate. In the first place the length of course or remoteness of origin has no weight in determining the relative importance of two rivers. The chief, and usually the only, standard of comparison is that of volume, or cubic discharge for a given period of time.* This is a proposition long recognised by geographers. If Lord Dunmore could show that the Aksu, on reaching the point of confluence with the Panjah, possesses the greater volume, he might prove his theory, but this is a matter that can only be determined at the confluence itself, a locality which he had no opportunity of visiting. As far as we are informed up to the present, the facts all tend in favour of the Panjah being the larger stream. The only English explorer who has ever seen the confluence went carefully into the subject, and showed that the Aksu (there known as the Bártang) has a much less volume of water than the Panjah, while the only Russian traveller (the botanist Regel) mentions nothing about the matter. As regards Lord Dunmore's second reason, the question of the derivation of the name of *Oxus* need not be further entered into here than to point out that authorities of no less weight than Sir Henry Rawlinson and the late Sir Henry Yule have shown that it is from *Wakhsh* (the Surkháb of Karategin and Eastern Bokhara) that *Oxus* is descended, and that the similarity to the Turki *Ak-su* is a matter of chance only.†

On the subject of the lakes of the Pamirs, also, our author seems to have arrived at certain conclusions intended to modify those of previous travellers, though in one case, at any rate, he does not appear to have examined the question very closely. He tells us that the sheet of water "represented in nearly all the maps" as one large lake, and called Rang-Kul, is in reality "two distinctly separate lakes," called respectively Chor-Kul and Rang-Kul. More particular inquiries from the local Kirghiz, however, might have revealed the fact that the sheet is entirely divided only during the winter, or low-water season; while during the summer, when all the water in these regions is at a high level, the dividing spit of sand, marked in most maps as jutting out from the south shore, is submerged, and the two Kuls become one. Lord

* The extent of drainage area may sometimes become a factor, but it cannot well be applied in the case of a glacier region like the one dealt with here.

† Since these lines were written, Mr. Curzon has set forth the same view in an able letter to the *Times* of December 14th, 1893.

Dunmore was at this spot late in November when the water was low. In the same way the small lakes in the neighbourhood of the Sássik (or Sassigh) Kul probably alter their shapes, sizes, and relationship to one another according to the variation in the water-supply at different seasons, and need not therefore always be as described in the book. The author is probably right when he states that the Bulun Kul communicates with the Yashil Kul; but the map at the end of Vol. I. is distinctly faulty in regard to the small lakes above alluded to.

With respect to the tribes of Kirghiz who inhabit the Pamirs, Lord Dunmore tells us, rightly enough, that these are divided into four main tribes and many subsidiary ones, but in detailing the four chief divisions he is misleading in giving their names as “(a) the Naiman, (b) the Kipchak, (c) the Tai-it, (d) the Kissack.” As far as we are aware, the list should stand:—(a) the Naiman, (b) the Tai-it, (c) the Kara Tai-it, and (d) the Kasik (not Kissack). The Kipchaks are not Kirghiz, but a tribe of entirely different origin; and though in this region they intermarry occasionally with the Kirghiz,* they can, in no sense, be regarded as Kirghiz by blood or descent. We need not enter here into particulars regarding the sub-tribes further than to remark that the Sarts are not a sub-tribe, or tribe of any kind, ethnographically speaking. The word merely indicates a townsman, or sometimes a settler, as distinguished from a nomad or grazier. A Sart may therefore be a person of almost any tribe or race common in Central Asia.

While remarking on the tribes, we should like to ask our author for some information regarding the “Chinese Tartars” whom he appears to meet with, if not on the Pamirs, at all events in Ladak, Yarkand, and other places. Who are these mysterious people never yet described by any traveller? In old books we believe that the name of “Chinese Tartar” was applied to the Mongols—the true Mongols of Mongolia—but there are no Mongols in Ladak or the districts of Yarkand and Kashgar, and indeed there is no race in any part of Asia, so far as our knowledge goes, to which such a name as “Chinese Tartar” can rightly be applied.

In matters historical Lord Dunmore is more successful than when he deals with geography and ethnography, for he has produced a fairly accurate account (Chap. 22) of the last days of the rule of the Andijanians and the subsequent (1877–78) re-occupation of Eastern Turkistan by the Chinese. The events were related to him at first hand by an eye-witness, and the story agrees mainly with the more trustworthy of the accounts which were received in India at the time. But it is tantalising to be told no more about the inscribed stone carried away by the Russians

* More especially with the Naimans, whom they regard as the direct descendants of the original Naimans of Northern Mongolia, and consequently, according to their ideas, of the most ancient Kirghiz blood.

from the banks of Yashil Kul than what is vouchsafed at p. 167 of vol. ii. It was placed in the museum at Tashkend, the author tells us; but though he furnishes a translation, he gives no hint of the date, the event it was intended to commemorate, or the language in which it is cut. It is believed that the inscription refers to the flight to Badakhshán of the Khoja rulers of Kashgar in 1759, and their pursuit by the Chinese (who had just then taken the country) up to the spot where the stone was erected. The language of the inscription has been said to be Uighur; and it was first seen by Captain Younghusband in 1890.

As might be supposed, Lord Dunmore is at his best when describing his stalks among the Ovis Poli and grey bears in the high nullahs of the Taghdumbásh Pamir. Though his visit happened to be at about the worst time of the year for finding game, he achieved a good deal, and showed himself so excellent a sportsman, that we wonder all the more when we find him make the mistake that he does at p. 191, vol. i., of believing himself to have seen a *Kastura*, or musk-deer, at Kizil-Angur near the foot of the Depsang plain, at an elevation of 16,000 feet or over. Sportsmen and naturalists may rest assured that the animal seen on that occasion was not a musk-deer, for these creatures are not to be found beyond the wooded regions of Kashmir, some 200 miles off, and are rarely seen above an altitude of about 10,000 feet. In all probability the animal met with was a female Burhel, or *Ovis Nahura*.

Dr. Lansdell, who now produces his third book,* is, like Lord Dunmore, a traveller pure and simple, and makes no pretensions to be explorer or geographer. His travels in Russian and Chinese Turkistan and in Ladak, etc., were undertaken chiefly, as he himself tells us, "to spy out the land for missionary purposes;" and it is, for the most part, to those interested in missionary enterprise that his narrative is addressed. He appears, however, to have added to this primary object a sort of hope that it might be possible for him to visit Lhasa, or, if not Lhasa, some part of Tibet easily accessible from India or China, by one of the routes already frequently attempted by others and as often proved to be impossible. By all these roads the European is expected, and they are, in consequence, carefully guarded by the officials of the Lama government. The author admits that he was many times warned by our frontier officers and others, who knew how the land lay, that his entry into Tibet by any of these gates was certainly barred; but having been provided by friends with funds to make an attempt, he thought himself bound to make one. He records with much detail the efforts he made to realise his desire by seeking the advice and help of various British officials,

* 'Chinese Central Asia. A Ride to Little Tibet.' By Henry Lansdell, D.D. Two vols. London, Sampson Low & Co., 1893.

missionaries, and former travellers. It of course formed no part of Dr. Lansdell's programme to try and penetrate Tibet from the north on his own account, as it were. Had he viewed the matter otherwise, he would have stood as good a chance as Rockhill, Bower, Bonvalot or Miss Taylor, of seeing a great part of the country and something of its people, though, it need scarcely be added, that any attempt on Lhasa would have proved as unsuccessful in his case as it was in theirs.

Dr. Lansdell's route lay eastward through the Russian possessions—by rail and post road—to the Chinese province of Ili, or Kulja; thence over the Tien-shan mountains by the Muzart pass (which he claims to be the first Englishman to cross) to Aksu, Kashgar, etc., and, after a flying visit to Khotan, along the ordinary road, by the Karakorum, to Ladak and India. Thus he saw only those parts of Chinese Turkistan which have been visited and described many times of late years by European travellers of nearly every nation, and there is therefore no occasion to trace his journey with great minuteness. After arriving in India he made some excursions to Nepal, Darjiling, Mandalay, Peking, etc., with a view to obtaining assistance to enter Tibet, and finally returned home by way of the Persian Gulf and Bagdad. His book is well and carefully got up, and bears evidence of a great deal of reading in the fields of history and geography relating to the countries he visited. The epitomised results of these studies he has embodied in several chapters which are interpolated at intervals through the two volumes, and they form, in some cases, very useful summaries. As a student, therefore, if not as a traveller, Dr. Lansdell may be said to have acquired a good knowledge of the eastern regions of Central Asia; but this being the case, it is a little surprising to find the second title of his book called 'A Ride to Little Tibet.' Little Tibet, or *Tibet i Khurd*, is a Persian name for Baltistan, a province of the Kashmir dominions lying among the mountains between Ladak and Gilgit, and was not visited by Dr. Lansdell. It appears from the context that the author has applied the name to Ladak, but that country is known to Central Asians as "Tibet" pure and simple, while the region to which the latter name is given by Europeans is usually called in Central Asia, *Chin*.

We are obliged to Dr. Lansdell for his protest (p. 318, vol. i.) against the irrelevant names frequently used in Europe to denote the province known to the Chinese as the *Sin-Chiang*, or "New Dominion"—that is, the Turki country lying east of the Pamir, and between the Tien-Shan mountains on the north, and the highlands of Tibet on the south, respectively. It is time to give up the use of such names as *Ali Shahr*, *Eastern Turkistan*, *Kashgaria*, etc., and to adopt, as the author rightly points out, that of "Chinese Turkistan," thus distinguishing it clearly from Russian Turkistan and Afghan Turkistan, besides applying to it a simple effective name, and one with a distinct meaning.

The three maps published with the book are all more or less general

ones, and are therefore suitable to the narrative, but the illustrations are not always effective or pleasing. There are some good appendices, however; more especially Appendix B on the bibliography of Chinese Central Asia, which will be found extremely useful to those interested in these regions. Indeed, printed together with the bibliographies in Dr. Lansdell's previous works, as a separate pamphlet, these lists would form a valuable guide to the literature of an important section of Asia.

THE STATE OF THE SIBERIAN SEA : THE NANSEN EXPEDITION.

By Captain JOSEPH WIGGINS.

CAPTAIN WIGGINS writes from Yeniseisk, Siberia, under date December 7th, 1893:—

I daresay you are wondering how we have succeeded in our attempt to reach this part of the world once more. Suffice it to say that we found the Kara Sea much the same as usual. During the latter part of August it was well free of ice; there was no difficulty in avoiding what ice there was, and in reaching our port of destination, Golchika, in lat. 71° 40' N., at the entrance of this magnificent river. This is my fifth visit to this place, and the ninth voyage across the Kara Sea since our first successful attempt in 1874.

The most interesting fact connected with this memorable trip is that we have succeeded in convoying the first Russian Government vessels that have ever arrived on these waters. What is perhaps of more importance to the future of this country, Siberia, we have (under private contract with the Russian Government) succeeded in landing the first section of rails for the construction of a Trans-Siberian Railway.

The Russian Government hearing of our proposed voyage with Mr. Popham in the *Blencathra* Arctic steam yacht, for the purpose of pleasure, and with the desire to assist Nansen with stores and coals across the Kara Sea, offered us the privilege of taking these first 1600 tons of rails. Though rather late in the season, we at once closed with the offer, and quickly despatched the *Orestes*, a large merchant steamer, to Vardö, where we were joined by two Government steamers and a large schooner barge, all for future use on this river. We also brought our own shallow-draught steam barge, now named the *Minusinsk*, and I am happy to say without any mishap. All these four riverine craft are now safely laid up in winter-quarters here. True, we have not managed to bring all the rails, owing to the wretched lighters that were sent down river to receive our cargo. They literally fell to pieces as we loaded them. A large portion of the rails now lies at Golchika, which must be brought up river next summer. Another

portion—some 250 tons—had to return to Archangel in the *Orestes*, seeing that no other lighters could be obtained. Nevertheless we have landed here and at Krasnoyarsk, some 300 miles further up river, about three thousand rails; and had the river barges not failed us, we should have brought up the whole cargo with ease. As it is, we have once more proved to the world at large the feasibility of this north-east ocean route. That has been accomplished not merely by specially-prepared Arctic vessels, but by ordinary sea and riverine iron steamers, one a paddle, another a screw barge, and an ordinary schooner barge, the latter being towed, of course. True, the Arctic yacht *Blencathra* accompanied us, but, as I have always found it, the Kara Sea ice was no hindrance to the safe progress of the other ordinary steamers. With ease and pleasure we ran these and the huge *Orestes* up to Golchika, demonstrating that the largest of our merchant steamers can trade to these parts. This vessel, and Mr. Popham's yacht *Blencathra*, arrived safely back at Archangel, where the *Orestes* discharged the balance of her rails, and loaded full cargo for a home port. All this should now surely prove the Kara Sea to be a commercial route.

I must now turn to a subject which will, no doubt, interest you even more than our success—brave Nansen and his trusty companions with the *Fram*. You will have heard that they succeeded in passing Pett's Straits, a fortnight ahead of us; and that they held communication with the villagers of Khabarova, or St. Nicholai, as it is now named. Nansen, before he left home, arranged with us that he would deposit letters and despatches at this village; but though we searched and made inquiries of the priest and Russian traders there, we could not discover any such documents. I now find that the gallant leader took advantage of a more speedy mode of transit, by handing them to the messenger who brought him dogs, etc.; by this foresight on his part the news reached England much sooner. Since that time nothing more has been heard of this heroic band, for I regret to say we were unable to visit and inspect Dickson's Harbour either in the coming or the returning of the *Orestes* and *Blencathra*; the weather proved very bad both times, and Mr. Popham had to continue on his voyage, which being of a commercial nature, had its serious risks at stake in regard to a Government cargo and insurances, etc.

The question with respect to Nansen now is, how has he succeeded not merely in passing the Kara Sea, and perhaps visiting Dickson's Harbour, but rather how has he managed to pass the northernmost promontory of these Arctic shores, Cape Chelyuskin? I am rather afraid he has had some trouble, seeing that I found the drift-ice very close in-shore to the northward of Dickson's Harbour; but as our voyage did not admit of a deviation sufficient for properly inspecting that ice, and ascertaining whether or not it impinged closely on to the north-west land, I am unable to give a decided opinion as to success or non-success.

This I must say, I never before saw the ice in that vicinity so late in the season; still that must not be taken as a drawback or hindrance to the steady and successful progress of the *Fram*. I sincerely hope that the ice we saw was at a fair distance from the land, in which case we may perhaps have news, by way of the Lena, of the safe wintering of the little band at or in the vicinity of the New Siberian Islands; providing always that Nansen has an opportunity of communicating with the mainland. On the other hand, I should not be surprised to find that Nansen has gone farther to the northward, should the lead of the outer edge of the main pack permit of his doing so. In such a case we can have no further news of his doings until we hear of his safe return by way of the Pole, or retreat by way of the Novaya Zemlya seas, the Kara Sea, or the Siberian coast.

If you remember, I recommended his keeping, if possible, in the line of and near the meridian of Cape Chelyuskin, or not farther eastward than the 100th degree, and to avoid the dangerous vicinity of the New Siberian Islands. I hope he has been able to do this. Of course, should the trend of the heavy pack-ice edge lead him eastward, he is bound to go; but I much fear the shallow water and strong erratic currents of the Siberian Islands may cause them much trouble. I have been confirmed in this belief by the experience of Dr. Bunge, of the Russian Imperial Navy, who has been located on those desolate islands for the last five years. He has but just left that spot, where he has been making scientific inquiries, to join this, our present expedition from England.

On the other hand, should Nansen have been prevented from rounding the Chelyuskin Cape, or have been compelled to retreat to Dickson's Harbour for the winter, then we ought to have heard of him by the many natives who roam about those parts. This absence of news leads me to think that he has rounded the Cape, in which case I hope he has gone well northward, where the strong and steady currents from the Kara Sea join the stream of these mighty Siberian rivers. By this route I have every faith that the expedition will reach a high latitude, discover new lands, and perhaps closely approach the vicinity of the Pole itself.

Mr. Jackson left the *Orestes* at Pett's Straits, where he located himself in the house of the Priest at St. Nicolai; his desire was to examine the Yalmal Peninsula and the eastern shores of the Kara Sea. I hear that on the return of the *Blencathra* Mr. Popham found him still there, but I have not heard what his future arrangements were, or what he intends doing. Probably he may return home by way of the Pechora and Archangel.

We leave here in a few days, and hope to reach home by February at farthest. The Siberians gave us a grand reception here; this voyage of ours is a momentous event to them, opening out a new era for their country.

December 19th.

Just a line to say that we are now on the eve of our departure for St. Petersburg, and then home.

An interesting event has just happened—the arrival here of two gentlemen from the New Siberian Islands. They are Baron Toll and a naval lieutenant, who were commissioned by the Russian Government and certain scientific societies to make observations and take stores to the above-named islands, by way of the Lena River viâ Irkutsk, but they made a most interesting detour on their route home by coming direct from Yakutsk across the northern Tundras to Dudinka—some 1000 miles down the river—and sledging up to the city. I have not the track of their journey, so cannot send it you, but will endeavour to obtain it, as it is unique.

They are very much interested in Nansen's work. They report having landed stores, etc., at the northern islands of the Siberian group, and that dogs are awaiting Nansen in the vicinity of the Olenek River. So we must expect that Nansen has called there for these dogs, in which event news should soon reach this vicinity or Irkutsk, as the messenger with dogs would bring letters, as was the case with the messenger who delivered him the dogs at Khabarova. On the other hand, these gentlemen assure me that should Nansen require to retreat by way of the Siberian Islands and the Lena, or any part of the coast between that and Cape Chelyuskin, the natives have been given notice to assist.

Knowing the anxiety arising from the fact of our not having been able to communicate with Dickson's Harbour this season, I send this at once in order that the minds of all friends, etc., of Nansen's Expedition may realise the important fact that should any trouble arise to them, compelling them to retreat by way of the main coast, there will be assistance at hand. I may here state that next summer I shall make a point of calling in at Dickson's Harbour should there not be news in the interval of Nansen's whereabouts or safety.

The weather here is wonderfully mild for the time of year, so I hope Nansen may be able to push on northward. The Yenisei is not yet all frozen over—a thing almost unprecedented.

COMMERCIAL GEOGRAPHY.

By HUGH ROBERT MILL, D.Sc.

THE course of lectures on the Principles of Commercial Geography with special reference to the British Empire, the commencement of which at the London Institution was intimated in the November number, has proved successful, the attendance having been about two hundred. The first or introductory lecture has already been briefly noticed

(Vol. II., p. 455), and forms the ground-plan on which the earlier half of the course dealing with general principles was constructed. During the lectures large use was made of the lantern; a special collection of maps, characteristic photographs, and statistical diagrams having been prepared to illustrate the subject. Lectures II. to VI. discussed the principles or underlying conditions of Commercial Geography, while Lectures VII. to XII. were concerned with the application of these general principles to the actual conditions of the United Kingdom, India, and the larger colonies.

The fundamental importance of the form and motions of the Earth in relation to the sun formed the subject of the second lecture, which showed how the Earth as a ball would have no natural points of reference, or directions for measurement, if at rest. The fact of rotation, however, gives it polarity, and thus supplies initial points for reckoning latitude, and cardinal points for expressing direction; and, by the constancy of the direction of the axis, rotation also makes it possible to determine latitude and longitude astronomically. The relation of the direction of the Earth's axis to the plane in which it performs its orbital revolution round the sun determines the amount and duration of solar heat in different latitudes, the length of the day, and succession of the seasons. If the Earth's surface were all land or all sea, climate would be a mathematical function of latitude. As things are, the composite structure of the globe, in which the lithosphere is partially covered by the hydrosphere and the whole surrounded by the atmosphere, sets up a complex system of circulation in air and sea which tends generally towards an equalisation of climate. Not only climate but configuration also is changed in this way. The cooling lithosphere puckers into ridges and hollows, outlining the great features of continent, mountain range, and ocean basin, but the sculpture of the surface and all types of scenery and classes of soil are due to the power of the sun's heat acting through air and water. The resultant surface features farther modify the direction of ocean currents and prevailing winds, and so ultimately produce the balance of climate and configuration which at present exists, thus fitting the Earth to become the dwelling-place of plant and animal.

Geographical conditions are brought into relation by the theory of evolution with the origin not only of the distribution, but of the forms of living things. And in turn living organisms react on their environment, aiding or retarding the physical processes of change. The distribution of species is mainly dominated by the occurrence of geographical barriers isolating regions which may possess similar climate. Wide stretches of ocean, expanses of deserts and long snow-crested mountain ridges are most effective in this way. In plant life the main conditions of luxuriance are soil, water, air, and solar heat and light. Green-leaved plants in sunlight are the only known means for building up the substance of earth, water, and air into the innumerable products which

supply food, clothing, and shelter, all animals being entirely dependent, directly or indirectly, on plant life. Where soil is wanting, as on rocky mountain slopes, or water is wanting, as in arid deserts, or solar energy is wanting, as in the Polar Regions, plant life is impossible; although terrace culture may make the mountain side fruitful by retaining soil, irrigation redeem the desert, and, if it were necessary to cultivate the Polar Regions, electric light and artificial warmth could utilise the soil and moisture there. Zones of relative fertility are dependent mainly on climate, the map of deserts, steppes, and forests showing an intimate relation to those of temperature and of rainfall. Change of climate by altitude on mountain slopes produces effects on vegetation similar to those produced by latitude. The distribution of animals is subject to similar conditions, only in their case the effect of environment in producing adaptation is more marked, and the effects of isolation, especially in islands, on the distribution of species may be used to reconstruct hypothetically former geographical conditions that have left no other trace. Both plants and animals are agents in modifying the land surface; mangroves have reclaimed a broad strip of low ground from the sea on many tropical coasts, and strong-rooted grasses binding sand-dunes are often the only barrier between fertile farms and sandy desert. The humbler orders of life produce the largest geographical results. Minute shell-forming organisms, especially foraminifera and diatoms, cover the sea-bed with calcareous and siliceous deposits, and the little coral polyp raises whole groups of islands from a considerable depth to the surface of the sea. The Earth clothed with vegetation and busy with animal life stands ready for human occupation.

The classification of the human race is a problem of great difficulty, but, disregarding minor differences, all peoples may be grouped under the three heads of the Black, Yellow, and White. These, speaking broadly, show a close relation to their habitat, and represent definite stages in civilisation and enterprise. The lowest races of the Black and Yellow type inhabiting exclusively the torrid zone, are almost entirely subject to the tyranny of their environment, against which they are practically incapable of contending. These are the savage tribes whose civilisation, to the point of appreciating manufactured goods, is an object of much commercial importance. The higher races, of the Yellow and White types, living in the temperate zones have, no doubt largely on account of the stimulus of adverse circumstances, developed qualities of foresight, self-restraint, and enterprise which enable them to adapt themselves to new environments, and impel them to spread over the globe and dominate other races. Minor differences in national character, produced by race and nurture, may be intensified in suitable surroundings in a surprising way. For instance, the difference between the Teutonic races of North-West Europe and the Romanic people of South-West Europe is trifling compared with the contrast between the

same races when transplanted to North America and South America respectively. The higher the degree of civilisation, the more freely may a people range over the globe, and accommodate themselves for a time at least to the most extreme conditions. The bond of the people to the land becomes closer as tribes emerge from savagery or a nomadic existence, and begin to depend on the products of the Earth raised by their own exertions or on trade. Towns become necessary at some stage in this progress, and geographical conditions are most important in fixing on sites. Sites capable of ready defence have attracted round them most of the great cities of Europe which date back to turbulent times; sites favourable to free intercommunication have now become more important, and the changed conditions are beautifully exemplified in the contrast between the "old" and "new" parts of many towns. Places situated conveniently for access to mineral wealth have become, by a process of instinctive selection, the centres of population in recent years. The distribution of population over the Earth is sparse in deserts and steppe-lands; extremely dense in the lower stretches of great tropical river valleys where means of agricultural life abound; and densest of all on the coal and iron-fields of the temperate zone where the products of mine and forge enable the toiling people to purchase and transport from a distance their food and clothing material.

The resources of regions constitute the most important feature in commercial geography, as on them the welfare of the people must immediately depend. Commerce looks with a limited view on natural products; the conditions of utility, ease of production, and economy of transport overriding all others. Thus the geologist, botanist, and zoologist are equally interested in every stone, plant, and animal, but the commercial man, with the one test of "Will it pay?" divides these into mineral wealth and rubbish, plants and weeds, game and vermin. The useful or desirable things entering most largely into trade are those of primary necessity for food, clothing, shelter, and the means—such as machinery—for producing these. Products due to life, whether plant or animal, differ from others by the fact that they are capable of being improved in quality and increased in amount to any extent by human skill in cultivation and breeding. Only in a few cases, such as untamable fur and feather-bearing animals, rapid extinction of the species is a consequence of human interference. Mineral products, on the other hand, are practically limited in amount to that which already exists in the crust of the Earth within reach of the surface, and the supply once exhausted cannot be renewed in the lifetime of the human race. The important food and clothing materials of the world's commerce are restricted as to the area of their growth by climatic conditions, and by the supply of cheap labour or the application of machinery. Useful foods or fibres, indigenous to a small area, have by commercial enterprise been spread over the globe wherever natural conditions rendered it

possible for their culture to be made to pay. Maize, tobacco, and potatoes overspread Europe, Asia, Africa, and Australia from America; while wheat, sugar, and coffee were sent in exchange, and now form staples of American agriculture.

A set of diagrams showing the production, export, and import of wheat, serves well to enforce the general laws of trade-geography. In modern times it has been found that dazzling mineral wealth, such as gold, diamonds, or silver, was most powerful in attracting population to new countries. On the other hand, commonplace minerals, such as coal and iron-ore, enable the densest population to subsist on food and clothing imported from a distance and bought with the result of their labour, but in every place ultimate prosperity must depend—looking far enough ahead—on the agricultural resources, which will remain when minerals no longer pay to work; and only lands agriculturally self-supporting can, in the long run, retain their economic independence.

As the last of the underlying principles of commercial geography, it is necessary to consider the artificial limits and restrictions to which the name of political geography is specially applied. Viewing a nation as a group of people similar or diverse in race and language but associated together under an organised government treating with other governments through a recognised head in the corporate name of the people, and viewing a region as a natural division of the Earth's surface or a group of such divisions, a country may be defined as a region exclusively occupied by a nation. When the nation is homogeneous or of one race and language, and the land they occupy is a region in the strict sense of the word, *e.g.* a naturally defined unit of the Earth's surface, such as an island or peninsula, the resulting country is an ideal country presenting the maximum of internal stability. The delimitation of frontiers between adjacent countries is always necessary, the crest of a mountain range or the line of a watershed being as a rule more satisfactory than a river. The Vosges presents a stronger and more natural frontier between France and Germany than the Rhine; but the Danube in the Balkan peninsula is an effective frontier on account of its political (not its natural) peculiarities, as it is a neutralised international waterway separately administered. Mathematical frontiers, such as the meridians and parallels between Canada and the United States and between the Australian colonies, are impossible in countries of natural and gradual growth, and useful only when highly civilised nations take possession of the lands of relatively powerless tribes. Invasions by hordes and armies are recognised methods by which one nation acquires control over another. A more insidious invasion is that by foreign capital which, while leaving a complex political independence, has made South America an economic fief of European moneylenders. The character of organised governments has a distinct geographical distribution. Asia is the home of autocratic monarchies, Japan being its only constitutionally governed

country as yet. Western Europe contains almost the only monarchies limited by popular legislation, and America is the continent of republics. A fourth class of governments is that of the "responsible" British colonies, which, without the responsibilities of independent existence, combine the advantages of the monarchical and republican forms. The ultimate prosperity of a country appears to depend less on its political character than on the fact of its economic resources being sufficient for the wants of the people, or capable of being kept efficient by the mastery of the sea, which is the one world-wide pathway of trade.

The United Kingdom of Great Britain and Ireland may be taken as the type of a country dependent mainly on mineral wealth and industrial occupations. It is distinguished from the other countries of Europe by its isolated position, its free yet orderly system of government, the voluntary character of its army and navy, and the entire freedom of trade, which is restricted legislatively only in so far as is necessary for excise purposes and the protection of workers. After passing through the stages of being a great pastoral and agricultural country, the British Islands are now practically dependent on the wheatfields and cattle-ranches of other countries for food, while the life of the nation depends on mineral and industrial wealth. Coal buys bread, not so much by direct exchange, as by the utilisation of coal to manufacture native or important raw materials, and so enhance the value as to make exports pay for imports. Thus the vital centres of the country are scattered over the coalfields and the coast, where manufacture or trade can best be carried on. When the coal supply is exhausted, wind, water, and tidal power must be employed, and the busy centres will migrate to the Highlands and the tideways.

As an example of a country with an immense population dependent almost entirely on agriculture, and thus on climate, no land approaches India. Climate is nowhere else so clearly dependent on configuration. Points of access for foreign trade are limited to a few seaports, which by their small number have become individually great. The people, compounded of the most diverse and antagonistic elements, are kept at peace though not redeemed from poverty by a resident population of Europeans, numbering only one to every 2500 natives. An Oriental country, India requires autocratic government for the proper development of its resources, and the adjustment of differences arising from race and creed. To the natural products of cotton, oil-seeds, rice, and tea, there have been added by introduction from abroad wheat, maize, cinchona, and many other products.

Tropical colonies are of value mainly as strategic points on trade-routes, coaling-stations or harbours, and as fields of production in plantations manned by native labour. Thus Aden is valuable as a station on the way to India, Hongkong as a trading post with China, Singapore as a collecting and distributing point for tropical products and European

manufactures; Ceylon, Mauritius, and the West Indies as plantation colonies producing commodities which cannot be grown in temperate lands or by white labour.

True colonies must lie in the temperate zone or at least enjoy a temperate climate. Of these the most important are South Africa, the Dominion of Canada, and Australia. The two latter groups of colonies were made the subject of separate lectures, their characteristic geography and the special products and trade of each being referred to in detail and illustrated by special maps.

The concluding lecture on December 19th was a review of the resources and commerce of the British Empire as a whole. In this respect the temperate colonies are most important, forming the nuclei of future countries with vast room for expansion; thus in Australia twelve times the area of the United Kingdom is awaiting occupation, and in Canada twenty times the area. The means of communication on the great trade-routes is mainly by steamers, although there are again signs of a considerable increase in the proportion of sailing vessels employed. The carrying trade of the world is mainly done by British steamers either under the national flag or under the flag of other nations. One-third of all the sailing vessels in the world and two-thirds of all the steamers engaged in trade belong to the United Kingdom. At least 52 per cent. of all the tonnage afloat flies the red ensign, but the war navy of the empire does not bear the same overpowering ratio to that of other countries. If the trade routes of the world may be compared to the arteries of commerce, the telegraph system plays the part of the nerves. The greatest gap in the telegraph system which remains is the want of a cable across the Pacific to correspond with the new steamer routes which now traverse that ocean.

Compared with the trade of all other countries, that of the United Kingdom is first both in volume and value of exports and imports, the combined value being nearly twice that of France, Germany, or the United States, which are nearly equal. A map of the world was shown with the countries coloured to bring out their importance to British trade as fields for the supply of food and raw materials as imports, and as markets for the sale of manufactured goods sent as exports.

GEOGRAPHY AT THE WORLD'S COLUMBIAN EXPOSITION.

By CHARLES T. CONGER, B.A.

THE first lesson in geography which confronted the visitor to the World's Fair was the topography of the grounds. He had to find his bearings and locate the numerous buildings situated about the beautiful Court of Honour, and the picturesque waterways that penetrated every-

where, and gave a Venetian aspect to the scene, only more serene and beautiful. Nature appealed to the visitor on every hand. The brightness of the American climate, the great blue expanse of Lake Michigan, and the landscape features combined to impress one pleasantly.

The historical and geographical element entered largely into nearly all of the exhibits. As was to be expected, the most elaborate geographical exhibit was found in the United States Government building. The Department of War, which controls all rivers and harbours, presented a great number of relief models of the rivers whose courses and mouths are undergoing improvement. The elaborate process of jetttying the Mississippi River, the famous deepening of part of the East River by New York, known as Hell-gate, and the Columbia River in Oregon, were shown in a highly interesting and instructive manner. There was also a model of the celebrated Sault Ste. Marie Canal, connecting Lakes Superior and Huron. The new lock is 100 feet wide throughout and 800 feet long, has a depth over the sills of 21 feet, and is to be worked by hydraulic engines actuated by turbine wheels. The importance of this improvement will be seen from the fact that in 1892, during a navigation season of only two hundred and thirty-three days, twelve thousand five hundred and eighty vessels passed through it, having an aggregate registered tonnage of 10,647,203 tons of 2000 lbs. each, and carrying 11,214,333 net tons of freight. This exceeds the Suez Canal in tonnage but not in value.

Another model showed the methods used in storing water in great reservoirs at the head-waters of the Mississippi River, which is systematically released to raise the summer levels of the river. Another showed the extensive process of sand-bar cutting and river straightening, in operation between the mouths of the Ohio and Missouri Rivers.

Arctic exploration was represented in a large map showing the polar latitude attained by the various nations, and by a striking panoramic scene of General Greeley's camp at Fort Conger. Relics and pictures of the unfortunate *Jeannette* expedition were numerous. The routes and plans of Nansen and Peary, past and prospective, were presented in a graphic way, which attracted crowds and indicated that there was considerable popular interest felt in geographical exploration.

The territorial growth of the United States by purchase and annexation, the extent of the land grants to railways, the location of the Indian Reservations, were portrayed in a series of large maps arranged according to a chronological system.

The Hydrographic Office, a sub-department of the U.S. Navy, collects, compiles, and distributes gratuitously to mariners and others interested in nautical matters such information as they could not otherwise get. Chart construction and marine meteorological observations were represented at the model observation station on board the war-ship *Illinois*. The whole process of chart construction from rough record

books and plotting sheets to the final finished printed map were admirably portrayed. Complete sets of Coast Survey, Lake Survey, and British Admiralty charts, as issued to vessels of the U.S. Navy, together with storm, ice and derelict charts, were shown to indicate the scientific and practical value of the department's work.

By far the finest feature of this exhibit was the relief map of the Atlantic bed, constructed on the polyconic projection on a scale of 1 : 100 of an inch to the nautical mile for horizontal measurements, and exaggerated fifty times in the vertical. It showed the various submarine telegraph lines, and the general orographic features of the bottom of the North and South Atlantic, and also the zones of successive depths between the surface and 1000 fathoms, 2000 and 3000 fathoms by deepening shades of green. The model was one of great beauty and suggestiveness, far excelling any map in portraying mountains and valleys beneath the sea. A similar relief model of the West Indies and the Caribbean Sea on the polyconic scale of 1 inch=33 miles for horizontal scale, and exaggerated thirty-three times in the vertical, showed clearly the characteristic features of the bottom of this sea, and the surrounding shores and islands. The highest land shown is in the Sierra Nevada de Sta. Marta in Colombia, 16,419 feet above the sea-level, and the greatest depth in depression, north of Puerto Rico, 4561 fathoms.

Deep-sea-sounding instruments, plane tables, telemeter staffs, storm charts, wreck charts, and ice charts indicated the extensive and invaluable-work executed by the department.

One interesting exhibit was that of a model of the United States and Alaska, as if cut from a sphere 42 feet in diameter, which would show physical features reduced to one millionth of their natural size. For convenience of transportation the model was built in eight sections. Of these the United States occupied four, each 15° of longitude in width ; and Alaska three, each 20° of longitude in width. The eighth was long and narrow, 10° of longitude and 34° of latitude, and formed the connecting-link between these two portions. The position was so arranged that the axis of the spheroid was perpendicular to the floor. Contrary to the usual custom pursued in making relief maps, the vertical scale was the same as that for horizontal distances. If a certain pictorial effect is thus lost, a proper conception of the relative insignificance of mountains in relation to the sphere is gained. They appear as a mere roughness of a smooth surface. At numerous points magnetic needles have been mounted, showing actual compass bearings. By this means a rough idea of magnetic variations is given. The character and progress of the primary triangulation along the 39th parallel between the Atlantic and Pacific are also shown.

The admirable work of the well-known U.S. Geodetic and Coast Survey was well exhibited by a large number of instruments, models, charts, and publications. Great trouble was taken to exhibit and explain

to the unscientific the Triangulation Survey of the United States, the different types of base apparatus, gravity pendulums, tide-gauges, deep-sea current-meters, and the various methods of determining time. The important magnetic data collected from the 897 stations and four magnetic observatories of the survey have been collected and mapped upon the globes correct for the United States and assumed for the rest of the world. These globes have a diameter of one meter, hence are about $\frac{1}{12,750,000}$ th part of the natural size. On each are shown two systems of magnetic curves. On globe No. 1 the red lines refer to declination, and in numbers attached give the angle in degrees. The areas where the north end of the needle points west of the meridian are tinted buff, the areas pointing east are indicated by a light blue colour. The agonic line of no variation is shown to pass through both the geographical and the magnetic poles. Globe No. 2 exhibits in red curves "magnetic meridians;" green curves show the isocliniclines. North of the magnetic equator areas are tinted light blue; south, of a buff colour.

Each of the States exhibited relief models of considerable size, showing the location of important mountain ranges, river-courses, and most important cities. These were the centre of great interest and not without their educational value. The graphic element prevailed throughout the Fair. Familiar knowledge and wearisome statistics were plotted in such a manner as to be highly attractive and instructive.

In the Convent of La Rabida were kept the valuable collections lent by the Spanish and Italian Governments, as well as the various pre-Columbian maps and relics owned by private collectors. Many of these will remain as part of the new Columbian museum, to be formed and kept in the fire-proof art gallery which is to remain in Jackson Park.

The Ordnance Survey and the Geological Survey of the United Kingdom were fairly well represented. The Hakluyt Society exhibited a set of publications of the Society from 1848 to 1892.

The Germans made the best exhibit of educational works in Geography. All the best German map-publishers had specimens on exhibition, either at the German building or in the elaborate German exhibit in the Manufactures and Liberal Arts Building. The work of the universities and learned associations was shown in detail. The French and British exhibits left much to be desired. The Royal Geographical Society's little book-case filled with its publications was overlooked, and lost in the maze of other material. The Society's great map, showing how much had been done for North American exploration by British explorers, was the centre of marked interest, and made one wish that the Society had dived deeper and brought forth more of its geographical treasures.

It may be interesting to note here that the new University of Chicago, in conformity with its broad and liberal plans, has recognised geography

as a suitable university subject by establishing two courses in geography. One is a thorough course in physiography and landscape geology, while the second, under the head of political geography, treats especially of anthropo-geography and historical geography. The Royal Geographical Society, in recognition of this effort to promote geographical instruction in American Universities, has presented the Society's publications exhibited at the World's Fair. It is to be hoped that the new courses will meet the same favour in Chicago that has marked them at Cambridge and Oxford.

ITALIAN EXPLORATIONS IN THE UPPER BASIN OF THE JUB.

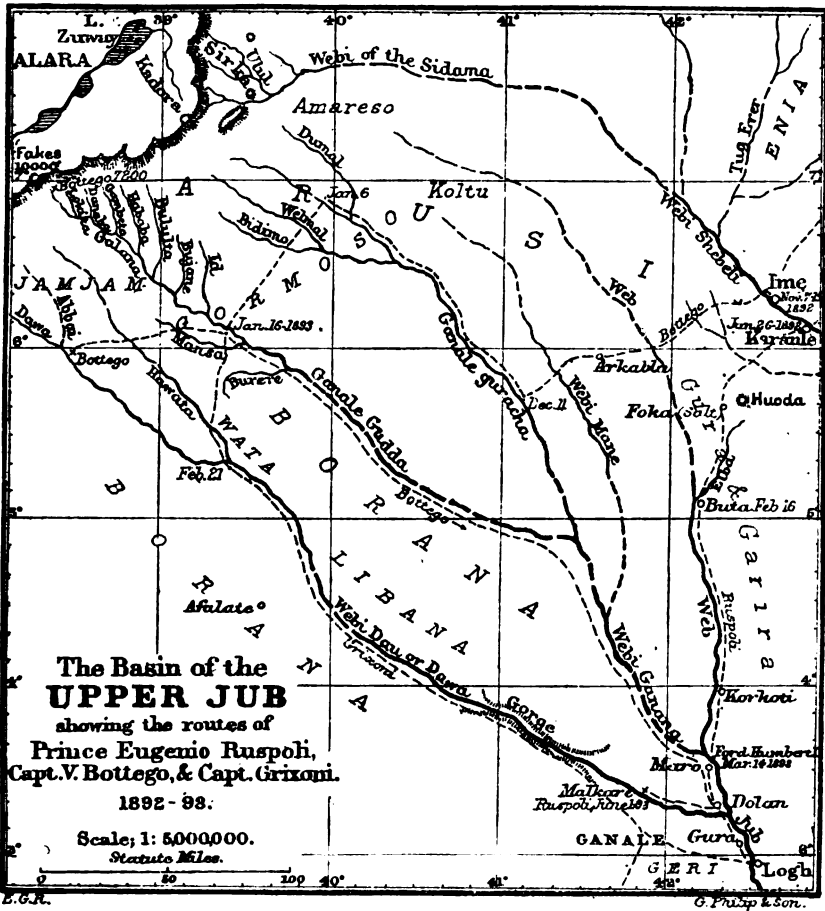
By E. G. RAVENSTEIN.

THE upper basin of the River Jub has in the course of the last two years been the object of various Italian expeditions; and although it cannot be said that all problems connected with that river have been solved, still very considerable additions have been made to our knowledge of a part of Africa which hitherto appeared as a blank upon our maps, or was at most delineated from conflicting native accounts. The sketch-map which accompanies this article shows at a glance what has been done by two of these Italian expeditions; namely, those conducted by Captain Vittorio Böttego and Prince Eugenio Ruspoli. It is quite preliminary, being based upon the very desultory letters of these explorers and the sketches published by Professor Della Vedova in the *Bollettino* of the Italian Geographical Society.* Neither of the two observers named appear to have determined even their latitudes by astronomical observations, and the honour of enabling us to lay down correctly the head-streams of the Jub upon a map is consequently reserved to some future explorer.

Captains Böttego and Guixoni left Berbera on September 30th, 1892, with one hundred and twenty-four men. On November 7th they reached the Webi Shebeli, or "Leopard River," at Imé, a place recently visited by Captain Swayne, who approximately determined its position. On the 15th they crossed the river, by a ford, and at once entered the country of the Arusi Galla, who proved hostile throughout, and with whom Captain Böttego had several conflicts. The country was hilly, covered with bush, and wanting in water, but it improved as the expedition neared the mountains of Ethiopia. Acacias and mimosas still prevailed, but there were also euphorbias and sycamores, and around a few Galla villages durra was being cultivated. The Web, the first head-stream of the Jub, took its course through a belt of verdure; but

* See more especially the *Bollettino*, 1893, pp. 621 and 688; also *L'Esplorazione Commerciale*, November, 1893.

beyond it there once more extended an arid plain ; in the midst of it, near a small lake, lay the populous village of Arkebla, whose inhabitants (Somal and Galla) were rich in cattle and sheep, and cultivated durra. On nearing the Webi Mane, which, like the Web, is bordered by dum-palms, the plain became dotted over with conical hills. One day's march beyond the Mane, on December 11th, Captain Böttego arrived at the Ganale Guracha, or Black Ganale, a river about 100 yards wide,



the turbid foaming waters of which rushed along between rocky banks. He ascended the river for twenty days, the country throughout being poor and rocky, and void of inhabitants, except near its confluence with the Welmal, where a few Gormoso Galla were met with.

Finding that this "Black" Ganale could not possibly be the main branch of the Jub, Captain Böttego left it in a west-south-west direction ; and crossing a broad, sterile plain, roamed over by the neigh-

bouring tribes of the Gormoso, Jamjam,* and Amaresa, he arrived on January 16th, 1893, on the Ganale Gudda, or "Great" Ganale. When forded, that river was found to have a depth of 4 feet. Captain Böttego, who suffered from fever, here built a "zeriba." His companion, Captain Grixoni, left for the coast on February 15th with thirty men, and there remained with his chief sixty-five men, fifteen camels, etc.

Four days after Captain Grixoni's departure, Captain Böttego started for the upper river, which is known in its upper course simply as "Galana," the Galla word for river. The Arusi Galla proved hostile. They attacked the caravan thrice, and three thousand five hundred rounds were expended in repelling these attacks. Ultimately, when within sight of Mount Fakes, which rises to an altitude of 10,000 feet, Captain Böttego felt constrained to retreat, for raiding parties of Abyssinians were said to be in front, and he felt no desire to come into contact with them. After a futile attempt to cross the country in a southerly direction, he returned to his old camp among the Gormoso.

He then crossed the tract separating him from the Dau or Dawa, and ascended that river until want of provisions compelled him to beat a retreat. The Ganale Gudda was once more reached after six forced marches, in the course of which eleven men died of hunger. Two more died in camp from exhaustion, and two were drowned whilst hippopotamus hunting.

Having laid in a supply of dried hippopotamus flesh, Captain Böttego descended the Ganale Gudda as far as Logh, where he arrived on July 17th last. On September 8th, 1893, he once more reached the coast at Barawa.

Captain Grixoni's return journey to the coast was effected by a different route. Five days after he had left his chief on the Ganale Gudda he reached the Hawata, which is a tributary of the Dau. He there came in contact with the Wata, a negro tribe living among the Borana Galla, tall and muscular, intensely black, with short, woolly hair, and naked except for a loin-cloth. They live on fish, roots, and hippopotamus flesh. Following the Hawata he reached the Dau, which was hardly ten yards wide, and seemed to be inferior to the Hawata in volume. The Dau or Dawa took its course though a broad plain, which narrowed gradually, until the river entered a narrow gorge bounded by rugged mountains, difficult to cross. On its left bank dwelt the Libana, on its right the Borana and Wata. The mountains bounding the gorge are uninhabited, and it was only after having emerged from them that Captain Grixoni again met with natives. They were Geri Somal searching for honey. Leaving the river, he crossed the fertile district of Ganale and arrived at Logh on March 15th.

* The Jamjam are evidently the Janjan of Sheet 3 of my map of Eastern Equatorial Africa (1883), whose cattle, horses, and sheep are all said to be black.

He then proceeded by way of Bardera to Barawa, which he reached on April 5th.

The expedition led by Prince Eugenio Ruspoli has not, up to the present, yielded results equal in importance to those achieved by Captain Böttego, but the Prince is still in the field, and proposes to push on as far as Lake Rudolf.

Prince Eugenio left Berbera on December 6th, 1892. At Herer he met the Duke of Orleans and Prince Boris on their return to the coast, and on January 23rd, 1893, he reached the Webi Shebeli at Karanle, and crossed it in a boat. The Webi there is about 60 yards broad and 28 feet deep when in flood. The vegetation along its banks is luxuriant, and the natives (Somal and Galla) cultivate durra, cotton, and beans. Cattle and sheep are numerous.

On the road to the Web the Prince crossed the Huoda (Audo?) mountains, beyond which begins the country of the Gura and Garira Galla, where salt is found.

The Web has a fringe of luxuriant vegetation; dum-palms and acacias are the most prominent trees, and the sacred lotus of the Egyptians is also met with. Elephants are numerous, and so are hippopotami. The Prince followed the river downward for twenty-five days, and reached its confluence with the Webi Ganana on March 14th. Whilst the Web varied in breadth between 60 and 160 feet, in depth from 10 to 16 inches, in volume from 3 to 4 cubic yards per second, the Ganana, or main branch of the Jub, measured 310 feet across, had a maximum depth of 3·6 feet, and a volume of over 80 cubic yards. When in flood, the width of the river increases to 560 feet, its depth to 14 feet. Prince Eugenio forded this river on the King of Italy's birthday, and established himself near a deserted village in Maro.* Here he left the bulk of his caravan, and proceeded down the river to Logh and Bardera. Logh he describes as a real town, defended by mud walls, and the centre of much trade, caravans arriving almost daily. The imports include rice, sugar, dates, coconut-oil, and cotton stuffs from the coast; cattle from the Webi, and ivory from the country of the Borana Galla. The river above Logh is navigable.

When on his way back to the Maro camp, Prince Eugenio met the whole of his people a day's journey beyond Logh. They had abandoned their camp, owing to sickness and want of provisions, but the Prince turned them back at once; and when last heard of, on June 1st, the whole expedition was encamped at Malkare, four marches up the Dau or Dawa.

It results from these explorations that the Webi Ganana, or Ganale Gudda, is the main branch of the Jub, whilst the so-called Webi of the

* The Prince named his camp Mogala ("country") Umberto I. Malo may be identical with the Marra on the Society's map of Eastern Equatorial Africa.

Sidama represents the Upper Webi Shebeli, or Haines River; and that these rivers, as well as the other head-streams of the Jub, rise in a range of mountains in the country of the Arusi Galla, which bounds the valley of Lake Zuway. The Gibbe, or Omo, seems to have no connection with the Jub, although it is as yet by no means certain that it reaches Lake Rudolf. Indeed, Dr. Traversi was most distinctly assured by an Abyssinian general, who recently raided in these regions, that it flowed to the east and not in the direction of the lake named.* Much work, therefore, still remains to be done by future explorers.

HYDROGRAPHY OF THE EASTERN MEDITERRANEAN.†

THE Austro-Hungarian ship *Pola* was again sent out last summer, by the Vienna Academy of Sciences, to the Eastern Mediterranean. Another deep depression has been discovered, this time to the east of the island of Rhodes, in latitude $36^{\circ} 5' 30''$ N., longitude $28^{\circ} 36'$ E., where the lead gave 3865 mètres (2110 fathoms); and although this depression is apparently shallower than the "Pola-Deep," 4000 mètres (2187 fathoms) in latitude $35^{\circ} 44' 20''$ N., longitude $21^{\circ} 44' 50''$ E., to the west of Crete, it is really deeper in relation to the land surrounding it, being fully 7000 mètres (3828 fathoms) below the summit of Ak-Dagh in Anatolia. The new depression is closed to the south-east by a ridge running in a south-easterly direction, which rises to within 1920 mètres (1050 fathoms) of the surface.

As in former years, the chemical character of the sea-water was determined by Dr. K. Natterer, and his investigations appear to him to confirm some previous results, which suggest some remarkable alterations in the accepted theory of the formation of certain geological strata. Dr. Natterer has again been unable to detect the presence of free carbonic acid in any of the samples of sea-water. Since a considerable amount of carbonic acid must be derived from the oxidation of plant and animal remains at the sea-bottom, its absence in the free state can only be explained by supposing that, besides carbonic acid, ammonia is formed, and that in almost equivalent quantities. These substances, having a tendency to combine, would go to form a corresponding amount of carbonate of ammonium.

Dr. Natterer is inclined to assign the chief part in the formation of not only the partly clayey, partly stony deposits on the sea-bottom, but also of calcareous and siliceous structures in living organisms to precipitates caused by the dissolved carbonate of ammonium. That the

* See *Bollettino*, 1893, p. 687.

† From our Vienna Correspondent, Dr. K. Peucker.

mechanical deposition of detritus carried to sea in suspension by surf or by river-waters plays only a subordinate part in comparison with such chemical precipitates (of carbonate of lime, siliceous clay, free silica, etc.), appears especially from the fact that, except near the mouths of rivers, clear water, free from suspended matter, was obtained directly from the water-bottles at all depths in the Eastern Mediterranean; and Dr. Natterer accordingly expresses the view that in the *Porcupine* and *Shearwater* expeditions in 1870-71, it was only because the Sigsbee apparatus was allowed to touch the bottom that fine mud was found in suspension in samples from the lowest layers of water.

The late Dr. W. B. Carpenter, who had scientific charge of those expeditions, ascribes the presence of suspended mineral particles to the fine sand brought down by the Rhone and other rivers (see *Proceedings R.S.*, xix., p. 146, and xx., p. 535). The relatively slight importance of the action of mechanical deposition is further shown by the circumstance that where the chemical conditions necessary for precipitation are absent, mineral particles are dissolved by the sea-water, except when they are present in sufficient quantity to cause the continued reactions observed by Natterer. In fact, the examination of water samples collected at the Tanitic mouth of the Nile, and near the harbour of Port Said, towards which all Nile water is carried by an easterly current, after it reaches the sea showed a surprisingly small amount of suspended matter even in late summer, when the quantity is likely to be large on account of the tropical cloud-bursts. Natterer supposes that the fine sand brought down by rivers is only to a small extent deposited directly, but that for the most part it is first dissolved, and remains in solution until a current carries it to a part of the sea where new conditions bring the separating action into play, and precipitation is caused by the action of living or dead organisms. This process assists in the formation of coral reefs and banks, helps the tide and the surf in the building of dunes, and provides materials for the mineral parts of organisms living in the sea.

Where the sinking of decaying organisms is prevented by a strong current, Natterer supposes that a strong crust is formed on the bottom, instead of the muddy deposits which cover by far the greater part of the Mediterranean basin; and this crust is harder the more slowly it is formed. Samples brought to Vienna prove the existence of intermediate transition stages between the two, and it is suggested that the ammonia, formed by the oxidation of the lower layers of deposits containing decaying organisms in the manner already described, rises to the actual sea-bottom by diffusion, and there causes the deposition of the stony crust by its action on the sea-water. The crust, which is chiefly composed of carbonate of lime, siliceous clay, and free silica, varies in thickness from about 1.5 centimètres (0.59 inches) to 8 centimètres (3.15 inches), and tends to obliterate the inequalities of the original

sea-bottom. Its upper surface is likely to be smooth and clean, while the lower is in immediate contact with the clayey sand.

Dr. Natterer also draws some interesting conclusions from the application of a special chemical method, based on local variations in the amounts of bromine, of iodine, and of nitrous acid contained in sea-water, to the detection and measurement of currents which move too sluggishly to be amenable to direct observations. He has this year been able to subject his method to a severe test in the currents of the *Ægean*, where it is possible to make direct measurements for comparison; and although the results are not yet fully worked out, the two methods agree very closely. Finally, with regard to the extraordinary poverty of the pelagic fauna of the Mediterranean as compared with the open ocean, Dr. Natterer expresses the opinion that so far as chemical conditions alone are concerned, these are favourable to animal life, and that as a matter of fact a rich fauna occurs in some regions in the immediate vicinity of quite sterile masses of water. It appears that abundant animal life is present just where the water is in rapid motion; and that, generally, the poverty of the Mediterranean fauna is largely due to the want of circulation in its waters—a result opposed to that of Carpenter, who believed it to be due to the excess of suspended matter.

THE MONTHLY RECORD.

THE SOCIETY.

Geography at Cambridge.—Mr. H. Yule Oldham, who succeeded Mr. J. Y. Buchanan as Lecturer in Geography at the Cambridge University, entered upon his duties last term. Throughout the term Mr. Oldham's lectures were well attended, and there is reason to hope will be equally well attended during the term just begun.

EUROPE.

The Forests of Abkhazia.—In a paper on the botany of Abkhazia ('Memoirs of the St. Petersburg Society of Naturalists,' vol. xxiii., Botany, 1893), N. Alboff, who is now working on his large collection of over one thousand three hundred species of phanerogams, points out the following typical features of Abkhazian forests. Their composition is very varied, no less than thirteen species of evergreens, six conifers, and eighty-six deciduous trees and shrubs being found in those forests. Climbing plants are prominent at the lower levels. A striking feature is the extremely wide vertical range of certain species. Most of them have a range of from 3000 to 4000 feet, while some (beech, walnut-tree, azaleas, *Rhododendrum ponticum*, *Ilex aquifolium*, and several others) extend from the sea-level to the uppermost limits of tree vegetation at an altitude of about 7000 feet. At this high limit they are then met with side by side with birch, mountain ash, *Ribes petraeum*, *Viburnum lantana*, *Quercus pontica*, *Rubus Idæus*, *Rhanus alpina*, and other alpine bushes, such as *Rosa mollis*. Nearly twenty-five species of ferns are

also met with in the forests of Abkhazia. M. Alboff further confirms the remarks of Engler and N. Kuznetsoff relative to the similarity of the West Caucasian flora with that of the tertiary period.

ASIA.

Chinese Map of Tibet.—In publishing,* in a European dress, a section of what may be called the “Chinese Atlas of Asia,” Dr. Wegener has performed a piece of work which is not only interesting, but useful, for he has judiciously selected just that region of Asia where modern cartographers have been able to do least, and for the geography of which we are still, to a great degree, dependent on Chinese maps. It is true that these maps are not entirely of Chinese construction; indeed, the author of the pamphlet explains briefly the conditions under which they were made. It may be said that Europe is indebted to the enlightenment of the three earliest (effective) Emperors of China of the present Manchu dynasty (Kanghi, Yungching, and Kienlung, whose united reigns lasted a hundred and thirty-five years), and that, on the other hand, the Emperors owe the maps of their possessions to European science and method, as exercised by the Jesuit missionaries at and about their court. A list of these mathematicians, astronomers, and surveyors would contain many illustrious names, and Dr. Wegener mentions especially those three whose work lay chiefly in the region of which his paper treats. These were d’Arocha, Hallerstein, and Espinha,† but there were many others, equally able, who carried on surveys within and beyond the Empire, such as Gerbillon, Verbiest, Jartoux, Régis, and several more; besides those who worked on the computations and the construction of the maps (Adam Schaal, Benoit, and others), or taught and trained Chinese pupils in geographical surveying, much in the same way that our Survey Department in India, in recent times, has trained the native explorers. One region alone—Tibet—as Dr. Wegener points out, was in the last century, as now, closed to the European missionaries, even though they were serving the suzerain emperor of the time, and it was here that the Chinese explorers who took their place did the work which still forms, to a great extent, the basis of our maps of Tibet. The original Chinese atlas was, as Dr. Wegener explains, published in 1718 (it is believed at Peking) during the reign of Kanghi, but it contained little more than maps of the eighteen provinces of China proper. In 1863 a new edition was brought out at Wu-chang-fu, the capital of the province of Hupeh. This was so much enlarged as to extend over the whole of Asia and even a part of Europe, and for this reason it may be called “a Chinese atlas of Asia;” and it is a section of the new edition that Dr. Wegener and Herr Himly have now translated and made accessible to Western geographers. The full Chinese title is *Ta-Tsing i tung yü tu*, or “General Map of the Tsing Empire,” and a copy of it, presented by Mr. H. G. Hollingworth, is among the maps of the R.G.S. Attached to the section now reproduced in German, are two useful indices of names as translated by Herr Himly, whose work seems to have been most carefully performed. He has not merely given the sounds of the Chinese characters, which profess to represent those of the original Mongolian, Tibetan, Turki and Tangut (a purpose for which the Chinese language is singularly deficient), but he has gone, wherever possible, to those languages themselves, and from these has transliterated the names into German—a task requiring no small labour and research.

* ‘Nord Tibet und Lob-nor-Gebiet in der Darstellung des Ta-Thsing i tung yü thu.’ . . . Von Dr. Georg Wegener. Sonderabdruck aus der *Zeitschrift der Gesellschaft für Erdkunde*, 1893.

† Some account of these three surveyors, by Mr. N. Elias, will be found in *Ocean Highways* for February, 1874.

The North Siberian Expedition.—According to the latest news received by telegram by the Russian Academy of Sciences, the expedition to the New Siberian Islands and the coasts of the Arctic Ocean, which went out under Baron Toll, has been quite successful. In the spring they visited, on sledges dragged by dogs, the Kotelnoi and the Liakhov Islands. In the summer they went, on reindeer, from Sviatoi Nos across the Tundras and the Khardulakh range, to Bulun, and thence in a boat across the delta of the Lena and eastwards to the mouth of the Olenek. From Volkolakh they proceeded again on reindeer along the sea-coast to the mouth of the Anabara, and up this river to the northern limit of the forests. During the winter the region between Volkolakh and the Khatanga was surveyed. The latitudes and longitudes, as well as the magnetic elements of no less than thirty-eight stations have been determined. The geological and palæontological materials collected are important for the geology of the region, and contain a solution of the questions which the expedition had in view, especially as regards the Anabara River. The spring this year was early, the summer hot, and during the autumn the weather was excellent. All members of the expedition are in good health.

Exploration in Siberia.—The construction of the Siberian Railway is giving a considerable impetus to geographical exploration both in Siberia and in Eastern and Southern Russia. As to the railway itself, it has been decided to build the line up the Usuri to Khabarovka as soon as the coast section from Vladivostok to Grafskaya is ready. The necessary surveys are already in full swing. Besides, as the main line will pass to the south of Tomsk, a branch line to the capital of West Siberia has been decided upon. Another main line, to connect Central Asia with South-eastern Russia, is planned, and at a recent meeting of the Russian Geographical Society Mr. Nikitin made a communication relative to his explorations in the Trans-Ural steppes and the Ust-Urt for that purpose. Two lines have been surveyed,—from Uralsk to Guriev and Kungrad, and another *viâ* Uil; attention being given by the way to the naphtha wells and the rich salt lakes of Indersk. The best direction proved to be that which leads through the Lower Emba to Lake Indersk and Alexandrov Gai.

AFRICA.

A Journey up the Cross River.—We have received from the Foreign Office a copy of a letter from Sir Claude Macdonald, K.C.M.G., H.B.M. Commissioner for the Niger Coast Protectorate. It is dated Old Calabar, November 26th, 1893. We give the following extracts:—"On October 30th I left Old Calabar in the stern-wheeler *Beecroft* for the purpose of proceeding, if possible, to the Rapids of the Cross River. The *Beecroft* is a stern-wheeler 100 feet long, 20 feet beam, and draws 3 feet. This river was first navigated as far as the Rapids in 1842 by Governor Beecroft in the *Ethiophe*; since that time no craft larger than a canoe has been up. Mr. King, surgeon of that vessel, made a chart which had been embodied in the Admiralty chart of the Calabar Coast; I was fortunate enough to have the chart with me. I had been compelled to delay this expedition to almost the end of the rainy season, which however has this year been exceptionally heavy. We succeeded in passing the so-called Rapids, and stayed the night at a village some 3 miles above them; the natives said that we could proceed for another two days, when we would come to the Falls, and then some days' land journey beyond that we should find "more white men," evidently the Germans in the Bali country behind the Camaroons. I would have proceeded up to the Falls, for although our coal was nearly exhausted we could have cut wood, but unfortunately the river commenced to fall and fell 9 feet in twenty-four hours; so, not wishing to risk the ship, I reluctantly returned.

My party consisted of Commander Dundas, R.N., who navigated the sternwheeler, and Mr. Billington, Curator of the Botanical Gardens at Old Calabar. I propose forwarding to your lordship by next mail a report on this river, accompanied by a chart and botanical notes. The chart will be almost a copy of the one made by Mr. King in 1842, and which is most correct; the names of many towns and villages which have either sprung up since Governor Beecroft's visit or were not put in by him will be added. The Upper Cross River is densely populated; the people were throughout most friendly, and begged us to return next rainy season."

Determination of the Position of Antananarivo.—At a recent meeting of the Academy of Sciences in Paris (*Comptes Rendus*, No. 13, vol. cxvii.), Mr. Alfred Grandidier announced the satisfactory determination by Father Colin of the latitude and longitude of the Ambohidempona observatory near Antananarivo, the capital of Madagascar. The latitude and longitude were given by Rev. Mr. Mullens in 1875 as $18^{\circ} 56' 30''$ S., $46^{\circ} 40'$ E., and by Rev. W. Johnson in 1882 as 19° S. and $47^{\circ} 45'$ E. In 1869 M. Grandidier fixed the position of the French cathedral as $18^{\circ} 55'$ and $47^{\circ} 31' 29''$ by means of a small theodolite, not specially accurate. Father Colin fixed the latitude by means of fifteen series of observations embracing one hundred and fifty-six stars, using a portable transit circle by Rigaud. The observations were made difficult by the incessant tremor of the mercury in the artificial horizon, due probably to the continuous easterly wind, but the determination for latitude may be viewed as accurate, being $18^{\circ} 55' 2' 10'' \pm 2' 18''$ S. Longitude was determined by the same transit circle by the method of lunar culminations, thirty-nine determinations being made with reference to five hundred and sixty-one stars, the mean time-difference from Paris being found as 3 hours 46 secs. ± 4 secs., corresponding to longitude east from Greenwich $47^{\circ} 31' 44'' \pm 1'$. The time difference between Ambohidempona observatory and Tamatave was found by telegraphic observations to be 7 min. 35.4 secs.; and as the longitude of this seaport is fixed by numerous chronometer and lunar observations, the result for the capital is deduced as $47^{\circ} 31' 22''$ E., only 22'' different from the direct determination.

AMERICA.

The Climate of British Columbia.—The annual report of the Canadian Department of the Interior for the year 1892, just received, contains, among others, the report of Mr. E. Deville, the Surveyor-General, containing a few interesting particulars regarding the climate of British Columbia. The prevailing winds are from the west, and in striking the coast range they are deflected upwards, and deposit a heavy rainfall in consequence of the resulting cooling. After passing over the coast range the air comes down into the slightly lower region around Kamloops, where, being heated, it is always dry. Pursuing its course eastwards, it soon strikes the western slope of the Selkirks—the highest range of the Rocky Mountains; the air is again forced upwards, and on coming to the altitude of the summit of the coast range rain is again precipitated, and continues to fall as long as the air ascends, that is, until it has passed over the summit. This explains why there is more rain on the western than on the eastern sides of the coast and Selkirk ranges. Still proceeding eastwards, the wind passes the summit of the Rocky Mountains, the air descends into the plains of the north-west territories, and is heated by the compression due to greater atmospheric pressure; but having previously absorbed the latent heat given up by the moisture which fell as rain on the coast range and the Selkirks, it is now at a much higher temperature than it was when at the same altitude on the western side of the mountains; it is also much above dew-point.

This is the explanation of the dry climate of the western plains and of the paradoxical chinook winds, which appear as if warmed by passing over numberless fields of snow and ice. It will thus be seen that no reasonable expectations can be entertained that the climate of the Selkirk region will materially improve.

Triangulation in the Argentine Republic.—The *Boletín del Instituto Geográfico Argentino*, tome xiv. 1893, states that the Committee appointed in May 1891, for the Triangulation of the Argentine Republic, have decided to cover the country with a net of triangles of the first order, each about 27 miles in the side, and with triangles of the second order ranging from 7 to 10 miles in the side. On account of the difficulties of triangulation in the plains, upon which Ligault towers 100 feet high must be established in order to be visible at distances of about 27 miles, the Committee have decided to determine the position of the apices of the triangles in the first-class net by means of astronomical observations for latitude and telegraphic determinations of longitude, according to the method of Horrebron, usually attributed by North Americans to Captain Talcoth. Experience has proved that longitude may be determined by this method with errors never exceeding one-sixth of a second, which would correspond to an error of 12 feet on the ground, while the possible error of latitude is $0''\cdot 1$; that is, about 10 feet. The maximum error in the length of any triangle's side would thus not be over 22 feet. The Subcommittee to supervise the work is composed of Sr. Francisco Beuf, Director of the La Plata Observatory; Carlos Maschwitz and Francisco Segui, engineers; Dr. Francisco P. Moreno; Captain Guillermo J. Nunez, of the Argentine Navy; and Sr. Abel Draz, secretary.

Patagonia.—Captain Hugo Capalowicz, of Vienna, in finishing his voyage round the world, visited Patagonia, and after ascending the Rio Negro to its upper course (Rio Limay), devoted himself specially to the study of the pampas grasses and to a thorough examination of the Nahuel Huapi and the neighbouring lakes on its northern side, and the geological conditions of the district. Specially worthy of note is the fact that Capalowicz could find nowhere any traces of a glacial period having affected the region. All those phenomena which Siemiradzki (*Geog. Jour.*, Vol. II. p. 158) not long before had noted in the same region as glacial, Capalowicz ascribes to fluvial causes. A detailed exposition of his investigations will shortly appear in the Memoirs of the Vienna Imperial Academy, with the title "The Rio Negro Region of Patagonia," together with a geological map of the North-West Limay Region. The orography of this map is based upon measurements taken by the explorer himself, and the map should, to a great extent, supplement Siemiradzki's map (*Petermanns Mitteilungen*, 1893, iii.), of the same region. The Nahuel Huapi appears on this map in almost the same shape as before, with the narrow island, about $12\frac{1}{2}$ miles long, in the middle, from which the lake takes its name of Nahuel Huapi or Tiger Island. But, as Siemiradzki has already rightly guessed, the lake is considerably smaller—above all, shorter—than was supposed; it measures about 40 miles from north-west to south-east; its altitude above sea-level is very much greater than was concluded from the last (Rohde's) measurement; namely, 3170 instead of 2030 feet.

AUSTRALASIA.

Damma Islands, Banda Sea.—In November, 1891, a visit was paid by P. W. Bassett-Smith, Surgeon, R.N., to the small island of Damma, lying in the Banda Sea, between Timor and the Tenimber group (*Journal Anthropol. Inst.*, xxiii., No. 2). Though nominally under Dutch rule, the only official was found to be an old Malay from Macassar, who had the office of "Post-holder." The island lies on

the route from Port Darwin to Hong-Kong, and is occasionally visited by trading-ships; but little is generally known of it or its inhabitants, who, placed on the border-line between the Malayan and Papuan races, cannot be hastily classed with one or the other of these. The island, which is of a rough, horse-shoe form, is mountainous, and shows signs of volcanic activity in a constantly-smoking truncated peak at the northern end, and in layers of lava, patches of sulphur, and hot streams and springs on the eastern side. The profuse vegetation of the island recalls that of the Moluccas. A landing was effected in a natural harbour on the east side, fringed with coral reefs. A large village at the head of this bay was visited, and another on the hill-side was reached during an excursion which led through thick forest. Both villages agreed in being surrounded by a wall. In the vicinity were plantations of coco-nut, betel-nut, and bread-fruit trees, plantains, etc., and at the lower village, of sago, which is extensively washed in machines, like those described by Wallace. The huts were of bamboo, not on piles, with walls of laths, and gable roofs of thatch. Species of *Acacia* and *Ficus* were met with in great numbers; and of birds, swifts, lorries, the great fruit-pigeon, etc. As far as could be judged, two types existed among the natives. The first, dark brown, with coarse straight hair, dilated nostrils, and large mouths, seemed to occur chiefly in the coast villages and to be of Malayan origin, though perhaps with some mixture. The other, which was observed in the hill-villages, was a coppery-brown—much lighter race—with frizzly hair, aquiline and slightly hooked nose, and of a much brighter disposition. These seemed, in spite of their light colour, to be more akin to the Papuans. Bows and arrows of bamboo, the latter 5 feet 6 inches long, are the principal weapons; while ingeniously made combs, ear-pendants, and bracelets of wood or bone, formed the chief ornaments. Boat-building is practised—the boats being “dug-outs,” with large outriggers, and often a high and pointed bow and stern. Wooden “gods” were seen near the villages, and were held in fear. The beating of a drum by the chief man of the village at sunrise and sunset was no doubt a religious rite. The “gods” as well as their carvings, ornaments, etc., were decidedly Papuan in type, and on the whole the majority of the people (who in some ways much resemble those of Tenimber), approach the Melanesian, rather than the Malay, race.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Temperature and Conductivity of Snow.—Volume xvi. of the *Repertorium für Meteorologie* contains an account of some important observations by Dr. H. Abels on the temperature, conditions, and thermal properties of snow. The object of the investigation was to find a relation between the thermal conductivity of snow and its density, the density being defined as the ratio between a given volume of snow and the volume of water obtained from it by melting. It was found from observations at Katharinenburg in 1891 and 1892 that the density of firm snow ranged from $\frac{1}{3}$ to $\frac{1}{3.7}$, and of loose snow from $\frac{1}{3.6}$ to $\frac{1}{4}$, the variation with depth being small to at least $4\frac{1}{2}$ inches below the surface. The data for calculating conductivity were obtained from hourly observations of temperature at the surface and at 2 and 4 inches below it. These showed a rapid decrease of amplitude in the daily variation of temperature with increase of depth, the decrease being faster in loose than in firm snow. The daily minimum rises much more rapidly than the maximum falls; the minimum observed at 4 inches was as much as 20° Fahr. higher than at the surface, while the maximum at that depth was only $7^{\circ}\cdot 5$ lower. The temperature in both loose and compact snow showed greatest uniformity at 4 P.M., the greatest difference amounting to $4^{\circ}\cdot 3$. In the case of denser snow the diurnal curve of temperature showed a regular retardation in both maximum and minimum,

the former phase being one hour later at a depth of 2 inches than at the surface, and the latter an hour and a half later. Loose snow, on the other hand, showed comparatively little alteration in the first 2 inches, but the retardation was markedly greater at greater depths. The author suggests that this peculiarity is due to the transparency of the loose surface layers to the sun's rays, whereby a certain amount of heat is received which is disposed of by conduction and not by radiation, the process being similar to what occurs in a forcing frame. Further explanation is thus afforded of the great protective action of a snow-covering, and an additional reason advanced for the higher temperatures observed in loose snow than in dense. Assuming the specific heat of snow to be the same as that of ice, and employing the temperature observations in the usual way, Dr. Abels computes the thermal conductivity of snow, and finds it proportional to the square of the density as above defined. From the numerical values it would appear that snow of average density, say $\frac{1}{2}$, offers about four times greater resistance to external changes of temperature than does one of ice of equal thickness, and that independently of its peculiar property of retaining radiant heat. This affords a measure of the protective power of a snow covering to the surface on which it rests. Considerable additional light on the general question of the influence of snow-covered areas on climate may be gained from a paper by Eduard Brückner in the *Zeitschrift des Deutschen und Oesterreichischen Alpenvereins*. Following closely the lines of Dr. Woeikoff's papers on this subject, temperature observations made at Danos are discussed in great detail, and the author finds that there the surface of the snow is usually colder than the air, except when snow is actually falling, the difference being greatest when the sky is least obscured by cloud. Hence the snow-covering exerts a strong cooling influence on the air, especially in calm anticyclonic weather, and under such conditions there is frequent condensation of vapour from the air on the snow-surface, in the form of "silver-thaw." These results may be taken as qualitative, and the author concludes the paper with an attempt to estimate quantitatively the variations of climate due to the presence or absence of snow in the Bavarian Alps.

The Daily Afternoon Minimum of Wind-force.—The Vienna Academy of Sciences has received from Professor Pernter, of Innsbruck, a paper entitled "An explanation of the daily oscillations in the velocity of wind." The author holds the view that the diminution of the speed of the wind on mountains at midday, and its increase during the night are due to the mixing of the upper strata of air with the lower, which, as is well known, causes an increase of the internal friction, thus retarding the movement of the masses of air. According to Köppen these convection currents are sufficient cause for the daily oscillations of the strength of the wind on the surface of the Earth; but there are no facts known which would justify the assumption that such currents attain to an altitude of 10,000 feet. Thus, although Pernter considers that the afternoon minimum registered from the observatory of the Eiffel Tower is explained by the retarding action of the mixing together of currents of air moving one above another, he ascribes the same minimum on the summits of high mountains to the local ascent up the mountain sides of valley winds. That is to say, he considers this phenomenon as resulting from special climatic causes rather than from general meteorological ones.

GENERAL.

Speed of Travelling in the Future.—In an article published in the *Bulletin* of the Antwerp Geographical Society (vol. xviii. p. 47), E. de Keyser discusses the future of rail and steamship travelling and of the speeds which may be attained in the next century. Having glanced at the first beginnings of ocean navigation,

the writer reviews the methods of travel in use so late as the end of last century, when the journey from Brussels to Paris by diligence occupied three to four days, the greatest improvements up to the introduction of railways hardly reducing that from Paris to London to two days. M. de Keyser then traces the progress made since the introduction of steam down to the present day, when the mean speeds maintained for long distances (including stops) on the great trunk lines average about 31 miles (50 kilometres) an hour, while experiments made for short distances have given three times this speed. The course of trans-Atlantic navigation down to 1892, when the record for the passage (made by the *Paris*) stood at five days fourteen hours, or 20·7 knots an hour, is also sketched, and the principal routes at present existing are described. By combining in the most advantageous way the actual runnings on the different lines which together complete the circuit of the globe, the writer shows that this may be made *viâ* San Francisco and New York in sixty-seven days (including a day's delay at the latter, and three more than necessary between Hong-Kong and Yokohama), while by the Canadian Pacific and New York, under a favourable conjunction of circumstances, such as occurred *e.g.* in August, 1891, the time here allowed from Yokohama to London may be reduced by six days. The quickest circuit will be made when the greatest proportion is by land; therefore when the Siberian railway is completed—and judging from the progress already made on different sections, another ten years should see Vladivostok in direct communication with Europe, by the help (provisionally) of steamers on Lake Baikal and the Amur—the time may be still further reduced. At the present rate of travel on existing lines, allowing a very moderate rate across Siberia, and supposing a connection established between Vladivostok and Yokohama by Japanese steamers and railways, it is found that the duration of the tour is reduced to fifty days, or forty-five when the whole Siberian railway is completed, and thirty-seven if European speeds were extended to it. In discussing the speeds attainable in the future, the writer, while allowing that with the steam-engine a safe limit must soon be reached, holds that by the help of electricity, the rate by rail may be increased almost indefinitely. With steamships the case is different, owing to the enormous supplies of fuel necessary for a greatly increased speed, and the limitation of draught, and with it of coal-carrying capacity, involved by the necessity of entering ports. With the electric railways of the future, with a speed double the present average for long distances, M. de Keyser sees it quite possible to perform the tour of the world in twenty-four days.

Cycling and Local Geography.—Mr. W. T. Arnold forwards us a paper on bicycling which he contributed to the *Manchester Guardian*. It contains an interesting instance of a cycling lesson in local geography, the particular exercise described being a run along the valley of the Medlock from a point as near the source of the main tributary as could be reached on wheels to the junction of the river with the Irwell. We can heartily commend this system of studying local geography; for although it necessarily limits the track of the traveller to made roads, or at least footpaths, the importance of changes of gradient and level is much more readily realised afoot than on wheels, and the cyclist's eye—already trained to observe the features of the way which affect his locomotion—can readily accommodate itself to the nobler exercise of seizing the salient aspects of the scenery, and gaining first-hand geographical knowledge on a small scale. For a school-teacher such a relaxation should prove invaluable, and would unquestionably lead to a more vital grasp of the greater watersheds and valleys of the continents that are so frequently handled as mere statistical abstractions. Mr. Arnold very truly says, in urging the importance of his plan:—"Abroad the teaching of geography always

begins with the district in which the children live. If Manchester were in Switzerland or Germany there would be large-scale maps of the district in all the elementary schools, showing its relation to the Pennine on the one hand and the sea on the other, and, above all, representing its river system with the greatest possible clearness. Manchester is where it is because the Irwell and the Mersey are where they are, and it is to the streams descending from the Pennine that the establishment of the cotton manufacture in Lancashire was originally due. But who knows the river system of South Lancashire—the course and origin of the Tame, the Medlock, and the Irk, for instance? Even the Mersey (Goyt and Etherow) and the Irwell are far less clearly apprehended than they should be. There is no good local map, and even on the Ordnance sheets it is by no means easy to trace the streams, so hidden and disguised they have been by man. The books are equally wanting, J. R. Green alone in his ‘Geography’ giving a few helpful hints.” The same is true of most districts of the United Kingdom. Local ignorance of existing means of information is remarkable, and in the course of University Extension lectures in different parts of England and Scotland the explanation of the Ordnance maps of the district, coloured to bring out the contour-lines and drainage-lines more clearly, has been found to be more of a revelation in geography than a lecture on the configuration of distant continents.

Geography and the Army Entrance Examinations.—Mr. W. Baptiste Scoones, in a recent number of *The Nineteenth Century*, speaks plainly and strongly on the subject of the selection of Army Officers by competitive examination. He recognises the great importance of Geography as a subject of examination for British officers, and in deploring the manner in which this science has been neglected, he makes the following remarks:—“The old preliminary examination in this subject unmasked a state of ignorance that was appalling. Its inconvenience as part of any established curriculum of study appears to be such that it has now been considered expedient to relegate it to the *optional* subjects, with marks sufficiently immaterial to discourage candidates from bothering their heads much about it. In the interests of our officers of the future this is scandalous. To no other subject is greater attention paid in examinations for officers of the French or German army. In France it is placed on exactly the same marks-level as history, and only a trifle below mathematics; while in regard to a modern language it stands as fourteen to ten. And, as with history, the same care is taken in their regulations to define the necessary course of study. Different countries and different subdivisions of the globe have to be considered under the several heads of, Physical Geography, Orography, Hydrography, Political Geography, and Railroads; and in the case of the rivers that are specified, the strategic importance of the regions they traverse has to be studied.”—“When it is remembered that twenty-three years ago English correspondents at the Franco-German War reported that every German commissioned and non-commissioned officer carried a map of France in his wallet and was quite at home in the topography of the invaded districts, it is high time to call to account those who have encouraged this blameworthy supineness of ours. Assuredly, then, Lord Sandhurst’s Committee will have to include Geography among the compulsory subjects, and assign to it the same prominence as History. Thus far it seems to have been kept outside the pale of ‘education,’ and has been treated as a subject *pour rire*. At school it has never occupied a position even approximating to that which at the Universities certain personages call ‘stinks’; and yet it would be difficult to mention any subject more likely to be of general utility to a soldier, provided the present humdrum, childish smattering could be made to blossom, as it

must do, into a minute and interesting appreciation of all its political, physical, and scientific aspects."

The late August Artaria.—The death is announced from Vienna, on December 14th, 1893, of August Artaria at the age of eighty-seven. Head of the map-publishing firm of Artaria & Co. since 1842, the deceased maintained the high reputation of the oldest business of the kind in Austria. It was founded in 1770. Scientific geography is chiefly indebted to him for the publication of the cartographical work of such scientific geographers as Anton Steinhauser (*ob.* 1890) and General Ritter von Hauslab, with whom he was always on the most intimate terms. To his co-operation with the most distinguished scientific workers of his time are due his admirable maps of the Alps, of Central and South-Eastern Europe, and of Austria-Hungary. The fact that in these maps Hauslab's method of colouring—amount of elevation corresponding to depth of tint—was carried to its fullest extent, places August Artaria at once among those who bore the burden and risk of introducing and proving the real scientific value of the newer methods of cartography.

Globus and Ausland.—In 1828 a weekly geographical journal was started in Augsburg, under the name of *Das Ausland Ueberschau der neuesten Forschungen auf dem Gebiete der Natur-, Erd-, und Völkerkunde*, thus being one of the earliest journals devoted exclusively to geography, the only one of prior date being the *Bulletin* of the Paris Geographical Society, which commenced in 1824. The place of publication was changed to Stuttgart in 1873, by the publishers, Messrs. Cotta; in 1882, the sub-title was changed to *Wochenschrift für Landes- und Völkerkunde*, and Professor Friedrich Ratzel's name appeared upon the title-page. Subsequently Dr. Karl von Steinen, and finally Dr. Siegmund Günther acted as editors; and, with the close of 1893, the publishers brought the journal to an end, nominally amalgamating it with *Globus*, which, published at Brunswick, has appeared since 1862, two volumes being issued each year. It is matter of speculation as to whether the growth of the numerous colonial journals now appearing in Germany has made it impossible for a scientific paper like *Ausland* to pay its way, or whether the lack of popular support which presumably led to the collapse of the journal arose from deeper causes. *Globus* has been distinguished for its excellent illustrations, and this feature is fully maintained in the earlier numbers for 1894, in which we also notice with pleasure that the publishers have abandoned the old German character and introduced Roman type.

Olaus Magnus and his Map of Northern Europe.—An article by H. A. Schumacher appears in the *Zeitschrift* of the Berlin Geographical Society (1893, No. 3), giving an account of the old Swedish Geographer Olaus Magnus and the part which he took in promoting a knowledge of the northern parts of Europe. He spent some time in travel and study at continental seats of learning, and at the instance of Ascimboldo, Papal Legate in Sweden, proceeded on a mission through the northern parts of Scandinavia, thus becoming personally acquainted with some of the countries on which he afterwards shed so much new light. On the succession of Gustavus Vasa, Olaus Magnus accompanied his brother, an exiled ecclesiastic, to Danzig, where they devoted themselves to literary pursuits, the elder working at the history, the younger at the geography, of the north. He made a journey to Rome in 1533, and in 1537 finally left Danzig and resided in Venice, where he made the acquaintance of Ramusio, and here in 1539 his great map was published accompanied by a descriptive index. The details of this are fully described by Schumacher, the characteristic feature being the amount of information respecting the northern

groups of islands and their productions, besides Iceland and Greenland. The latter years of Olaus' life were spent in Rome, where he completed a voluminous 'History of the Northern Nations,' in which the most varied matter is thrown together without much arrangement. The map of Olaus differed from its contemporaries in showing the separation of Norway from Greenland by the Ocean, and thus supported the views of those who held that it was possible to sail to China by following the north east. After the death of its author, the map soon fell into oblivion, and later copies omitted much of its detail. From many points of resemblance between it and the map attributed to the Zeni, the writer holds that this was really of later date, and principally taken from that of Olaus Magnus.

CORRESPONDENCE.

The Determination of Longitudes by Photography.

December 18th, 1893.

I have with much interest read Mr. Ravenstein's remarks on my paper about the determination of geographical longitudes by photography (*Journal*, November 1893). The following notes may, I think, throw some further light on this important subject:—

Mr. Ravenstein is of opinion that we have scarcely as yet got beyond the experimental stage in the determination of longitudes by photographic lunars, and that not a single determination of that nature has been made in the field. But in reply to that I may say that more than a year ago, at the meeting of the British Association at Edinburgh, I gave the results of a complete computation of a longitude, taken with strict observance of all conditions in the field. In *Nature* (August 25th, 1892), and in *Petermanns Mittheilungen* (vol. xxxix., 1893, p. 88) reports are to be found on these results, proving that I introduced the new method in a complete form to the scientific world. The sole reason why my paper in the November number of the *Journal* contains no computations is in deference to the wish of the Editor to have the subject-matter of the paper brought before the Fellows of our Society in such a form as to be intelligible to everybody without entering into mathematical details. The necessary computations have been published in the *Verhandlungen des X. Deutschen Geographentages*, Berlin, 1893.

I am not aware that any leading authority has condemned *in toto* the sextant for astronomical work on *terra firma*. I for my part—although I do not claim to be an authority in this respect—have never entertained such a thought. In my opinion a *good* sextant is of the utmost value for all observations in connection with local time and geographical latitude, on sea as well as on land. But the case is totally different with lunar observations. Sir Isaac Newton computed that the average velocity of the proper motion of the moon in one second of time amounts to the very small angle of 0.5479 second of arc. Moreover, errors in the time of the observation of a certain lunar distance produce, as is well known, serious errors of longitude. Under these circumstances it is evident that strict accuracy cannot be looked for from single sets of lunar observations measured with the sextant or other reflecting instruments.

Mr. Ravenstein says that the apparatus which I have invented is in fact nothing but a "photogrammeter." The novel and principal features in the

construction of my apparatus are that the images of moon and star can be made equidistant from the centre of the plate, and that at the same time the observations can be repeated with the utmost rapidity, enabling the observer to take as many sets of lunars as he likes without loss of time or waste of photographic plates. It is evident that the minute accuracy, as well as the practical value of the method, depend on these peculiar arrangements, which are fully described in my paper, and which differ entirely from any "photogrammeter." I may be permitted to add that many experiments, as well as months of labour, were required before I was satisfied with the construction of the apparatus, both as to accuracy and simplicity.

With regard to the preference which Mr. Ravenstein gives to some other kinds of observations, I shall always be very glad to see longitudes accurately determined by these or any other of the old-established methods; but up to the present time strictly accurate results are rare. One of the main reasons why I worked out this new method is the indisputable fact that only a very small number of accurately determined geographical longitudes in the interior of unsurveyed countries exists. It is, however, well known that approximate determinations are numerous; but their mathematical limits of accuracy are very doubtful. Probably Mr. Ravenstein refers to such approximations, when he says in his letter that of recent years quite a number of longitudes have been satisfactorily determined in Africa.

Let the theodolite, the sextant, and the photographic apparatus compete in the accurate determination of longitude, latitude, and local time, and the "survival of the fittest" will soon become evident.

HENRY G. SCHLICHTER.

P.S.—I take this opportunity to correct a printer's error in the table which forms part of my paper (*Journal*, November, 1893). The fourth lunar distance between Spica and the moon should, of course, read 20·672mm., instead of 30·672mm.—H. G. S.

The Sea Route to Siberia.

December 21st, 1893.

I have read with much interest the notes recorded by Mr. Ernest C. F. James, who accompanied the small fleet of vessels that took the consignment of rails to Golchika this year, piloted by Captain Wiggins. I should like to add a few remarks which I think might be useful to anyone who is anticipating making a trade route of the water-way to Siberia. Doubtless the reader will remember that in the year 1890 the Anglo-Siberian Trading Syndicate sent out two vessels (organised under the inspiring influence of the late Sir Robert Morier), the s.s. *Biscaya* and the s.s. *Thule*, the former a Norwegian vessel of 700 tons register, and the latter of 400 tons. The s.s. *Biscaya* carried Mr. Oliver Williams and myself as representatives of the Syndicate, a mining expert, Mr. William A. Mercer, A.M.I.C.E., as well as Mr. Julius M. Price, F.R.G.S., a special correspondent from the *Illustrated London News*.

The *Biscaya*, under the command of Captain Petterson and Captain Crowther, as ice-master, reached the Yugor Straits on August 4th, and Golchika August 13th, and, not meeting the s.s. *Phoenix* with the Company's agent on board, proceeded up the Yenisei, piloted by the little English steam launch *Donna-Anna*, in charge of Mr. W. A. Mercer, to Karul, a distance, as before stated, of 200 miles beyond

Golchika, without any accident or difficulty, where we met the river flotilla. This was the first, and I believe so far the only steamer drawing 18 feet of water that has penetrated the estuary and reached the sheltered bay of Karul, where cargoes can be transhipped without any risk whatever. The s.s. *Thule*, with the tug-boat *Bard* in tow, and commanded by Captain Cordiner (the *Bard* being in charge of the brother of Captain Wiggins), arrived safely a week later, bringing Mr. W. H. Tagart, one of the Directors. After transshipping cargoes to the river steamer *Phoenix* and various barges, the *Biscaya* and the *Thule* returned to England with Siberian produce, while the *Phoenix* and the small tug *Bard* proceeded to Yeniseisk, arriving there safely on October 25th.

According to Mr. James very little difficulty was met with in the Kara Sea as regards the ice. We, on the contrary, experienced great trouble, owing probably to the fact of our being somewhat in advance of the season, and were ice-bound for three days. Once however through the ice-belt, we experienced no further trouble. It is evident that an uninterrupted passage is by no means a certainty, and to provide for any emergency vessels destined for this route should be stout wooden vessels suitably strengthened for ice-ramming; for it is of great importance to be able to force aside the detached floes, thus frequently opening a free passage.

The experience of 1893, as well as of past years, seems to me to prove that Golchika is unsuited for the port of transfer owing to its being an open roadstead, exposed to sudden storms. We clearly demonstrated that ocean steamers, drawing upwards of 18 feet, can safely be piloted by steam launch as far as Karul, where, as before observed, there are natural facilities for discharging cargoes.

J. GOLDSMITH PROCTER.

OBITUARY.

Sir Samuel White Baker.

By E. G. RAVENSTEIN.

IT is with regret we place on record the death of Sir Samuel White Baker, which took place on December 30th at the deceased's country residence, Sandford Orleigh, near Newton Abbot. Baker was born at Thorngrove, near Worcester, on June 8th, 1821. He received an excellent education, and, when still a young man, in 1845 he joined a brother at Nuwara Eliya in Ceylon. The farming operations in which they engaged did not prove a success, but an eight years' residence in Ceylon afforded Baker an opportunity of gaining experience and even renown as a sportsman.* After his return to Europe he was engaged for some time upon the railway which now connects Ruschuk with Varna. This occupation, however, could afford no satisfaction to a man of Baker's adventurous spirit and love of sport. Ample private means enabled him to follow his inclinations. His friends Speke and Grant had left Bagomoyo in October 1860 in search of the true source of the Nile. Baker determined to meet them. His young wife, a lady from Pest, insisted upon sharing all dangers and hardships. On April 15th, 1861, Baker left Cairo. He was able to travel leisurely, for Speke and Grant were not expected on the Upper

* 'The Rifle and the Hound in Ceylon.' London, 1854. 'Eight Years' Wanderings in Ceylon.' London, 1855.



SIR SAMUEL W. BAKER.

(From a Photograph by Mauill & Fox, May, 1866.)

Nile before the beginning of 1863. On reaching Berber he turned aside, and spent a full year in the region watered by the Atbara, Setit, and other Nile tributaries of Northern Abyssinia. He had thus an opportunity not only of satisfying his love of sport and adding to some extent to our geographical knowledge, but also of acquiring a knowledge of Arabic and of native character which proved of the utmost service to him during his subsequent career.*

On June 11th, 1862, Baker reached Khartum, where he waited until December for the northerly winds, which enabled him to reach Gondokoro on February 2nd, 1863. Speke and Grant arrived there a fortnight afterwards, whilst Petherick, who had left Khartum in March, only reached Gondokoro on February 20th. He had, however, placed boats and stores at Gondokoro for the use of the expected travellers.†

Speke had indeed discovered the Victoria Nyanza to be the true source of the Nile, but he had been unable to visit a lake to the westward which the Nile was stated to cross on its way to Gondokoro. Baker at once determined to clear up this interesting geographical question. His own men were in a state of mutiny, whilst the slave-traders openly defied him to penetrate into the interior. Nevertheless, he started on March 26th, and his courage and resolution enabled him to overcome obstacles to which most other men would have succumbed. His wife stood nobly by him during all these trying times, and a full share of the success of the expedition must be awarded to her. Having spent some time in the Latuka country, Baker crossed the Nile at Karuma, visited Kamrasi, the king of Unyoro, at Mruli, and on March 14th, 1864, he looked down upon the lake he was in search of, and bestowed upon it the name of Albert Nyanza.

Baker, deceived perhaps by the condition of the atmosphere, and misled by native reports, conceived this lake to extend far to the south, possibly as far as the Tanganyika. For thirteen days he followed its eastern shore, as far as the mouth of the Victoria or Somerset Nile. Whilst ascending that river he discovered the Murchison Falls. In March 1865 he was back at Gondokoro. He then hastened home, and met with a most enthusiastic reception. The Royal Geographical Society, in recognition of his important discoveries and trustworthy astronomical observations, had already awarded him its Patron's Medal, the Paris Society voted him a similar distinction, the Royal Society elected him one of its Fellows, and the Queen conferred upon him the honour of knighthood.‡

During this remarkable expedition Baker had become an eye-witness to the horrors of the slave-trade, and he resolved to offer his services for its suppression. He proposed to the Khedive to annex the whole of the region of the Upper Nile, as far as the lakes; to establish there a strong paternal government, to take measures for the development of the great natural resources of those countries, and to open them to legitimate trade. The Khedive favourably entertained these propositions; he conferred upon Baker the rank of pasha and large powers, but owing to the ill-will of all the Egyptian authorities, and especially of those in the Sudan, Baker never had a fair chance of accomplishing the difficult task which he had undertaken. He left Khartum in February, 1870, with a small flotilla of two steamers and thirty-one sailing vessels, but of the 800 soldiers who accompanied him about one-half were discharged convicts. The expedition met with obstacles from its

* 'The Nile Tributaries of Abyssinia and the Sword Hunters of the Homran Arabs.' London, 1867. See also *Journal* R.G.S., Vol. XXXIII., 1864, pp. 237-41; and *Proceedings*, Vol. X., 1866, pp. 279-95.

† For Petherick's own account of this "failure" of bringing succour to Speke and Grant, see 'Travels in Central Africa,' by Mr. and Mrs. Petherick. London, 1869.

‡ 'The Albert Nyanza.' London, 1866. See also *Journal* R.G.S., 1866, pp. 1-18.

very outset. The Nile, above the Sobat mouth, had become choked with matted vegetation, such as had probably deterred Nero's centurions from proceeding any further. Baker, however, was not to be deterred. He determined to make his way to the upper reaches by way of the Bahr Zaraf. The task proved more formidable than he had expected, and it was April 15th, 1871, before he arrived at Gondokoro. Two years were spent in fighting slave-dealers and native tribes, the retreat from Mazindi forming perhaps the most stirring episode in this warfare. When Baker left Gondokoro in April, 1873, peace had been established in the region to the south of Gondokoro, and the slave-traders had been compelled to retire. New geographical discoveries had not been made, but Lady Baker had carefully kept a meteorological journal, whilst Lieutenant Julian Baker had largely improved the map of these regions.*

Baker never again returned to savage Africa, being content to seek sport in Cyprus † and other more accessible countries of the world, continuously enriching his home in Devonshire with trophies of the chase. He retained, however, a deep interest in the future of Africa. No one deplored more than he did the evacuation of the Sudan, for he looked upon the whole basin of the Nile as a natural and necessary appendage of Egypt, and ever urged the present rulers of that country to adopt a determined and continuous policy with respect to the Sudan. ‡

Baker's name will for ever be associated with the solution of the great problem of the Nile sources, which has occupied the geographical world since the days of Herodotus. There have been African explorers who covered more ground, or who, favoured by circumstances, have been able to bring home a greater mass of scientific information; but none whose labours were dictated by nobler motives: none who in the pursuit of their work were called upon to exhibit greater courage, circumspection, and resoluteness. Lady Baker shared in all the hardships and perils of her husband; she stood fearlessly by his side at critical moments, and may fairly share in the honour that has been won.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1893-94.

Fourth Ordinary Meeting, January 15th, 1894.—Sir JOHN KIRK, K.C.B.,
G.C.M.G., &c., Vice-President, in the Chair.

ELECTIONS.—*William Lindsay Alexander; James Victor Burn-Murdoch; Ronald Stanley Clarke; I. Irvine; Edmund George Lamb, M.A.; Hon. G. W. Spencer Lyttelton; William John May; Dr. Hamilton Seymour; Cecil William Paulet Slade; Arthur Smith Wood.*

The Paper read was:—

“An Expedition to the Glaciers of Mount Kenia.” By Dr. J. W. Gregory.

There was an exhibition of photographs in the tea-room.

* ‘Ismailia.’ London, 1874. See also *Journal R.G.S.*, 1874, pp. 131-48.

† ‘Cyprus as I saw it in 1879.’ London, 1879.

‡ See, for instance, “The Soudan and its Future.” *Contemporary Review*, January, 1884; “Khartum and the Soudan,” in F. T. James’s ‘Wild Tribes of the Soudan’; and letters in the *Times* of December 18th, 1883, December 8th, 1884, and May 31st, 1890.

GEOGRAPHICAL LITERATURE OF THE MONTH.

*Additions to the Library.*By HUGH ROBERT MILL, D.Sc., *Librarian, R.G.S.*

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

A. = Academy, Academie, Akademie.
 Ann. = Annals, Annales, Annalen.
 B. = Bulletin, Bollettino, Boletim.
 Com. = Commerce, Commercial.
 C. R. = Comptes Rendus.
 Erdk. = Erdkunde.
 G. = Geography, Geographie, Geografia.
 Ges. = Gesellschaft.
 I. = Institute, Institution.
 J. = Journal.
 M. = Mitteilungen.

Mag. = Magazine.
 P. = Proceedings.
 R. = Royal.
 Rev. = Review, Revue, Revista.
 S. = Society, Sociétés, Selskab.
 Sitzb. = Sitzungsbericht.
 T. = Transactions.
 V. = Verein.
 Verh. = Verhandlungen.
 W. = Wissenschaft, and compounds.
 Z. = Zeitschrift.

On account of the ambiguity of the words *octavo, quarto, &c.*, 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.

EUROPE.

Alps and Jura.

Brückner.

Ueber die angebliche Aenderung der Entfernung zwischen Jura und Alpen. Von Professor Dr. Ed. Brückner. Separatabdruck aus dem XI. Jahresbericht der Geographischen Gesellschaft von Bern für die Jahre 1891–1892. Size 9 × 6½, pp. 9.

Alpine History.

Edgecombe.

A Missing Page in Alpine History. By Richard Edgecombe. [From *The National Review*, October, 1893, pp. 249–257.]

Finland.

Rees.

A Fortnight in Finland. By J. D. Rees, O.E. [From *The National Review*, October 1893, pp. 215–229.]

France—Caverns.

Martel and Gaupillat.

Annuaire Club Alpin Français 19 (1892): 201–235.

Sous Terre: cinquième campagne. (Vaucluse et Basses-Alpes; Ardèche; Gard; Lozère; Aveyron; Tarn-et-Garonne; Lot; Charente; Puy-de-Dôme; Côte d'Or). Par MM. E. A. Martel et G. Gaupillat.

These records of underground mountaineering are as full of interest as ever, and are illustrated by diagrams of some of the very uncomfortable places which the adventurous explorers succeeded in reaching and returning from.

Holland. *Tijdschrift Nederlandsch Aardrijk. Genootschap* 9 (1892): 301–348. Tonkes.

Over den Regenval in Nederland door Dr. H. Tonkes.

An essay on the distribution of rainfall over Holland; illustrated by six maps.

Iceland.

Thoroddsen.

Geologiska Iagttagelser paa Snæfellsnes og i Omegnen af Faxebugten i Island af Th. Thoroddsen. Med et geologisk Kaart. Stockholm, 1891: size 9 × 6, pp. 97.

This paper on the geology of the Faxa and Reide fjords in Iceland appears in the *Proceedings of the Royal Swedish Academy of Sciences*, vol. xvii., part 2.

Manchester Ship Canal.

Egerton.

The Manchester Ship Canal. By the Right Hon. Lord Egerton of Tatton. [From *The Nineteenth Century*, January 1894, pp. 12–22.]

Norway—Gullmarfjord.

Palmqvist.

Hydrografiska Undersökningar i Gullmarfjorden Sommaren 1890 af A. Palmqvist. Med 3 Taflor. Stockholm, 1891: size 9 × 6, pp. 19.

Particulars of temperature and other observations in the Gullmarfjord. Published in the *Proceedings of the Royal Swedish Academy of Sciences*, vol. xvii., part 2.

Pyrenees. *Annuaire Club Alpin Français* 19 (1892): 432-456. Schrader and Margerie.

Aperçu de la forme et relief des Pyrénées. Par MM. F. Schrader et Emm. de Margerie. *Map in colours.*

Another copy. *Presented by the Authors.*

This admirable summary of the orographical structure of the Pyrenees will be specially noticed.

Russia—Archæology.

Congrès International d'Archéologie et d'Anthropologie Préhistoriques. Deuxième Session, à Moscou, août 1892. 2 vols. Moscow, 1893.

The two volumes, of which the second is just out, contain, besides some important papers contributed by West European anthropologists, a number of papers and notes relative to the stone, bronze, and iron-ages, inhabitants of the territory of the Russian Empire, as well as to the craniometry of several of its present inhabitants.

Russia—Industries.

Crawford.

The Industries of Russia. Vols. I and II. Manufactures and Trade, with a general Industrial Map by the Department of Trade and Manufactures, Ministry of Finance for the World's Columbian Exposition at Chicago. Editor of the English translation, John Martin Crawford, U.S. Consul-General to Russia. St. Petersburg, 1893: size 10½ × 7, pp. xv., liv. and 576.

Vol. V. Siberia and the Great Siberian Railway; with a general Map by the Department of Trade, &c. St. Petersburg, 1893: size 10½ × 7, pp. xii. and 265. *Presented by M. V. I. Kovalevsky.*

Russia—Novgorod Province.

Peredolsky.

V. S. Peredolsky. Remains of the Stone-Age Inhabitants of the Shores of Lake Slonen, the Banks of the Volkhov, and the Territory of Novgorod Velikiy. St. Petersburg, 1893.

The book is based on a very rich collection of stone-age implements discovered during excavations made by the author at Novgorod and Kolomtzy. The conclusion of the author is, that the inhabitants of the shores of Lake Slonen have stayed there since the Glacial Period, down to the times of the first Russian annals. The locality would thus represent the stone-age cradle of the North Russians.

Russia—Perm.

Smishlyaer.

The Perm Region (*Permskiy Krai*). A collection of information on the Government of Perm, published by the local Statistical Committee. Edited by D. Smishlyaer. Two volumes. Perm, 1892-93. [In Russian.]

The first volume is entirely devoted to information on agriculture. The second contains valuable ethnographical and archæological articles—viz., M. Toploukhov's researches into the "Ciud" antiquities; a copy of the map of the province of Ekaterinburg and Solikamsk, compiled in 1734-1736, with a descriptive text; historical information upon the possessions of the Stroganovs (to whom the Ural mines and forests had been given by the Crown); on the fishes of the region; on the insects destructive to corn-crops; and on popular medicine, &c.

Spain—Elché.*Annuaire Club Alpin Français* 19 (1892): 278-298.

Riston.

Une oasis saharienne en Espagne: la forêt de palmiers d'Elché. Par M. Victor Riston.

Switzerland.

Steck and Zeller.

Arbeiten aus dem Geographischen Institut der Universität Bern. Th. Steck: Die Wassermassen des Thunevund des Brienzensees. Th. Steck: Die Denudation im Kandergebiet. R. Zeller: Die Schneegrenze im Triftgebiet. Separatabdruck aus dem XI. Jahresbericht der Geographischen Gesellschaft von Bern für die Jahre 1891-1892. Bern, 1893: size 9 × 6½, pp. 40.

ASIA.

Ararat. *Annales G.* 3 (1893-94): 81-94. **Chantre.**
L'Ararat. Par E. Chantre.

After a brief recapitulation of the early climbers of Ararat, M. Chantre gives an account of his observations while camped at the base of the mountain in 1890.

Asia-Minor. *R.G.S. Supplementary Papers* 3 (1893): 639-739. **Hogarth and Munro.**
Modern and Ancient Roads in Eastern Asia Minor. By D. G. Hogarth and J. A. R. Munro. *With maps.*

This forms the concluding part of Vol. III. of the *Supplementary Papers*. It may be had by all Fellows of the Society on application at the office. The price to non-Fellows is five shillings.

Borneo. *J. Anthropological L.* 23 (1893): 156-172. **Hose.**
The Natives of Borneo. By C. Hose.

Ceylon. **Haeckel.**
Indische Reisebriefe von Ernst Haeckel. Dritte vermehrte Auflage. Berlin, Paetel, 1893: size 10 × 6½, pp. xvi. and 416. *Price 16s. 1*

This edition of Professor Haeckel's letters from Ceylon is adorned with a series of beautiful illustrations from photographs of the people, and sketches of scenery in the island. We know of no equally vivid description of tropical nature, which the great German naturalist appears to appreciate as thoroughly in its artistic as in its scientific aspects.

Ceylon Handbook. **Ferguson.**
The Ceylon Handbook and Directory and Compendium of Useful Information. To which is prefixed a Review of the Planting Enterprise and Agriculture of the Colony, with Statistical Information referring to the Planting Enterprise in other Countries. Compiled and Edited by J. Ferguson. [Edition of 1893-94.] Colombo, A. M. & J. Ferguson, 1893: size 8½ × 5½, pp. 1. and 1219. *Presented by the Compiler.*

Dutch East Indies. **Hooze.**
Tijdschrift Nederlandsch Aardrijk Genootschap 9 (1892): 129-160.
Overzicht der Voornaamste Kolenterreinen van den Nederlandsch Indischen Archipel. Door J. A. Hooze.

On the coal deposits of the Malay Archipelago.

Eastern Asia. **Széchenyi.**
Die wissenschaftlichen Ergebnisse der Reise des Grafen Béla Széchenyi in Ostasien 1877-1880. Erster Band. Die Beobachtungen während der Reise. Mit 175 Figuren, 10 Tafeln und einer geologischen Uebersichtskarte. Nach dem in Jahre 1890 erschienen ungarischen Originale. Wien. Ed. Hölzel 1893: size 12 × 9, pp. ocliv. and 854. *Presented by the Publisher.*

The contents of this huge volume are an Introduction by Count Bela Szechenyi; a Discussion of the Geographical Results, by the late Gustav Kreitner; and of the Geological Results, by Dr. Ludwig Loczy. The second volume will shortly be published, containing a paper on the Philology, the statistics of the journey, and a series of short appendices by specialists on the collections made, and on particular observations. A more complete summary of the first volume will appear in the *Journal*.

India—Great Trigonometrical Survey.

Synopsis of the Results of the Operations of the Great Trigonometrical Survey of India. Vol. XXXI. Descriptions and Co-ordinates of the Principal and Secondary Stations and other fixed points of the Khanpura Meridional Series or Series G of the South-west Quadrilateral. Dehra Dun, 1893: size 12½ × 10. *Diagram and chart.*

Vol. XXXII. Descriptions, etc., of the Singi Meridional Series or Series H of the South-west Quadrilateral. Dehra Dun, 1893: size 12½ × 10. *Diagram and charts. Presented by the Secretary of State for India.*

India—Chins. *R.G.S. Supplementary Papers 3* (1893): 561-585. **Rundall.**
The Siyin Chins. By Major F. M. Rundall.

India. **Twining.**

Travels in India a Hundred Years Ago, with a Visit to the United States; being Notes and Reminiscences by Thomas Twining, a Civil Servant of the Honourable East India Company. Preserved by his son, Thomas Twining, of Twickenham, and edited by the Rev. William H. G. Twining. London, Osgood, Mellvaine & Co., 1893: size 9½ × 6, pp. xii. and 538. With portrait and map. Presented by the Publishers.

The ingenuous narrative of the elder Twining's travels has improved greatly by keeping, and as a picture of India, and, incidentally, America a hundred years ago, serves as a curious landmark of progress.

Siberia—Kamchatka. *Ausland 66* (1893): 63, 664, 682, 699. **Brückner.**
Kamtschatka. Von A Brückner (Jena).

A compilation giving a connected account of Kamchatka and its natural conditions.

Sumatra—Deli. **Eastwick.**

Deli, in Sumatra. By R. W. Egerton Eastwick. [From *The Fortnightly Review*, November 1893, pp. 634-645.]

The district of Deli occupies the eastern plain at the north of Sumatra, adjoining Achin.

Sumatra. *Norske G. S. Årbog 4* (1892-93): 1-24. **Rømcke.**
Plantagebestyrer H. Rømcke; Syv år i Ostindien.

An illustrated article on seven years' residence in the Malay Archipelago, with special reference to plantations and people in Sumatra.

Tibet. *Z. Ges. Erdk. Berlin 28* (1893): 201-242. **Himly and Wegener.**

Nord-Tibet und Lob-nur-Gebiet in der Darstellung des Ta-Thsing-i thung yü thu, unter Mitwirkung des Herrn Karl Himly in Wiesbaden herausgegeben von Dr. Georg Wegener.

His description and criticisms of the official Chinese map of Central Asia is noticed elsewhere.

AFRICA.

Africa. **Noble.**
The Chicago Congress on Africa. By Frederick Perry Noble, Secretary. [Extract from 'Our Day,' October 1893, pp. 279-318.]

Africa. **White.**
Chartered Government in Africa. By Arthur Silva White. [From *The Nineteenth Century*, January, 1894, pp. 126-131.]

Algeria. **Sharp.**
The New Winter-Land. By William Sharp. [From *The Nineteenth Century*, January, 1894, pp. 99-114.]

Descriptive of Algeria as a health resort.

British East Africa—Handbook.

Handbook of British East Africa, including Zanzibar, Uganda, and the Territory of the Imperial British East Africa Company. Prepared in the Intelligence Division, War Office, 1893. London, Harrison and Sons, 1893: size 9½ × 6, pp. 176. *Maps. Presented by the Secretary of State for War.*

This volume will be referred to, with other books on Africa, in a subsequent number of the *Journal*.

Egypt. **Whitehouse.**

How to save Egypt. By Cope Whitehouse. Reprinted from the *Fortnightly Review*, November 1893. London, Chapman and Hall. Size 10 × 6½, pp. 12. *Maps. Presented by the Author.*

French West Africa. *Tour du Monde* 66 (1893): 305-368. **Maistre.**
La Mission Maistre (du Congo au Niger a travers l'Afrique Centrale). Par
M. C. Maistre.

The full and authoritative account of a remarkable journey, the main facts of which have already been placed before our readers. The illustrations in quality and profusion maintain the high character which the *Tour du Monde* has long held in this respect. The journey is also described by M. Maistre in the *Annales de Géographie*, vol. iii., pp. 64-80.

German East Africa. **Stuhlmann.**

Mit Emin Pascha ins Herz von Afrika. Ein Reisebericht mit Beiträgen von Dr. Emin Pascha, in seinem Auftrage geschildert von Dr. Franz Stuhlmann. Im amtlichen Auftrage der Kolonial-Abtheilung des Auswärtigen Amtes herausgegeben. Band I. Zwei theile in einem Band. Berlin, Dietrich Reimer, 1894: size $11\frac{1}{2} \times 7\frac{1}{2}$, pp. xxii. and 902. *Illustrations. Presented by the Publishers.*

This magnificent volume contains two valuable maps, including the region between Lakes Tanganyika, Victoria, and Albert Edward, portraits of Emin and of Dr. Stuhlmann, thirty-two full page illustrations finely reproduced, and two hundred and seventy-five smaller pictures in the text from the author's photographs and sketches. The geographical importance of the work will be referred to in a special article on recent books of African travel.

German West Africa. *M. Forschungs. Deutschen Schutzgeb.* 6 (1893): 281-289. **Ramsay.**
Bericht des Leiters der Südkamerun-Hinterlandsexpedition H. Ramsay über seine Reise von den Kidifällen nach dem Dibamba (Lungasi).

The report is accompanied by a route map and table of determined altitudes.

Katanga. *Tour du Monde* 66 (1893): 257-272. **Benchamps, &c.**

L'Expedition du Katanga, d'après les Notes de Voyage du Marquis Christian de Bonchamps. Par M. René de Pont-Jest.

The story of Captain Stairs' Katanga expedition, and the death of Msidi from the point of view of the French member of the staff; illustrated by many effective, if somewhat imaginative, pictures.

Lagos Almanac. **Payne.**

Payne's Lagos and West African Almanack and Diary for 1894. Lon lon, J. S. Phillips; size $9\frac{1}{2} \times 7$, pp. 147. *Portrait and illustrations. Presented by the Author.*

In the present issue of the Lagos Almanac care has been taken to bring the information down to the latest date. The volume is, as usual, mainly of commercial interest and importance, and contains a deal of out-of-the-way matter bearing on the West African Settlements. Among the illustrations are three plates, representing the hieroglyphic or symbolical letters, as used by the tribe of Jebu in West Africa.

Madagascar—Tamatave. *B.S.G. Com. Bordeaux* 16 (1893): 417-438. **Foulonneau.**

Etude Commerciale sur Tamatave (Madagascar). Par Fr. Eugène Foulonneau.

Mashonaland. **Bent.**

Mashonaland and its People. By J. Theodore Bent. [From *The Contemporary Review*, November, 1893, pp. 642-653.]

Portuguese East Africa. **Baptista.**

Africa Oriental. Caminho de Ferro da Beira a Manica. Excursões e Estudos effectuados em 1891. Sob a direcção do Capitão de Engenharia. J. Renato Baptista. Lisboa, 1892; size $12 \times 8\frac{1}{2}$, pp. 122. *Plates and maps.*

A well illustrated report of preliminary railway surveys from Beira.

Timbuktu. **Zondervan.**

Tijdschrift Nederlandsch. Aardrijck. Genootschap 9 (1892): 375-400.

Timboektoe. Door H. Zondervan.

Critical *resumé* of the geographical knowledge which has been obtained regarding Timbuktu.

No. II.—FEBRUARY, 1894.]

M

Zulu Language.**Grout.**

The Isizulu: a revised edition of a Grammar of the Zulu Language with an Introduction and an Appendix. By Rev. Lewis Grout. London, J. F. Shaw, 1893: size 9½ × 6, pp. xxvi. and 814. Presented by Sydney S. Bagster, Esq.

Mr. Grout laboured for a lifetime as a missionary among the Zulus under the auspices of the American Board of Missions, and he has devoted great attention to the structure of the Zulu language and its phonetic expression in Roman letters. The Grammar is divided into three parts—Orthography, Etymology, and Syntax; and the appendix contains examples of eleven other Bantu languages, with a discussion of their mutual relations.

NORTH AMERICA.**Canada—Indians.****Young.**

Stories from Indian Wigwams and Northern Camp-Fires. By Egerton Ryerson Young. London, C. H. Kelly, 1893: size 7½ × 5½, pp. 293. Illustrations. Price 3s. 6d. Presented by the Publisher.

An account of missionary experiences in British North America, with descriptions of the Indians, their habits, and mode of life.

United States—Arid Lands.**Powell.**

Eleventh Annual Report of the Director of the United States Geological Survey to the Secretary of the Interior, 1889-90. By J. W. Powell, Director. Part II., Irrigation. Washington, Government Printing Office, 1891: size 12 × 8, pp. pp. xiv. and 396. Plates. Presented by the U.S. Geological Survey.

United States—California—Mining.**Irean.**

California State Mining Bureau. William Irean, jr., State Mineralogist. Eleventh Report of the State Mineralogist (First Biennial). Two years ending September 15th, 1892. Sacramento, 1893: size 9 × 6, pp. 612. Maps and plates.

United States—Eastern Cherokees.**Donaldson.**

Eleventh Census of the United States. Robert P. Porter, Superintendent. Extra Census Bulletin—Indians. Eastern Band of Cherokees of North Carolina. By Thomas Donaldson. Washington, D.C., 1892; size 12 × 10, pp. 24. Maps and plates.

The greater portion of this Bulletin is occupied with General H. B. Carrington's report on the condition of the Eastern Band of Cherokees of south-western North Carolina in 1890. The total number of Eastern Cherokees in 1890 is given as 2885. Of this number 1520 live in North Carolina, and are known as the Eastern Band of Cherokees of North Carolina; 936 are said to live in Georgia, 318 in Tennessee, and 111 in Alabama.

CENTRAL AND SOUTH AMERICA.**America.****Gambier.**

The True Discovery of America. By Captain J. W. Gambier. [From *The Fortnightly Review*, January, 1894, pp. 49-64.]

Argentina—Patagonia. B.S.G. Argentino 14 (1893): 267-291.**Mercerat.**

Un Viaje de Exploracion en la Patagonia Austral. Por Alc. Mercerat.

Account of a journey in Southern Patagonia in the summer of 1892-93.

Chincha Islands.**Boyd.**

Romances of the Chincha Islands. By Major A. J. Boyd. Read at a meeting of the Royal Geographical Society of Australasia, Brisbane, Friday, September 30th, 1892. Size 8½ × 5½, pp. 12. Presented by the Author.

The Chincha Islands lie off the coast of Peru in 13° 40' S. lat., 76° 13' W. long.

Yucatan.**Thompson.**

The Ancient Structures of Yucatan not Communal Dwellings; and Yucatan at the Time of its Discovery, By Edward H. Thompson. Worcester, Mass., 1893: size 9½ × 6, pp. 14. Plates. [From *Proceedings of the American Antiquarian Society*, October 21st, 1892.]

AUSTRALASIA AND PACIFIC ISLANDS.

Kei Islands.

Wertheim.

Tijdschrift Nederlandsch Aardrijks. Genootschap 9 (1892): 757-821, 921-973.

Verslag van mijne reis naar de Kei-Eilanden. Door C. J. M. Wertheim.

A full account of the geological exploration of the Kei Islands carried out by a Dutch expedition in 1888 and 1889.

New South Wales.

Coghlan.

The Wealth and Progress of New South Wales, 1892. By T. A. Coghlan. Sydney, C. Potter, 1893: size 8½ × 6, pp. 969. Presented by the Agent-General for New South Wales.

Illustrated by a number of diagrams, and a map showing the density of population at the censuses of 1861, 1871, 1881, and 1891.

New Zealand—Year-Book.

Dadelszen.

The New Zealand Official Year-Book, 1893. Prepared . . . by E. J. von Dadelszen. Wellington, 1893; size 8½ × 5½, pp. vi. and 456. Map.

This is to be an annual publication, similar in character to the handbook published last year. The present issue is divided into three parts. Part I. contains matter of an introductory, official, and statistical nature. Part II. consists of a series of articles on special subjects, some of which are of geographical interest. Part III. contains a digest of the land laws, and descriptions of the various land districts in the Colony.

South and West Australia.

Lindsay.

Journal of the Elder Scientific Exploring Expedition, 1891-92. Under command of D. Lindsay. Equipped solely at the cost of Sir Thomas Elder, G.C.M.G., for the purpose of completing the exploration of Australia, and placed under the control of the Royal Geographical Society of Australasia, South Australian Branch. Adelaide, C. E. Bristow, 1893: size 8½ × 5½, pp. 208. With maps in a separate portfolio.

The Journal of this unfortunate expedition will be the subject of a special article.

POLAR REGIONS.

Magnetic Conditions.

Solander.

Observations du magnétisme terrestre faites à Upsala sous la direction de Rob. Thalen pendant l'exploration internationale des Régions Polaires en 1882-83. Calculées et rédigées par E. Solander. Publiées par l'Académie Royale des Sciences de Suède avec 4 planches. Stockholm, 1893: size 12½ × 10, pp. 76. Presented by the Royal Swedish Academy.

Spitzbergen.

Nordenskiöld.

Redogörelse för den Svenska Expeditionen till Spetsbergen 1890 af G. Nordenskiöld, Med sex Tafior och en Karta. Stockholm, 1892: size 9 × 6, pp. 93.

Published in Vol. XVII., Part II., of the *Proceedings of the Royal Swedish Academy of Sciences*, with a series of excellent illustrations.

Spitzbergen.

Ekholm, &c.

Explorations internationales des Régions polaires 1882-83. Observations faites au Cap Thorsen, Spitzberg par l'Expédition Suedoise. Publiées par l'Académie Royale des Sciences de Suède. Stockholm. Size 12½ × 10. Vol. I. (1892), pp. 40 and plates iii., 56 and plates ii., 278 and plates xiii., and 238 and plates xlvii. Vol. II. (1887), pp. 409 and plates xxx., 54 and plates iv., 20, and 28. Presented by the Royal Swedish Academy of Sciences.

Human ingenuity could scarcely go farther in creating stumbling-blocks to ready reference, than in the production of these volumes. They are really a juxtaposition of pamphlets and books on separate aspects of the work done, and would have been much more serviceable if produced as separate octavo volumes if the difficulties in the way of simultaneous publication and continuous pagination were really insuperable. Volume I. contains an introductory narrative by Nils Ekholm, the leader of the expedition, followed by papers on astronomical, geodetic, mareographical, and meteorological

observations by the same author; a note on geographical reconnaissances by H. Stjernapetz; and a treatise on terrestrial magnetism by E. Solander. Volume II., published four years before the preceding, contains papers by Carlheim-Gyllenkiöld on auroras, and on optical phenomena of the atmosphere; by S. E. Andree on atmospheric electricity; and by R. Gyllencreutz and Frithiof Holmgren on researches on the supposed change of colour in the human skin after a winter in the Arctic regions.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Ethnology.

Bastian.

Controversen in der Ethnologie. Von A. Bastian. I. Die Geographischen Provinzen in ihren culturgeschichtlichen Berührungs-puncten. Berlin, Weidmannsche Buchhandlung, 1893: size $9\frac{1}{2} \times 6$, pp. xii. and 108. Price 2s. 6d.

This work deals rather with the controversies than with ethnology.

North Sea and Baltic.

Pettersson and Ekman.

Grunddragen af Skageracks och Kattegats Hydrografi enligt den Svenska Vinter-expeditionens 1890 Iakttagelser samt föregående Arbeten. Å Deltagarnes Vagnar Redigerad af Otto Pettersson och Gustaf Ekman. Med 10 Taflor. Stockholm, 1891: size $12\frac{1}{2} \times 10$, pp. 162.

Included in Vol. xxiv., Part ii., of the *Transactions of the Royal Swedish Academy of Sciences*, with a summary in English. We hope shortly to publish a paper by Professor Pettersson on his recent hydrographical work in the Northern Seas.

Meteorology.

Abbé.

Smithsonian Miscellaneous Collections. The Mechanics of the Earth's Atmosphere. A collection of Translations by Cleveland Abbé. Washington, 1893: size $10 \times 5\frac{1}{2}$, pp. 324. Presented by the Smithsonian Institution.

The translations include the valuable papers of Helmholtz and Bezold from 1858 to 1888, and some more recent work of Rayleigh, Ferrel, and others.

GENERAL.

Biographical Dictionary.

Lee.

Dictionary of National Biography. Edited by Sidney Lee. Vol. xxxvii. Masquerier—Millng. London, Smith, Elder, & Co., 1894; size 10×7 , pp. vi. and 453. Price 15s.

The following names more or less connected with geography and travel appear among the notices in this volume:—George Matcham, by A. F. Pollard; Henry Maundrell, by W. P. Courtenay; Sir Murray Maxwell, John Meares, Christopher Middleton, David Middleton, and Sir Henry Middleton, by Professor J. K. Lughton.

General Geography.

Reclus.

Nouvelle Géographie Universelle. La Terre et les Hommes. Par Elisée Reclus. XIX. Amérique du Sud. L'Amazonie et la Plata. Guyanes, Brésil, Paraguay, Uruguay, République Argentine. Contenant 5 cartes en couleur tirées à part, 169 cartes intercalées dans le texte et 62 vues ou types gravés sur bois. Paris, Hachette & Co., 1894: size $11\frac{1}{2} \times 8$, pp. 824. Price 25fr.

The last volume of M. Reclus' great geography is fitly graced by his portrait as a frontispiece. The whole work, which has occupied twenty years in compilation, will shortly be made the subject of a special article. Meanwhile it is sufficient to point out that the geography of Europe occupies five volumes, of Asia and Africa four volumes each, Oceania one volume, and America five volumes, the whole comprising 109 coloured maps, 3406 maps in the text, and 1442 illustrations in MM. Hachette's best style.

Maps.

Peucker.

Ueber Geländedarstellung auf Schulkarten. Ein Vortrag gehalten auf dem X. Deutschen Geographentag in Stuttgart im Jahr 1893. Von Dr. Karl Peucker in Wien. Berlin, 1893: size $7\frac{1}{2} \times 6\frac{1}{2}$, pp. 10. Presented by the Author.

An extract from the *Verhandlungen* of the Tenth German Geographical Congress.

NEW MAPS.

By J. COLES, *Map Curator, R.G.S.*

EUROPE.

England.

Johnson.

S. L. Johnson's New Map of the Neighbourhood of Eastbourne. Scale 1 : 63,360 or 1 statute mile to an inch.—S. L. Johnson's Handy Map of Eastbourne. Scale 1 : 21,120 or 3 inches to 1 statute mile.—S. L. Johnson's New Tourists' and Cyclists' Road Map to and from London, Croydon, Epsom, Redhill, Reigate, Tunbridge Wells, Brighton, Hastings, Lewes, and Eastbourne. London: Published by Simpkin, Marshall, Hamilton, Kent & Co., Limited. Eastbourne: Minns & Jeffrey. Designed by S. L. Johnson, Eastbourne. *Presented by the Author.*

In these maps the author endeavours to combine some of the features of a panoramic view with the ordinary map drawing, a combination which, to those who are not accustomed to maps, may be more readily understood. This, however, is a questionable gain, as it is impossible to carry out this system and preserve the scale.

England and Wales.

Ordnance Survey.

Publications issued since December 12th, 1893.

1-inch—General Maps :—

ENGLAND AND WALES :—Sheets 165, 198, 199, 215, 216, 233, 326, 339, engraved outline, 1s. each.

SCOTLAND :—126, 131, hills shaded, 1s. 9d.

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Town Plans—5-foot scale :—

London (Revision), V. 60, 68, 69, 70, 79, 80, 100; VI. 4, 14, 16, 25, 34, 36, 51, 71, 91, with houses stippled, 2s. 6d. each.

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ASIA.

India.

Surveyor-General of India.

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Sheet No. 2 contains two maps, one showing the gradual expansion of Egypt up to the time of Thothmes III., and the other showing the Eastern World at the time of Amenhotep III. On sheet No. 5 there are maps of the Greek Colonies previous to the fifth century, and the Greek world at the time of the second Median war. Sheet No. 46 contains four maps showing the changes and additions which have taken place in France and her colonies, in Europe, Asia, and Northern Africa, since 1815. As usual with this atlas, each map is accompanied by well written explanatory letter-press which cannot fail to be of service to students.

Meteorological.

Bebber.

Mittlere Absolute Jahres-Maxima und-Minima der Temperatur. Entworfen von Prof. Dr. W. J. Van Beber. I. Jahres-Maxima. II. Jahres-Minima.—Mittlere Absolute Jahresschwankungen der Temperatur. Entworfen von Prof. Dr. W. J. van Beber. Petermanns Geographische Mittheilungen, Jahrgang 1893, Taf. 19, 20. Gotha: Justus Perthes. *Presented by the Publisher.*

The World.

Johnston.

W. & A. K. Johnston's Royal Atlas of Modern Geography, Edition in Monthly Parts. Part 27. W. & A. K. Johnston, Edinburgh and London. *Price 4s. 6d. Presented by the Publishers.*

This issue contains maps of Africa and North America, with indices.

The World.**Schrader.**

L'Année Cartographique. Supplément Annuel a toutes les Publications de Géographie et de Cartographie, dressé et rédigé sous la direction de F. Schrader. Troisième Supplément, contenant les Modifications géographiques et Politiques de l'Année 1892. Paris: Hachette et Cie., 1893.
Presented by the Publishers.

This is the third annual supplement published in connection with Schrader's "Atlas Géographie Moderne." The first sheet is devoted to Europe, Asia and Australia, and consists of two maps, one of Europe and Asia, and another of Australia, showing the extent of surveys and explorations. The second sheet is devoted to Africa, and contains, first, a general map of the continent, on which is shown by different shades of colour the positions that have been surveyed or explored. This is followed by special maps having reference to particular route surveys. The first half of the third sheet contains a general map of North and South America, showing the progress of topographical surveys and reconnaissances; the other half is a map of the Andes of Ecuador, reduced from Wolf's Map of Ecuador. On the back of each sheet notes are given.

CHARTS.**North Atlantic and North Pacific.****U.S. Hydrographic Office**

Pilot Chart of the North Atlantic Ocean. January 1894.—Proposed Pilot Chart of the North Pacific Ocean. January 1894. Published at the Hydrographic Office, Bureau of Navigation, Navy Department, Washington D.C. Charles D. Sigsbee, Commander U.S., hydrographer. *Presented by the U.S. Hydrographic Office.*

Previous to the year 1894 the Hydrographic Office at Washington has issued Pilot Charts of the North Atlantic only, but from the commencement of the present year it is proposed to issue a similar chart for the North Pacific. The Secretary of the Navy has submitted in his estimates an item of 10,000 dols. for the publication of this chart, and should Congress grant this sum it is proposed to issue an edition on the first day of each month, containing similar information to that given on the North Atlantic Pilot Chart. The present copy of the North Pacific Pilot Chart which has been forwarded to this Society is a specimen, and is intended to give an idea of the amount and character of the information which the Department will be able to produce with the observations and material which it has been collecting for many years past, and is constantly receiving from mariners and others. The United States hydrographer appeals for support and co-operation to all who may have the opportunity of contributing to this useful work.

PHOTOGRAPHS.**Brazil.****Teed.**

Twenty Photographs of Rio Negro and Upper Amazons, taken by T. M. Teed, Esq. *Presented by T. M. Teed, Esq.*

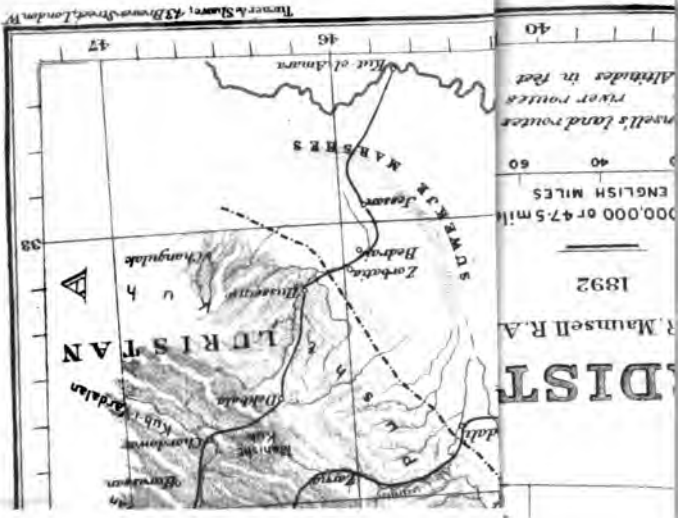
This set comprises twenty photographs taken by T. M. Teed on the Rio Negro and Upper Amazons. They convey a very good idea of the tropical vegetation and scenery of the country.

South-East Africa.**Leverson.**

Seven photographs taken by Major J. J. Leverson, R.E., in South-East Africa. 1892. *Presented by Major J. J. Leverson, R.E.*

These photographs were taken by Major J. J. Leverson, R.E., while in command of the English party employed on the Anglo-Portuguese boundary survey in South-East Africa. They are for the most part photographs of natives and incidents which occurred during the expedition.

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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VOL. III. No. 3.



The Geographical Journal

INCLUDING THE PROCEEDINGS OF THE ROYAL GEOGRAPHICAL SOCIETY.

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The Geographical Journal.

No. 3.

MARCH, 1894.

VOL. III.

THE EVOLUTION OF INDIAN GEOGRAPHY.*

By R. D. OLDHAM, A.R.S.M., F.G.S., Superintendent, Geological Survey of India.

IN the paper which follows there will be found no narrative of exploration of countries before unknown, no tale of dangers encountered, or account of difficulties overcome—at any rate, in the ordinary sense of the words. Difficulties there have been, but they have been difficulties of interpretation or reconciliation of apparently contradictory statements; dangers have been met, but they have been the dangers of drawing too confident conclusions from insufficient data; an exploration has been attempted, but it has been a journey into the past—a form of exploration which is even now regarded by some as lying outside the scope of geography, but erroneously so. Science is for all time, and geography, regarded as the delineation of the form and condition of the earth's surface, is of all time. Since the earliest times, when first a crust solidified upon the surface of the primeval molten globe, and cooled enough to allow of the condensation of water upon it, there has been an ever-changing geography; land and sea, mountains and rivers, have come and gone with ever-varying forms, and though no man was there to see and describe them they have left their impress, more or less complete and decipherable, in the record of the rocks. The interpretation of this record is the work of geology, but the information obtained may often be geographical in its nature; and it is the information which can be gleaned from the rocks, regarding the ancient geography of the country included in the Indian Empire, and the

* Paper read at the Royal Geographical Society, December 11, 1893.

stages by which its present geography has been reached, with which this paper will deal.*

The geological map of India, as it now stands, shows clearly a division into the three great geological regions, known respectively as the peninsula, the Indo-Gangetic alluvium, and the extra-peninsular area. This distinction is so well known that it is unnecessary to dilate on it, or to refer to it further than to point out that the distinction is in no way artificial, but represents strongly marked divergencies of geological history. The peninsular area has been, throughout a long geological past, a land area, which has not been depressed beneath the sea since the close of the palæozoic era; while the sea has flowed repeatedly over the extra-peninsular area—or, at any rate, that portion of which we have any extensive knowledge—up to the commencement of the tertiary. Besides this, there are very striking differences in the geological structure and surface contour of the two regions; but for the present purpose the distinction is one rather of convenience and necessity, for the peninsula forms but the remnant of a once much more extensive continent, and its existing limits were only marked out at a comparatively late period, when the great plain of the Indo-Gangetic alluvium first came into existence.

The earliest stages in the geological history of India are wrapped in obscurity. The peninsula consists essentially of a very ancient core of gneisses and granites, on which there lies a succession of systems of more or less altered and disturbed, unfossiliferous, sedimentary rocks, known generally as the transition, Cuddapah, and Vindhyan systems. All, or nearly all, these rocks, except perhaps the newest, the upper Vindhyan, seem to have been deposited in the sea, and throughout the great length of time represented by these deposits we know that there were alternations of sea and dry land, but there are no indications sufficiently definite to allow us to form any idea of the general distribution of land and sea at any particular period. This much, however, we may say, that none of the leading features of Indian geography were marked out, in anything approaching to their present form, until the latter half of the Vindhyan period, which seems to have been marked by great earth-movements, whose effects are still traceable in Indian geography.

From the eastern flanks of the Aravalli mountains there stretches a great spread of fine-grained sandstones, with a lesser thickness of shales, and some subsidiary limestones. They are generally of a more or less distinctly red colour—a feature which is suggestive of fresh water

* In order to avoid overburdening the text with footnotes, a general reference may be made to the 'Manual of the Geology of India, Stratigraphical and Structural,' 2nd edit. (Calcutta, 1893), published by the Geological Survey of India, where fuller information and references regarding the subjects dealt with will be found.

rather than of marine origin—while the enormous area over which they are found to maintain a remarkable uniformity of character, and the absence of fossils, makes it probable that they were formed by rivers and in fresh-water lakes and lagoons. Throughout the area where these Vindhyan rocks are exposed, and probably also in the extensive area where they are covered by the Deccan traps, they have been but very little disturbed, and, ancient as they are, lie horizontally or in very gentle undulations of bedding.

The boundary of this great area of still undisturbed sandstones towards the Aravalli range is, however, a great fault of over 5,000 feet in throw, and beyond this faulted boundary there are some small patches of disturbed Vindhyan rocks, resting on the slates of the Aravalli range. The relation resembles closely that which subsists between the undisturbed river deposits of the Gangetic plain and the disturbed Siwalik beds and slates of the Himalayas; and as the deposits of the Gangetic plain can be shown to be derived from the waste of the Himalayas, and to have been formed during the elevation of those mountains, it is difficult to avoid the conclusion that the upper Vindhyan sandstones were similarly formed of the debris washed down from the Aravalli range, and that the period during which they were being deposited represents that of the elevation of the Aravalli mountains and of their maximum development.

However this may be, one thing is certain—the compression of the rocks of the Aravalli range, and consequently its elevation, had been completed before the close of the Vindhyan period. Since this remote period no further disturbance of any importance has taken place, and the Aravallis have been exposed to a continuous degradation, till they are now little more than the wreck of a mountain range.

But the Aravalli range does not seem to be the only one of the principal features of Indian geography which dates from this period. Running northwards from the neighbourhood of Madras, and curving round to follow the curve of the coast-line, there are a series of hills known as the Nallamalai, Yellakonda, etc. The compression of the rocks here is by no means so great as in the Aravallis, and they were probably never so important a range; but at one time they must have been very considerably higher than they are now, and the zone of disturbance, continuous with that of the Nallamalais, which can be traced northwards to the Godaveri, probably represents part of the original extension of the range. Now, the compression which the rocks of this range have undergone was certainly of later date than the Karnul series, which is generally regarded as the equivalent of the lower part of the Vindhyan system, while it is equally clear that it was earlier than the commencement of the Gondwána era, that which next succeeds the upper Vindhyan. Consequently, the period when the Nallamalai hills were elevated seems to coincide with that of the origin of the

Aravalli range, and we may take them to be products of the same great period of earth-movements.

Yet this is not all. The close parallelism between the east coast and the Nallamalai hills, as far as they extend, seems to point to a direct connection between the two. In confirmation of this antiquity of the east coast, we find no marine deposits of secondary or tertiary age in the interior of the peninsula, and the small patches that are found in the immediate vicinity of the coast consist of littoral and shallow-water deposits, thinning out against the rocks of the mainland in a manner which shows that the boundary of land and sea must in the main have been very much what it now is. Since the latter part of the palæozoic era, the sea has never spread far beyond its present limit on the east coast, and, though dry land may frequently have extended to the east, it probably did not do so to any great extent.

So ended the first great epoch in the geographical history of India, leaving its impress in two great features—the Aravalli range on the north-west of the peninsula, and the East coast—which have remained throughout all subsequent changes. The period of great earth-movements to which they were due was succeeded by a long era of quiescence, during which a great system of river-deposits, known as the Gondwána system, was accumulated. The Gondwána system is a most interesting one in many ways which cannot be dilated on here, one of them being the presence in the lowest beds of numerous ice-borne boulders, and the evidence of glaciers having descended to low levels in what is now the Penganga valley and in western Rajputana. At present, however, we are only concerned with the information that can be drawn from it regarding the distribution of land and sea at the close of the palæozoic and during the greater part of the secondary eras, so different from that of the present day.

First, it may be noticed that the north-easterly limits of the peninsular area, as they are now defined, had not then been determined, but that the rock area of dry land extended over the Assam hills and the eastern Himalayas. Not only are the older rocks of the Assam range of hills closely related to those of the peninsula, but coal-bearing sandstones, identical in character and fossil contents with those of the coal-fields of Bengal, are found along the Himalayas from Sikkim eastward. How far this north-easterly extension reached, or where its northern margin lay, cannot at present be determined, but its southern shore was probably not far removed from the southern flanks of the Assam range.

The east coast of the land coincided very closely with the present eastern coast; for along it, from Cuttack on the north to near Trichinopoly on the south, there are scattered small patches of beds belonging to the Rajmahál series or upper portion of the Gondwána system, and

in many of these patches marine fossils are found. The marine beds are, however, confined to the immediate neighbourhood of the coast, and thin out against the older rocks, usually resting directly on the gneiss, though west of Rajamahendri on an eroded surface of lower Gondwána rocks.

The north-western margin of the land area probably coincided approximately with the Aravalli range, at any rate, in later secondary times, for the jurassic rocks of western Rajputana are of marine origin. But before trying to trace this or the eastern shore further, it is necessary to leave India for a while and turn to South Africa.

There are some remarkable resemblances between the geology of South Africa and that of India. In the interior there is a great series of old river deposits, known as the Karoo series, which corresponds in every way to the lower Gondwána series of India. They commence with a glacial boulder clay, and in the overlying strata are many coal-seams presenting the same peculiarities as the Indian coal. Besides these general resemblances (which count for little), the plants of the Indian and African coal-measures are without exception identical; and among the few animals which have been found in India, one is indistinguishable from an African species, another is closely allied, and both faunas are characterized by the very remarkable genus group of reptiles comprising the *Dicynodon* and other allied forms.*

These, however, are not the only analogies, for near the coast of South Africa there are developed a series of beds containing plant fossils in the lower part, and marine shells in the upper, known as the Uitenhage series, which corresponds exactly to the small patches of the Rajmahál series along the east coast of India. The few plant forms found in the lower beds of Africa are mostly identical with, or closely allied to, Rajmahál species, while of the very few marine shells in the Indian outcrops, which are sufficiently well preserved for identification, at least one species is identical with an African form.

These very close relationships between the plants and animals in Africa and India at this remote period appear to be inexplicable, unless there were direct land communication between them, over what is now the Indian Ocean. The age of the Uitenhage marine beds is now generally taken as neocomian, and in the immediately succeeding period the proofs of a continuous land barrier are as conclusive as it is possible to imagine them. This subject has been so frequently treated at greater length than would here be possible, that it will not be advisable to do more than briefly indicate the nature of the argument.

On the east coast of India, in the Khási hills, and on the coast of

* 'Manual of the Geology of India,' 2nd edit. p. 203, where further references will be found.

South Africa, the marine fossils of late jurassic and early cretaceous age are largely identical with, or very closely allied to, each other, showing that they must have been inhabitants of one and the same great sea. In western India the fossils of the same age belong to a fauna which is found in the north of Madagascar, in northern and eastern Africa, in western Asia, and ranges into Europe—a fauna differing so radically from that of the eastern exposures, that only a few species of world-wide range are found in both. Seeing that the distances between separate outcrops containing representatives of the two faunas are much less than those separating the outcrops from the nearest ones of the same fauna, the only possible explanation of the facts is, that there was a continuous stretch of dry land connecting South Africa and India, and separating two distinct marine zoological provinces.

The existence of a land connection at the commencement of the cretaceous period having been established, we need not stay for a consideration of certain hypotheses which have been supposed to preclude the possibility of such a land area having ever existed, but may conclude that the obvious deduction from the close palæontological and lithological relations of the permian and triassic rocks of India and Africa is the true one; and that, from the latter part of the palæozoic area to near the close of the mesozoic, a great continent stretched across what is now known as the Indian Ocean. The land we have been considering has been named Gondwánaland by Suess, for the purpose of distinguishing it from the supposed continent of Lemuria, and whether this name be adopted or not, the two must not be confounded. None of the arguments derived from living plants and animals, to show that there has, or has not, been a direct land connection between India and Africa, even if they be accepted in their entirety, can in any way affect the existence of this ancient continent, of which there is no geological evidence after the close of the secondary era.

So far only the peninsular area of India has been dealt with; it is now necessary to turn to the extra-peninsular regions, and see what was taking place there during all this period. The oldest rocks of the extra-peninsular hills have been but little studied, and one great region, the eastern Himalayas, is absolutely unknown except for a few visits, none of which have extended far into the range. So far as is known, no marine sedimentary rocks occur there, and, as has already been mentioned, this region probably formed part of a land area continuous with the peninsula, throughout the palæozoic and mesozoic eras. We find, however, in Burma on the one hand, and in the north-west Himalayas, and the hills west of the Indus, on the other, a great series of marine sediments, showing that these regions formed part of the ocean. It is not meant that they were continuously covered by the sea, for unconformable breaks show that there were alternations of land and sea; but there are no extensive subaërial formations, and there is no evidence

of any considerable disturbance or compression of the rocks. There were periods of placid accumulation of sediments, interrupted by times when they were quietly raised above sea-level and exposed to denudation, but there are not at present sufficient data to allow of our attempting any detailed restoration of the geography until the close of the jurassic period. Some indications of the main features have already been given, and all that remains is to complete these and embody them on the small sketch map printed below.*

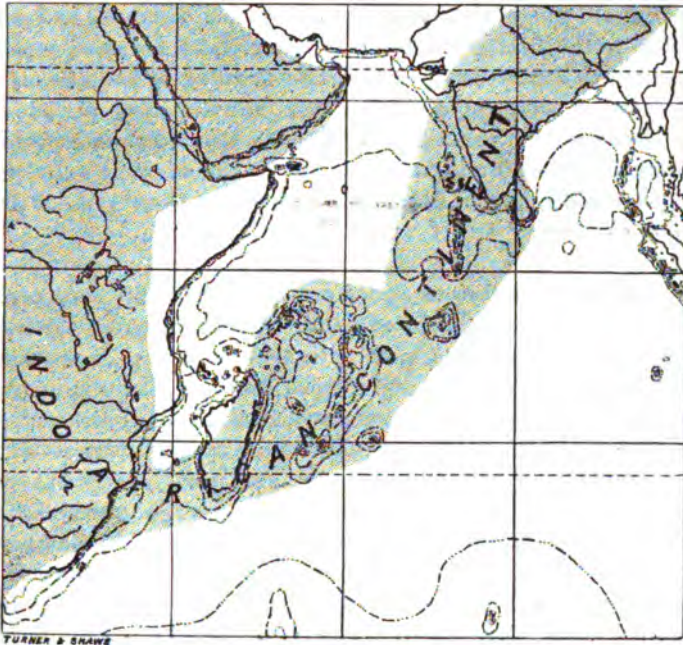


FIG. 1.—SKETCH MAP SHOWING APPROXIMATE DISTRIBUTION OF LAND AND SEA AT THE CLOSE OF THE JURASSIC PERIOD AS COMPARED WITH THAT OF THE PRESENT DAY.

* The map is based on one published by the late Professor Neumayr in the *Denks. k. k. Akad. Wiss. Wien. L.* (1885), which, so far as India and Africa are concerned, has been but little altered. The principal change introduced is a continuation of the land area from the northern portion of the present peninsular area, over the Indo-Gangetic plain, to the eastern Himalayas and the Assam hills. The very wide strait he drew between the peninsula and the Himalayas does not seem to be required by the palaeontological facts, while it is contrary to the indications of a former extension of the peninsular land to the north and north-east, and to the evidence there is of the much more recent origin of the Gangetic depression, now occupied by the alluvial plains of Upper India. I have consequently taken a somewhat different view of the distribution of land and sea at this period, and prefer to look upon the occurrence of a few shells common to the uppermost Cutch jurassic beds and the marine deposits of the east coast, as indicating a connection of the two seas through the temporary submergence of an isthmus further south, rather than by the existence of sea stretching across the present area of the Gangetic plain. Taking everything into consideration it seems probable

It will be seen that the distribution of land and sea was very different to what it now is. All the land west of the Aravalli range, the north-west Himalayas, a great portion of Tibet, and all Upper Burma, were then covered by the sea; while dry land spread to the south-west far beyond the present coast. The great mountain system of the Himalayas had not been upheaved, and the hills west of the Indus, and the Arakan Yoma, were not only non-existent, but the very rocks of which they are composed had to a large extent not been formed. The only features of existing Indian geography which we can recognize are the Aravalli range, then probably loftier than it now is and extending further to the north, and the east coast, which occupied much the same position as it now does. These two features, as has already been explained, are of much more ancient date, and the long period which elapsed between the great series of palæozoic earth-movements, to which they owe their origin, and the close of the mesozoic era, does not seem to have added any of the leading features of our present Indian geography.

The close of the cretaceous period saw the end of this long period of repose and the commencement of another period of great earth-movements, which have led to a most extensive reshaping of the surface, and a radical change of the geography of India, to that represented in the more familiar form found in modern atlases. This series of earth-movements appears to have been ushered in by the greatest series of volcanic eruptions found anywhere in the world, eruptions which covered an area of 200,000 square miles with an accumulation of lavas and tuffs, several thousands of feet in thickness. Whether this unparalleled exhibition of volcanic activity was directly connected with the great series of earth-movements that immediately succeeded it, and resulted in the elevation of the extra-peninsular mountain chains, cannot be stated with certainty; but the process of mountain-building has elsewhere been found to have been preceded by volcanic outbursts in the neighbourhood of the chain that was afterwards upheaved, and the forcing out of this enormous mass of lavas may well have been the prelude of the upheaval of the greatest mountain chain of the world.

However this may be, the commencement of the tertiary period found a great set of earth-movements already commenced, which continued with increasing intensity, reached their maximum in the pliocene period, and are still in progress, though in diminished intensity. The result of these movements has been to drive back the sea which, at the close of the cretaceous period, flowed over the country now

that the geography of India towards the close of the jurassic period was very much as depicted in the figure, though it must be remembered that we know nothing of the former geography of the existing oceans, and land may have extended over them to a greater extent than has been represented.

occupied by the hills of our western frontier, the high plateau of Tibet, and the whole of Burma, and to crush and fold the rocks, forcing them up into mountain ranges, till marine limestones of nummulitic age have been raised to heights of 20,000 feet above the sea in the Himalayas, and the sea-formed rocks of the country beyond our western frontier folded and raised into inhospitable hills, now occupied by warlike and lawless tribes. On the east the Arakan Yoma, and the range of hills whose summits form the Andaman and Nicobar Islands, were elevated, driving the sea back from a large area over which it once flowed to the foot of the plateau of the Khási and Garo hills.

The age of the hills of Burma and the western frontier is limited by that of the rocks they are composed of, and when we find beds, containing nummulites and other marine fossils of eocene, or even later, age, widely distributed in them, it is evident that the hills cannot have been upraised till the latter part of the tertiary era. With the Himalayas it is different; their vastly greater bulk would in itself suggest that the forces of upheaval had acted on them for a longer period, and we find proof that even so far back as the pliocene period they constituted a mountain range comparable to that of the present day, and, what is more, with the main features of the drainage system marked out on the existing lines.

The geological map shows a long strip of upper tertiary beds flanking the foot of the Himalayan range; these are the rocks of the Siwalik series. They were originally river deposits similar to those now being formed at the foot of the hills, and beds of the same age could doubtless be found deep below the Gangetic alluvium; but they have been cut off from the rest of the plains, compressed, disturbed, and elevated to form the Siwalik range, or foot-hills of the Himalayas. Now, it is found that the higher beds of the series consist of coarse conglomerates near the places where the principal rivers issue from the hills, and these conglomerates consist of large well-rounded boulders of hard crystalline rocks, such as are found in the interior of the range, showing by their size and shape, no less than by their composition, that they had been carried by large and rapid rivers for a long distance. In the intermediate country, between the points where the rivers leave the higher hills, the same beds are found to consist of clays, sands, and conglomerates in which the pebbles are smaller, less well-rounded, and composed of the rocks which are found near the margin of the hills. From this it is clear that, even so long ago as the time when the extinct Siwalik fauna flourished, the principal rivers of the Himalayas flowed much where they now do, and the size of the boulders brought down proves that they must have had rapid currents and have flowed in channels of comparatively steep gradients. We may conclude, then, that the Himalayas of the pliocene period were, if not so lofty as at the present day, at any rate a lofty and important mountain range.

Another result of these earth-movements was the formation of a depression parallel with the ranges, and separating them from the peninsula of India, which has been filled up by the Indo-Gangetic alluvium. At first the drainage of this depression had but one outlet, where the Indus now reaches the sea, and in this great river, formed by the whole of the drainage of the Himalayas, a certain species of dolphin established itself, and gradually acquired the habit of living and pursuing its prey in fresh water. At a later period a depression was formed between the Rajmahál and Assam hills, by which a gradually increasing portion of the drainage escaped, and the single river broke up into two separate drainage systems, one finding its way to the sea by the Indus, the other by the delta of the Ganges and Brahmaputra. The date of this separation is geologically recent, and the diversion of the drainage from the Indian Ocean to the Bay of Bengal must have been a gradual process, whose final stage, the permanent diversion of the Jumna into the Ganges, may even have taken place within the historic period. Before this the waters of the Jumna must have flowed westwards, then it may have wandered and flowed alternately into the Ganges and Indus, or that dry river channel which can still be traced through the desert of the western Rajputana. In its latest stage it probably, like the Casiquiari in South America at the present day, divided its waters between the eastern and the western drainage; but now no further change can take place, for the river has cut its channel deep below the general level of the plain, and must perforce remain a tributary of the Ganges.

While these great changes were going on in Extra-Peninsular India, the peninsula itself had remained almost in a state of quiescence. There had been some minor changes of level, doubtless, and the northern limits, as we now know them, were defined; but, speaking broadly, it took no part in the disturbances which were going on all round, and remained quiescent, undergoing no changes beyond those produced by the agency of subaërial denudation. Yet it would be surprising if such extensive earth-movements had produced no sympathetic changes in neighbouring regions, and one such change can be pointed out—the establishment of the present west coast of India. At the commencement of the cretaceous period we know that land stretched away from the present west coast to South Africa, but some small patches of marine tertiary rocks on the coast show that it had been marked out, with much the same general course as it now has, by the close of the eocene period. We may conclude, then, that land connection between India and Africa had already been cut off, and that the gradual submergence of this continent took place during the last great period of earth-movements, leaving nothing to mark its original position but the coral archipelagoes of the Laccadive and Maldive Islands and the great Chagos bank.

The great range of the Western Gháts, the most striking feature in

the geography of India proper, is of more recent date, and the cause of it is somewhat obscure. It bears some resemblance to a great inland sea-cliff, and there is reason to suppose that the sea did once wash its foot; but all the present surface features are due to subaërial action, and on the whole it seems more probable that this range owes its origin to comparatively recent elevation, whose effects are noticeable in its scenery. Here alone in peninsular India do we find the stream valleys as a rule deep, narrow, and steep-sided, or the streams still actively engaged in deepening, and cutting back the heads of, their valleys. In the Gháts both these features are noticeable; they are the same as we find, even more strikingly, in the valleys of the extra-peninsular hills, and in both cases the cause is the same—a recent elevation of the land which has not yet been counterbalanced by the cutting down of the valleys.

The most remarkable feature of Indian hydrography, that all the principal rivers, except the *Narbada* and *Tapti*, take their rise within sight of the west coast and flow thence eastwards across the whole breadth of India, owes its existence to the same cause. It is not meant by this that there were originally considerable rivers flowing westward, and that the elevation of the Gháts reversed the slopes and turned the rivers eastward, for had that been the case there would be deep-cut gaps in the crest marking the original position of the valleys. A more probable explanation is that the peninsula, as we now know it, is but the eastern half of a once more extensive land area, whose principal watershed was not far removed from the present one, and that the westward-flowing rivers have disappeared in the subsidence of the land they once drained.

The absence of low-cut gaps in the western Gháts has been noticed as evidence that there were not any westerly flowing rivers whose drainage has been reversed. But at the southern end there is just such a gap, known as the *Palghát*, to the south of which the Western Gháts are continued in the *Travancore Hills*. No satisfactory explanation of this gap has been given, and it is not impossible that it may indicate the place where a considerable river once flowed westward, whose course has been interrupted, and drainage diverted to the east, by the changes of level consequent on the elevation of the Gháts. With this exception, all the main lines of drainage in peninsular India appear to have been marked out even before the close of the *Deccan trap* period; indeed, some of them, such as the valleys of the *Godavari* and *Mahanadi*, may date as far back as the commencement of the secondary era, while such changes as have taken place since the commencement of the tertiary era have been of only minor importance.

We have now traced the history of the growth of the main features of Indian geography. We have seen that the north-west boundary of the peninsular area, the *Aravalli* range, and the east coast were marked

out in some distant period, of which we can but say that it was prior to the age of the English coal; and we have seen that the extra-peninsular ranges, the great Indo-Gangetic plain, the northern margin of the peninsula, and the western coast owe their origin to another great series of earth-movements which took place during the tertiary era. There remains for consideration the influence which its geological history has had on the minor topography and scenery of both peninsula and extra-peninsular India.

The peninsula is, broadly speaking, a region of broad open valleys and easy slopes, in which the rivers are flowing near their base level of erosion, and are not at present actively lowering their channels. This is what might be expected of an ancient land surface which has been long exposed to the shaping action of the forces of subaërial denudation.

The exceptions to this general rule, apart from the one already mentioned; though often striking in themselves, are really of minor importance, and are merely the result of the mineralogical differences of constitution of the underlying rocks. Thus a hard bed, lying nearly horizontally on a softer one, or on a rock which is more readily decomposed, will always form a steep and precipitous scarp. The most conspicuous instance of this is the great southern scarp of the Vindhyan sandstones, known to geographers as the Vindhyan range, where it overlooks the valley of the Nerbada, and as the Kaimur, where it overlooks that of the Son. A similar scarp surrounds the gneiss area of Bundelkhand, and on a smaller scale is found in many other parts of India at the limits of the outcrop of horizontal sandstone beds.

The Deccan trap, consisting as it does of a great thickness of horizontal strata differing widely in their resistance to denudation, has a peculiar type of scenery of its own, with flat-topped hills marked by horizontal lines of cliffs of the same general type as is found wherever a country of this particular structure has been exposed to subaërial denudation.

Sharp-crested, steep-sided ridges, too, are a conspicuous feature where, as in Bundelkhand and parts of the southern Mahrata country, there are numerous massive quartz reefs traversing the gneiss, and in the Aravalli range there are many such hills formed by the outcrops of hard quartzites. But even here the valleys are broad and open, and largely exceed the narrow steep-sided ridges in size.

Granite tors and bosses are developed, often on a very large scale, in the gneissic regions of the peninsula. One may instance the rock of Trichinopoli; the great bull on the Charimundi Hill in Mysore, carved out of a single block of granite; and the Madan Mahal in Jubbulpore, where a small palace has been built on the top of a great rounded mass of granite.

All these, however, striking as they often are, do not alter the general truth of the statement that the peninsula is a region of open valleys and gentle slopes. Compared with the scale of the country, the exceptions are proportionately very small, and even the valleys draining the sides of the mountains, though steep-sided and narrow compared with the general surface contour of the peninsula, are open and of moderate gradients when compared with the valleys of the extra-peninsular mountain ranges.

In the extra-peninsular area of India the geological conditions are very different, and the difference is reflected in the present form of the surface. Much of this land area has only been raised above the sea within the tertiary era, and even within the latter portion of it.



FIG. 2.—VIEW AT KHANDALLA. DECCAN TRAP.

Everywhere there have been great changes of level; mountain ranges have been elevated at a greater rate than the agencies of subaërial denudation could properly cope with, and the result is that we have steep-sided deep valleys, at the bottom of which flow rapid torrents, carrying with them quantities of debris, and, generally speaking, actively engaged in deepening their channels. The valleys are, as a rule, comparatively narrow at the bottom; at times, however, the raising of the river bed has been too rapid for the downward cutting action to keep pace with it, and, by checking the gradient of the stream, has caused it to deposit an alluvial plain above the obstruction or, in extreme cases, even to form a lake.

There are, however, some leading differences in the general type of valley in different regions, due to differences in the nature of the rocks and of the disturbances they have undergone, as well as to the amount

of rainfall. In the western hills of Baluchistan and eastern Afghanistan, the rocks consist of thick beds of hard limestone or sandstone alternating with bands of shale or shaly rocks, which readily disintegrate into small fragments or even into impalpable mud. Where there is an outcrop of these latter rocks we find broad open valleys, sometimes comparatively smooth at the bottom, where they have been filled up with stream deposits, but generally full of minor irregularities caused by the numerous runnels of water carving the surface into gullies.

Between the open portions of the valleys, where they traverse the soft rocks, there rise ranges of sandstone or limestone cut by narrow



FIG. 3.—CHAPPAR RIFT: VIEW OF UPPER END. FROM A PHOTOGRAPH BY THE BENGAL SAPPERS AND MINERS.

gorges through which the streams flow. These gorges are most striking where they traverse hills composed of the massive limestones of tertiary or cretaceous age. They are locally known as "tangis," which may be literally translated as "tight places," and appropriately, too, for woe betide the caravan that is caught in one of these gorges by a flood; escape is impossible, and man and beast are swept away, never to be seen or heard of again.

The best known of these, and one which may be taken as a type of the rest, is the Chappar rift, represented in Fig. 3, through which the railway to Quetta has been carried. The entrance to this is not twenty feet wide, and through this narrow gorge escapes the drainage of over a

thousand square miles of country. The hill through which this gorge is cut, is formed by an anticlinal fold of limestone, whose surface has been washed bare of the overlying shales, and exposes a smooth surface unbroken except by the Chappar rift and another valley known as the Blind rift. So remarkable is the feature, that it has not unnaturally been considered to have been caused by a fissure; but a careful examination of the rocks has revealed no trace of this, and to the geologist, accustomed to the study of the action of the water, it stands out clearly as a river-cut gorge. A fracture might account for the gorge itself, if



FIG. 4.—DIRGI VALLEY BELOW THE CHAPPAR RIFT. FROM A PHOTOGRAPH BY THE BENGAL SAPPERS AND MINERS.

there were any trace of such to be found; but it would not account for the open valley shown in Fig. 4, formed where the valley traverses a band of shales. A precisely similar broad and open valley is found where the stream flows through soft shales above the gorge, from which an immense amount of material has been removed, every particle having been carried down through the gorge, and helped to enable the stream to grind away the hard limestone. This, having been protected by the scanty rainfall and consequent absence of vegetation from the disintegrating effects of water freezing in fissures of the rock on the one hand, and the solvent action of carbonic and humic acids on the other, has not been broken away, and remains standing as vertical cliffs on either side of the gorge.

The upper end of the Chappar rift is faced by the opening of

another known as the Peel rift, cut through an anticlinal of limestone parallel to the Chappar. The reason of this course of the drainage across the axes of elevation must be looked for in the drainage being what is known as antecedent; that is to say, its general course was marked out before the rocks were thrown into their present folds. As soon as the land rose from the sea, the rainfall would run off into the depressions and collect in streams, which cut down into the rocks. If, owing to a subsequent compression, these were gradually bent into anticlinal and synclinal folds, and if the movements were not too rapid, the streams would maintain their general course, cutting down through the rising crests of the anticlinal folds, and, though the surface contour would be largely influenced by internal structure and by the different degrees of resistance offered by the different rocks, yet the main features of the drainage system would be of older date and independent of the minor structure of the country.

There is ample proof throughout this country that there have been considerable local disturbances and alterations of level within the recent period of geology; and even within what would be regarded as recent from the historical point of view there has been compression, resulting in a relative rise of the ground over the crests of anticlinal folds. Proof that this compression is still going on was given on December 20, 1892, when a severe earthquake resulted from the sudden yielding of the earth's crust, along what appears to be an old line of fault, west of the Kojak range,* whereby an adjustment took place, indicated by a shortening of some two and a half feet in the railway line which crossed the fault.

A very striking feature, resulting from these local changes of relative level, is the frequency of more or less extensive valley plains occupying rock-bound basins. In a region of small rainfall the erosive power of the streams is only exerted when they are in flood, and this is only a small portion of the year. A rise of the river bed, which would easily be coped with in countries with a more abundant rainfall, is here enough to interrupt the drainage, and the same scanty rainfall prevents the streams filling the basins so formed with their own deposits or with water. There result, consequently, more or less extensive plains, covered mainly by fine-grained deposits of wind-blown dust, precisely similar to the great loess deposits of China. The drainage which finds its way on to these has in many cases no escape except by evaporation or underground percolation; but in many other cases the deposits have accumulated till the surplus water has been able to find an escape over the lowest point of the surrounding ring of hills, a point which is by no means necessarily coincident with the original bed of the stream.†

* "Records," *Geological Survey of India*, vol. xxvi. p. 58. 1893.

† See "Records," *Geological Survey of India*, vol. xxv. p. 28. 1892.

The hills which lie between India proper and Burma differ in some respects from those of the western frontier. The difference is partly due to lithological causes. The rocks are more homogeneous as a whole, for, though there are great variations in the hardness of different beds, the alternations are more frequent, and there are not thick bands of strongly resisting rock alternating with as thick or thicker bands of soft and easily disintegrated beds. But the differences are still more largely due to climatic causes. Instead of an arid country almost devoid of vegetation, there is an abundant rainfall, the hills are everywhere covered with a dense semi-tropical vegetation, and the humic acids developed in this have generally decomposed the rock for a considerable depth from the actual surface. As a result, there are not the narrow vertical-sided gorges of the western frontier, nor any areas of closed drainage, for the streams have everywhere been able to maintain their course to the sea in spite of any local elevations of the stream bed. In places, however, these movements have formed rock basins, which have been filled up by the stream deposits as rapidly as they have been formed, and instead of broad, barren plains of wind-blown loess, we have fertile alluvial plains, such as that of Manipur. But for the most part we have a series of parallel ranges, between which the streams flow in deep parallel valleys connected by short transverse gaps by which the streams break through the ranges, often to flow back again parallel to their original course.

The mighty mass of the Himalayas contains within itself every range of structure and climate that is found in the hills already referred to, and, having been a mountain range when they were still to a considerable extent covered by the sea, it has attained greater dimensions, and exhibits in one part or another all the features already described, but developed on a much larger scale.

In the outer Himalayas, the sides of the deep valleys are almost everywhere so steep that they are in an unstable condition, every heavy fall of rain bringing down larger or smaller landslips, and at their bottom flow rapid streams or rivers. The general steepness of the slopes of the valley sides, a slope often as great as the natural angle of repose of disintegrated rock, or steeper, shows that the streams are for the most part cutting down their beds, and that the other agencies of subaërial denudation have not been able to open out the valley to the curved slopes of lesser steepness which are found in regions where the streams have long been at or near a condition of equilibrium.

In places we find the valley bottom opens out, and is occupied by a plain of river gravels or fine-grained alluvium. This is due to an interruption of the gradient by a local elevation of the stream bed, which has not been balanced by an equally rapid cutting down or corrosion. The result has been to check the gradient of the stream and cause it to

deposit part of the solid material it was transporting, and so form an open plain in the valley. The best known and one of the largest of these is the plain of Kashmir; but from this they range downward to quite small and narrow accumulations. Some of these valley deposits have been re-excavated since their accumulation; others are still in course of formation, or but slightly cut into by the stream which formed them, and correspond in position and appearance to the lakes of other mountain ranges. In the Himalayas there are no lakes of any size, except in the central portion of the range; in a position corresponding to that of the Alpine lakes there are none, but there are these plains of stream deposits, filling what are clearly rock basins. Had these rock basins been filled by a glacier during their formation, or had the elevation of the barrier been too rapid and recent to give the streams time to fill up the hollow, we should have had a lake resembling in appearance those of the Alps or the British Isles.

In the Himalayas, as in the other extra-peninsular hills, we find the drainage of the country frequently cutting across the ranges of which the system is composed, and this feature is developed on so large a scale that it has been noticed ever since there was any definite information regarding the geography of this region. As a single very typical instance we may take the cross-valley by which the Indus breaks through the Ladakh range, one of the best defined of the ranges of the north-west Himalayas. It forms the south-west side of the upper Indus valley, which runs parallel to the range as far as it can be traced; but about longitude $78^{\circ} 30'$ the river suddenly turns south-west, breaks across the range at right angles to its axis, again turns sharp to the north-west, and flows on still parallel to the range, but on its south-west side. It can be proved geologically that this range is what is known as an axis of special elevation—that is to say, the general upheaval which the country has undergone has been specially great along this range; and the best explanation of the observed facts is, that the Indus river is older than the range, whose elevation has not been so rapid as to interrupt the course of the river. The broad open valleys above and below the transverse gap are due partly to the smaller amount of downward cutting that had to be performed before the river reached its base level of erosion and could turn to the widening out of its valley, but more largely to the fact that the rocks exposed are softer than those of the Ladakh range.

The same phenomenon is exhibited on a larger scale, in the fact that the whole of the drainage of the northern slopes of the Himalayas ultimately escapes to the south. The Indus and Sanpo rivers, rising within fifty miles of each other, flow along the north of the range in opposite directions till they break through it at either extremity and enter the alluvial plains of India. The Sutlej, too, as well as the Gogra, Kosi, and Subansiri, drain large areas north of the line of highest peaks.

and in all these cases the most probable explanation is, that here again we have cases of antecedent drainage; that is to say, the rivers are more ancient than the mountains which have been raised across their course, but the extent of the drainage area upstream of the zone of most rapid elevation has given the rivers sufficient power to cut down their valleys through the rising mountain range and maintain their course to the south.

Besides these leading examples, it has been noticed that the main watershed, between the drainage which flows directly south and that which at first flows northwards, does not coincide with the line of highest peaks, but lies somewhat to the north of it. In other words, the highest peaks do not rise from the main watershed, but are situated on spurs running southwards. In most of these cases the rivers do not seem to have sufficient catchment area north of the line of highest mountains for the explanation given above to be applied, and a more probable one is to be found in a cutting back of the heads of these valleys, owing to the steeper gradient and greater rainfall on the southern slopes than on the northern. In every case the southern approach to the passes across the main watershed is through deep-cut, often precipitously sided valleys, and at the head there is a long and steep ascent. On the other side there is either a comparatively short and gentle descent, or even no appreciable descent at all, and one enters at once an open, gently sloping valley, whose form shows that it must have been made by a much larger stream than now occupies it, and that the drainage area must have extended over the deep-cut valley from which the ascent has just been made.

These features, noticeable all along the known parts of the Himalayas, are well shown on the trigonometrical survey maps of the Kumaon Himalayas, and nowhere more markedly than in the group of passes at the head of the Girthi and Kiogadh valleys. In Fig. 5, a portion of the atlas of India representing this group of passes has been reproduced, as well as a diagrammatic section across them, based on the data provided by the map. Both alike show the great difference between the valley slopes on either side of the water parting; and it will be seen that the valleys of the northern drainage—here locally flowing eastwards—have not the steep slopes at their upper end which are always found in valleys which are cutting their way backwards into the hills; in other words, their original upper extremities have been removed or robbed by the streams that are cutting their way back from the southern or outer margin of the hills. On the section the heights of the peaks along the lateral water partings, many of them lying beyond the northern margin of the small map—have been indicated; they show very conspicuously how the water parting lies inside the line of the highest peaks, the heads of the valley extending nearly ten miles beyond the highest peak.

The general features which are so conspicuously noticeable in the Chitichun group of passes, are common to all the passes across the main

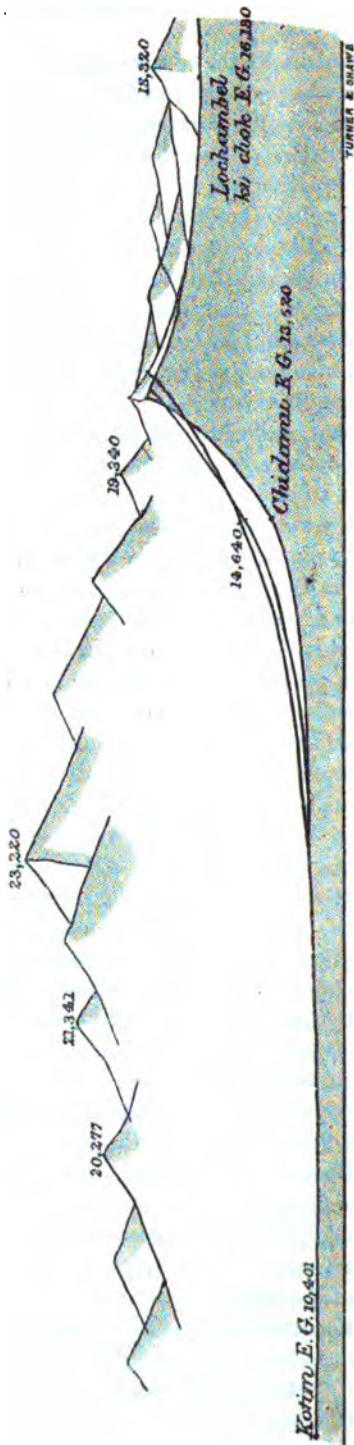


FIG. 5.—PLAN AND SECTION OF THE CHITICHUN GROUP OF PASSES IN THE KUMAON HIMALAYAS. VERTICAL SCALE OF SECTION EXAGGERATED 2½ TIMES.

range, though they are not by any means always so conspicuous. Everywhere we find signs of a recession of the watershed, and on the north the valleys are generally more or less completely choked with debris



FIG. 6.—LOGAR VILLAGE IN SPTUL RIVER VALLEY PARTIALLY FILLED WITH DEBRIS. FROM A PHOTOGRAPH BY BOURNE AND SHEPHERD.

washed down from the sides, as in Fig. 6, owing to the streams being no longer powerful enough to keep their valleys clear. This loss of power is partly the result of the diminished drainage area due to the shifting

of the watershed, but more largely to the gradual rise of the Himalayas having cut off a larger and larger proportion of the rainfall. In this way the amount of water flowing down the valleys of the outer slopes has increased, and in proportion to this increase has been the diminution of that which found its way down the valleys of the inner slopes.

There can be little room for doubt that in the latest phase of the history of the Himalayas, this cause has very actively aided the steeper gradients on the outer sides of the passes in causing a recession of the watershed, and a robbing of the drainage areas of the streams draining the inner slopes. Nowhere is this robbing of one valley by another more conspicuous than in the best known of all the main passes—the Zoji La, on the road from Kashmir to Ladakh. Here there is on the south side a long and steep ascent of about 2000 ft. at the head of the Sind valley, where the stream flows in a narrow and steep sided gorge; at the top of this an open valley partially blocked with talus fans is suddenly entered and seen to stretch away in front of the traveller, as in Fig. 7. On the other side no descent can be seen, and as he travels along what appears to be a level valley, it is only the direction of the flow of the stream which tells him that he has crossed the summit of the pass.

Similar features have been noticed in the Alpine passes, and in both cases the explanation appears to be the same. The greater gradient of the valleys draining southward, as well as the greater rainfall, has given their streams a greater power of erosion, as a result of which they have been able to cut their valleys backward, and gradually encroach on the drainage area of the northward-flowing streams. The peculiar features of the Maloja pass in the eastern Alps find their counterpart in the Zoji La of the western Himalayas, and in both cases the explanation is the same, that the steep slopes at the head of the northern valley have been completely obliterated by the encroachment of the southern.

This sketch of the evolution of Indian geography has, owing to the exigencies of time and space, necessarily been an inadequate one. There is hardly a single point which would not require nearly as much space for its proper elucidation as it has been found possible to devote to the whole, and brief as the references have been, much has had to be omitted. The series of recent and extinct volcanoes found in the Bay of Bengal, the sandhills of the great Indian Desert, the changes that have taken place in the course of the rivers through the Indo-Gangetic plain, the origin of the Tibetan lakes, and the gradual drying up of that country, may be instanced as subjects of considerable interest, all reference to which has had to be omitted; and, besides this, it has been impossible to distinguish adequately between what is merely the personal opinion of the author, and what may be regarded as well-established and generally accepted conclusions. Only such opinions have been admitted as seem to be so well supported that their general acceptance may be safely looked for, where not already attained, and many subjects have been

omitted, as they do not seem to be so fully proved. These are, indeed, but the forms of land which loom on our horizon as we sail across



FIG. 7.- SUMMIT OF THE ZOJI LA. FROM A PHOTOGRAPH BY CAPT. A. F. HOOKLER-FERRYMAN (43RD LIGHT INFANTRY).

the boundless main of human ignorance; the experience of the past has shown their deceptive nature; what seemed to be isolated rocks have expanded into noble continents; what promised to be a con-

continent has shrunk to a group of isolated islets, or proved the illusion of a mirage, and the decision of the true nature of those which the look out now sees may be left to time, which tries all things, and proves or rejects them. It has been enough for me to sketch briefly some of the discoveries that have been made in the past, and I would beg you to remember that, though the voice may be mine, the hands are the hands of my colleagues, past and present, and of that band of volunteer workers, alas! so small in number, by whom the facts have been collected, and on whose observations the conclusions I have spoken of are based.

Before the reading of the paper, the following remarks were made by the President:—

The paper this evening, on the "Evolution of the Geography of India," is by Mr. Oldham, who has been for fourteen years a member of the Geological Survey of India, and has traversed almost every part of that country from Beluchistan to Burma. Mr. Oldham is a son of the founder of the Geological Survey—of that accomplished and indefatigable public servant who for more than a quarter of a century worked in India in his department, and whose talents, energy, and accomplishments did so much to raise that survey to the position which it now holds. His son, Mr. Oldham, is admirably qualified to inform us on the subject which is announced for this evening, and I anticipate a most interesting communication as a result of his studies.

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

Sir ARCHIBALD GEIKIE: I should first like to be allowed to express my own gratification at hearing this paper from the lips of the son of the distinguished geologist who for so many years was the life and spirit of the Geological Survey of India. Those who remember Dr. Oldham will be pleased to think that his son should have followed up his work so ably. The subject which has been brought before us is one of surpassing interest, for it illustrates well what geographers are too apt to forget—that, in order to understand the geography of any region as it now is, we must learn how it has been gradually built up. No country came into existence just as it is. If we would discover how its topography has originated, we must study the results of long-continued geological observation. It is only by such a thoughtful study that such a lecture as we have had to-night can be elaborated. Mr. Oldham has shown skill in marshalling the facts collected in India by his predecessors and colleagues as well as by himself. My own acquaintance with Indian geology is not large enough to entitle me to criticize the paper, but there are one or two points which must have struck you as of more special interest. Mr. Oldham showed, for instance, how in India, as in other regions, we can still in some degree trace out the ridges that have existed from early geological periods, and form the nucleus round which the outer framework of the country has gradually been built up. He also gave us illustrations of a singular fact which has been brought out exceedingly well in other parts of the globe—the slow growth of many mountain-chains. When we see among the Alps, as at the head of the Lake of the Four Cantons, the rocks of whole mountain-sides folded upon each other like so many crumpled layers of carpets, we are apt to imagine that so stupendous a result could only have been achieved by the sudden operation of some colossal force. But in certain cases there is distinct evidence that the process of mountain-making may be exceedingly slow—not faster, indeed, than the rate of erosion of a river, and we

know how comparatively slow that is. Deep gorges have been gradually cut out of ridges, because the rivers passed over the land before these ridges were upraised, the rate of elevation having been so slow that the rivers could saw their way down as fast as the ground rose. There are one or two features in the later evolution of Indian geography which have interest for us here. Mr. Oldham pointed out the enormous sheets of volcanic material in the Deccan. Something of the same kind may be seen in the great level basaltic plateaux of North-Western Europe and Iceland, which are fragments of the vast lava-fields poured out in tertiary time before the last upheavals of the Alps. The Deccan volcanic sheets may be more extensive than those of Europe, as the mountain ranges of that region are vaster than ours, but there appears to be a kind of relation between the sequence of events in both regions. A very interesting part of the paper was that in which the author described how the forces that have carved out the valleys are getting feebler and feebler, and how in certain places they are so feeble as no longer to act. Mountains there will eventually be buried under their own debris. I must congratulate Mr. Oldham on his paper, which may be taken as a good example of the manner in which the geographical evolution of a region should be worked out.

Dr. W. T. BLANFORD: As one of the older members of the Geological Survey, who retired from the service about the time that Mr. Oldham entered it, I can only express my gratification at hearing so able an account of what may fairly be described as the contributions made in the course of years by the Geological Survey of India to our knowledge of the physical geography of that country. The majority of the facts brought forward by Mr. Oldham have long since been published, and were noticed in the original 'Manual of the Geology of India,' of which he has lately completed a second edition; but, at the same time, he has added some novel observations and made some good suggestions. Amongst the most interesting of these are the data as to the geological age of the Aravalli range, and of the eastern and western coasts of the Indian Peninsula. The interest of the former is rather geological than geographical, but the history of the coast-lines comes certainly within geographical limits, and deals with a subject on which geology has much to say. On maps of India two ranges are often represented, called the Eastern and Western Gháts, approximately parallel to the two coasts. The name is bad, for a ghát is not a mountain. It may mean a pass, but as it also means a wharf or landing-place on a river—everybody has heard of bathing and burning gháts—it is clear that the term really implies a place of access. The Western Gháts were the places at which roads from the westward led up to the plateau which occupies so large a part of the Indian Peninsula, and which attains its greatest height near the Malabar and Bombay coast. Now, the northern part, known also by the far better and more distinctive name of Syhádri, is merely the scarp of a plateau composed of horizontal lava flows, and is not really a range at all; and the southern portion, consisting of ancient gneissic rocks, has no well-defined axis. The "Eastern Gháts" are a figment of the imagination, the name belonging to the roads that lead to the Mysore plateau having been loosely applied to sundry groups of hills that have no connection with the Mysore plateau, nor with each other. One of these groups, it has been suggested by Mr. Oldham, may be connected with the history of the eastern coast from Madras to Masulipatam. In this case, however, it will be seen, by looking at the geological map, that the parallelism is not very well marked, and there is no range at all having the same relation to the coast south of Madras. The age of the west coast may be rather later than eocene, the marine fossils found in Travancore, upon which the geological date depends, being miocene, not eocene. The curious gap in the "Western Gháts," through which the railway passes from Madras to Beypore, is very probably, as Mr. Oldham has suggested, due to an

ancient river, and this may have run from the eastward. But there is another possible explanation, and that is that the river ran from the westward, at a time when the Peninsula of India extended to beyond the Laccadive islands.

If the present paper does nothing more, it may be hoped that it will give the deathblow to one venerable tradition. Few persons can travel by railway from Calcutta to Lahore, and from Lahore to Karachi, without being struck by the wonderful plain of Northern India, and all who have visited the base of the Himalayas must have noticed how the spurs of the mountains rise from the plain as land rises from the sea. It is almost a natural deduction that this great Indo-Gangetic plain is an ancient sea-bed filled up by alluvial deposits. When I first went to India I accepted this view, and never doubted its correctness until I had seen something of the Indus valley, and until considerable progress had been made in mapping the geology of the country on the borders of the great plain. Then it gradually dawned upon me that there must be some reason why marine tertiary beds occur everywhere, and marine cretaceous and jurassic rocks in many places, along the borders of the Indus plain, whilst not a trace of a marine bed has been found on the margin of the plains watered by the Ganges and Brahmaputra from Delhi to Assam. South of the hills that rise on the southern side of the Assam valley plain are marine beds of tertiary and cretaceous age that mark the prolongation of the old eastern coast of the Indian Peninsula, but, so far as it is possible to judge, the great plain of Northern India east of Delhi has never been sea. Nevertheless, the marine origin of this plain has been so generally admitted as to have been accepted by many geologists and by writers on the distribution of animals, like Dr. Wallace, as a well-known fact.

This is an example of the usefulness of a paper like the present in calling attention to scientific observations which are almost certain to be overlooked so long as they are only published amongst the detailed accounts of a geological survey.

Sir HENRY HOWORTH: Although I must obey the chairman's invitation, I feel some hesitation in intervening in a discussion in which my two friends have already taken a part. I congratulate the meeting very much, not only on the paper, which has been a model of lucidity in dealing with an intricate subject, but in that we have also had with us two veterans, each of them *facile princeps* in his own way, one of whom has almost founded the science of applying geology to physical geography. Many points that have arisen and have not arisen are singularly interesting to us all, and might tempt a long digression. I should like, among other things, to learn from Mr. Oldham about one of the greatest of all problems in the recent geology of India, namely, an explanation of the deposits of laterite, the great crux of Indian geology, and to ask him if he has a theory of any kind by which to explain them. The outlines of India are very old, as is confirmed by the fact that in the laterite beds human weapons were found, and were apparently contemporary with the extinct animals of the Nerbudda valley, and therefore, probably, the eastern boundary of India at that time was very much what it is at present. With regard to land extending across where the Laccadive and Maldivé archipelagos now exist, we know that in the island of Perim the same species of tertiary mammals occur as in the Siwaliks of India, proving that there has been a collapse of land along the northern part of the Indian Ocean in recent geological time. I am glad Dr. Blanford has called attention to the great northern plain of Hindustan, and the problems arising out of it. This very old plain contains in its bosom very much of the secret history of our race. It is almost the oldest alluvial plain in tropical regions where we have reason to believe man existed in very early time, and in the lower strata of its alluvium we should find secrets explained which we have looked for in all kinds of places. When we go further north we enter into a

congeries of difficulties which have raised polemics of various kinds, namely, as to the age of the Himalayan range. It is impossible to enter into this problem now, but I was pleased to hear Mr. Oldham's view, that the elevation of this range is so recent, comparatively, as the pliocene and subsequent period. This confirms the opinion of the veteran Strachey, in his admirable article in the 'Encyclopædia Britannica,' that 15,000 feet have been added to the height of that range in very recent geological times. It casts opprobrium on our race, that with all its energy and go, and with so many public servants at its command, we should be so absolutely ignorant of the deposits on the flanks of the higher ranges. We know little of them beyond what has been brought down in a fragmentary way through Tibet half a century ago, and, it seems to me, we ought to converge our efforts upon solving what is such an important scientific problem, namely, the actual age of the Himalayan range. This was a problem that the king of geographers, Alexander Humboldt, set before himself long ago, and which he was constrained to solve in a way that, in several recent memoirs, I have felt myself obliged to follow. He employed some cogent arguments to prove that the Himalayan range is very much younger than is supposed; that the mountains were raised to their present great elevation in exceedingly recent geological times. I must join with my friend, Sir Archibald Geikie, in congratulating Mr. Oldham (the son of the pioneer of Indian geology) on his paper, and in wishing him a long and successful career in India.

Mr. OLDHAM: The only points in this discussion that appear to require any reply from me, are those raised by Dr. Blanford with regard to the east and west coasts. When I spoke of the age of the east coast, I did not mean to say that it has kept very closely its present position ever since the distant period at which the Aravalli hills were raised, but that its present position marks approximately the extreme limit beyond which the sea has not been able to extend; the land doubtless extended further to the east, and there have been great variations in the coastline. As for the west coast, I take it that the miocene deposits of Travancore and thereabouts show that at the close of the eocene period the coast had been established; further back than that I have no desire to go. Sir Henry Howorth will, no doubt, excuse me from replying to the points he has raised, because they are so uncertain that they could not be adequately treated without introducing a great deal of matter still open to controversy, and consequently rather unsuitable at this period of the evening. They are of very great interest, and I should very much have liked to have been able to treat of them.

The PRESIDENT: Mr. Oldham's most interesting paper, and the discussion which has followed it, more especially the remarks of Sir Archibald Geikie and Dr. Blanford, remind us how much we owe to geology. The meeting will remember that it was a President of this Society who compiled and produced the first geological map of India, and that this attempt—for I believe that Mr. Greenough never professed that it was anything more than an attempt—stimulated the study of geology in India many years before the foundation of the present Geological Survey. My predecessor felt strongly that these geological studies were the basis of physical geography, and that we must look to geologists to explain to us many of the grandest phenomena we see upon the surface of the earth now, because their origins must be looked for in a very remote geological period. Several explanations of these phenomena have been given us to-night in Mr. Oldham's paper, and they manifest the close connection between geology and physical geography. It was such considerations which led Sir Roderick Murchison to insist so strongly upon this connection in the two last anniversary addresses which he gave us. There is one other point I should like to refer to. Mr. Oldham has explained the crossing

of the axis of the Himalayan range by some of the great northern rivers, especially the Indus. It seems to me that in the courses taken by these rivers we see, in the most graphic way, the connection between our studies and those of the geologists. We must go to the geologists to explain the origin of those gaps in the mountains (elbows, as they are termed by General Cunningham). We must go to the geologists to learn how the Jumna once formed part of the basin of the Indus; and we could not venture as geographers—although geologists can venture—to assume that the waters of the Jumna once gave a share to the Indus and a share to the Ganges, just as the Casiquiari, in South America, gives a share of its waters to the Orinoco and a share to the Amazon. Then the comparative geographer comes in. He can tell us that from the dawn of history the Jumna had been flowing into the Gangetic valley. He tells of the change in the position of the junction between the Chenab and the Indus, and how the bed of the Ravi has wandered away from the walls of Multan. Thus we find the study of the two sciences closely interlaced. There are many other very interesting and suggestive points in Mr. Oldham's paper, and I am quite sure that the meeting will authorize me to assure him that we have appreciated his communication, and that you will all unite with me in giving him a cordial vote of thanks.

A JOURNEY IN HADRAMAUT.

By LEO HIRSCH.

My intention to undertake an exploration of Hadramaut is an old one. I tried to execute it in the year 1888, when I went to Aden for this purpose. But want of information, and the uncertainty of success in consequence, made me give up the idea, and I went instead to the country of the Somals, making a stay of three months at Bulhar, where I applied myself to the study of the Somali language. After my return to Europe, I entered into a lively correspondence with an intelligent Arab at Aden, Abdul Kadir Mekkawi, whose acquaintance I had made during my stay there. From this intercourse I derived great advantage, and the valuable statements of my Arab friend encouraged me to take up my former design, and try it a second time. I arrived at Aden on December 2, 1892, receiving every assistance needed, especially letters of introduction to the chiefs of Makalla, Shehr, and Kishin from the British Resident, General Jopp, and the native Assistant-Resident, Mohammed Salih Ja'fer. In the middle of January, 1893, I left in a small steamer for Shehr, where I arrived after thirty-eight hours, the distance being 320 geographical miles. I was well received by the Jem'adar Husein bin Abdalla bin Omar bin Audh el Ka'aity, and a house was assigned to me, but nothing done to promote my aims. I therefore left, and went, February 4, by a sambuk to Seihut, a port on the Mahra coast, near the outlet of the great wadi, generally called Masila, which, after having taken its course through the whole of Hadramaut, enters the sea about two hours west of said place. My secret hope of pene-

trating the interior by this valley was, however, doomed to disappointment, the civil authorities, two brothers, the Sheikhs Abdalla and Abder-Rahmān ba Karīf, being quite powerless, whilst the Bedwins, of the tribe Bet Ziyad or Zuwedi, were hostile to my entering the interior. When, nevertheless, I undertook a small trip to a place Raidat-el-Kebira, about three hours north of Seihut, in the very beautiful and romantic valley of the same name, accompanied by a little boy only—as grown men would not go with me from fear of the Bedwins—they got very excited, and the sheikhs, fearing acts of violence, persuaded me strongly to depart. Consequently I left for Kishin, where Sultan Ali bin Abdalla bin Afrīf showed me much kindness, but was unable to assist me, for the same reason as before. I went back to Makalla, where I expected better success, and after having delivered my letters to the governor, Abdul Khalig bin Almas, a very clever man, who is appointed by the Jemadars, I really thought from his words I had come nearer to my aim. But he kept me in suspense till I got impatient, and, though he tried to conciliate me by giving me the permission of visiting Wadi Khirba (not Qirba, as Wrede has it), together with a numerous but superfluous escort, I returned to Aden by a sambuk without taking leave of Abdul Khalig, and complained to the Resident of the disregard paid to a British recommendation, asking at the same time the favour of being provided with a new letter in terms a little more impressive for Makalla, which I consider the best point from which to begin this undertaking. My wish was readily and courteously granted, and after some delay, caused by the want of a steamer, and the contrary wind not allowing a sambuk to make the journey, I sailed, on May 25, a second time for Makalla, which, I learnt, is just 280 geographical miles from Aden.

My second letter was taken, of course, in good part, but the ill-will would not subside. I was delayed again some time under several pretexts, but finally carried my point. A Bedwin of the Haigy, one of the tribes of the Saiban, was assigned to me as my sayyir—that is, a guide and guarantee in one—and a soldier-slave given me as an escort to Hajaren, in Wadi Doan, my next place of destination. Besides, I got letters from Abdul Khali and Jemadar Husein at Shehr for the authorities at Hajaren and Shibam, which interior places, together with some others, are in the hands of the Ka'aitys. I left on the evening of July 1, with two camels, the people mentioned, and my Arabic servant, whom I had brought from Aden. We first encamped outside the town gate near the seashore, till at half-past ten the moon had risen above the mountain range, and “o'er the dark her silver mantle threw,” when our camels were loaded, and we went on in the name of God—“bismillah.” I had left my European dress at Makalla, and transformed myself into an Arab sayyid, though not into a Moslem. My knowledge of the language and the Koran, however, gave me a certain prestige in the

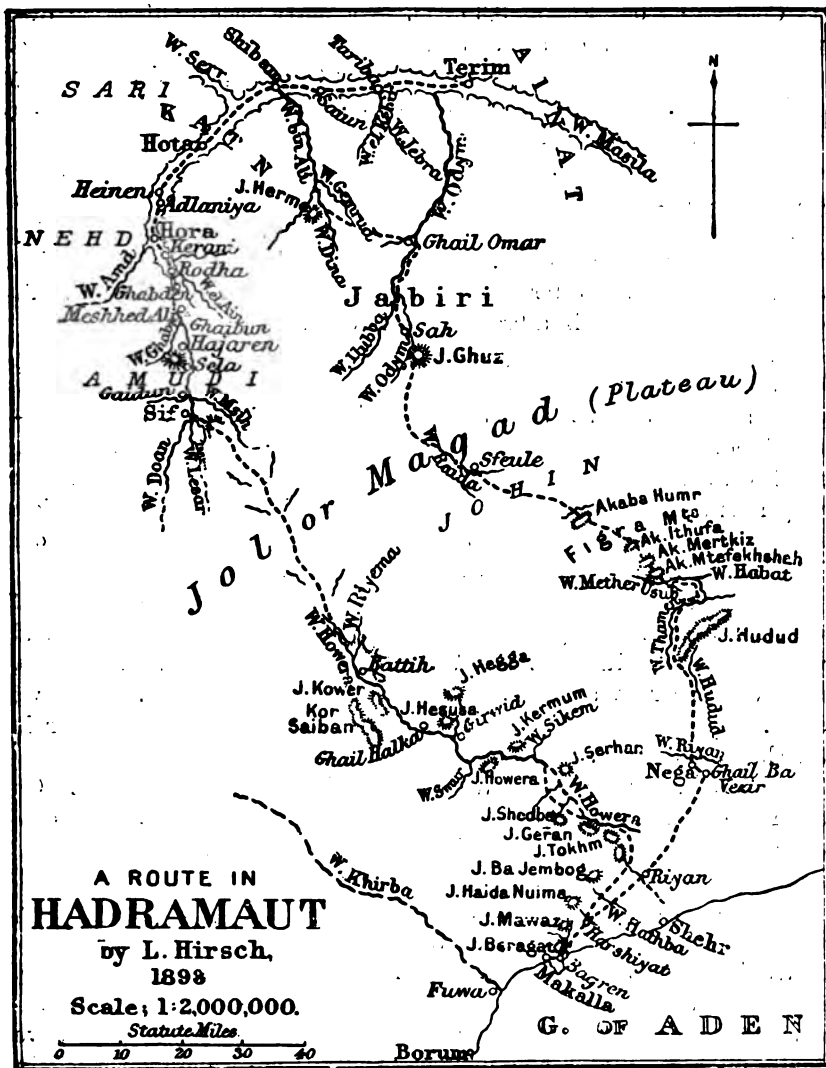
opinion of these people, to whom all worldly science is a weak reflex of the heavenly one.

The short description of my route I am about to give can, of course, only be a very rough sketch, in which the overwhelming abundance of details can be but partially regarded. We first march westward along the sea, arriving after a quarter of an hour at the "Aiga," which is at the same time a large wadi coming from north, and leading the surplus waters of a system of small but fertile wadis to the sea—and a depression of the soil between two mountain ranges, where the sea in the season of autumn (kharif) sends its waters far up unto the land. Salt water is always found here, more or less, according to the season, and the ground, even where it is dry, is completely impregnated with salt, which was obtained at this place even in old times by digging holes, in which the water rises, evaporating by the heat of the sun, and leaving behind the valuable product. We enter this valley, keeping to the left side, which is bordered by a range of rocks of a reddish-yellow colour. Through the whole country, here as in the interior, the commanding heights are generally crowned with some fort (husn) or detached square tower (koot), but few of these are occupied by soldiers in time of peace.

The ground gradually rising, we turn north-east, passing the plantations of Minaura, and taking the direction towards Bagren, which is at a distance of about one hour from Makalla. We could not recognize it in the night, but I had been there before. It contains about fifty clay houses and huts, made of palm branches, overlooked by the Husn Ba Dehman, situated on the side of a hill. Bagren is a favourite place of the inhabitants of Makalla, and many a day they go there, the Jem'adar not excluded, for sport and recreation. Near it, at the bottom of a wild and stony ravine, runs a streamlet of real water, and the high and rocky banks of this wadi are covered with a wilderness of palms and other outgrowth of a luxuriant vegetation, such as bananas, tobacco, and vegetables of every kind. Springs trickle down the rocks everywhere, and their waters are conducted by artificial irrigation to every place needed. At the end of the plantations Husn Ghowezi rises on a mighty overhanging rock, hollowed out underneath, so as to impart the strange impression of a proudly raised head on frail legs.

Very near to Bagren, about a quarter of an hour, a smaller place of nearly the same name is situated, Bageren, also with numerous palm-trees extended at the foot of Jebel Beragat, projecting here on our left. We are in the broad stony ground of Wadi Sided, which comes forth from the mountains before us, turning from here in a curve to the Aiga. This is also the place of our camp, which we pitch at the side of a sigaya (watering-place) at about midnight. Leaving the place in the next morning at 4.30, we are accompanied by several caravans that had passed the night at the same spot. We proceed by Wadi Sided, which

is shortly joined by Wadi Beragat, coming from the right side of Jebel Beragat. Our direction cannot be ascertained; it is continually changing. In the north, Jebel Mawaz can be seen, a mountain range of considerable height, apparently in the direction west to east. Wadi Mawaz descends



from it, entering Wadi Sided, and enlarging it considerably. At 6.30 a.m. Harshiyat is visible in the east, with numerous palm-trees and some watch-towers on the surrounding hills, in the broad valley of the same name, which descends from the northern mountains, and goes south-east

to the sea. Beyond Harshiyat we go east, afterwards north and north-east. We see from our road in succession El Hauwa, Jewabiyat, Dikdak, Bir Selah, all of them small places with more or less plantations. After an hour we descend Wadi Hathba, about 300 feet broad, pitching the camp in its bottom at 8 a.m.

Continuing our way at 3.30 p.m. in a north-easterly direction over rising ground, we soon arrive at a stony plain, bordered by ranges of low hills, with high mountains looming in the west, called collectively Haida-Nuima. Our direction remaining unchanged, we perceive at 5 p.m. on our left at some distance another high range of mountains, the name of which is Ba Jembog. After a quarter of an hour we ascend a steep acclivity, an arduous task for the camels, and reach a wide plain strewn with black stones; an hour later the stony bed of Wadi Riyan presenting itself in a southern direction. It comes from the northern mountains, and I was told that after a heavy rain its waters reach the sea. At 6.30 p.m. we encamp in a branch of this wadi.

Next day we leave shortly after 3 a.m., marching along Wadi Riyan, and approaching the high mountain-chain of the Tokhm. The camels being sent by another way, we ascend by a nearer path the akaba—that is, a steep ascent or descent of a mountain—of the Tokhm. Having reached the height, we next descend a little, and, at 5 a.m., march over very rough ground among gigantic stone blocks, along deep precipices in a north-westerly direction between two mountain ranges—on our left, the Tokhm; on our right, the mountains of Ghail Ba Vezir.

After an hour we reach the wild Wadi Ershenit, in the bottom of which is a small village; in its neighbourhood a few palm-trees and vegetables are cultivated. At 7 a.m. on our right the Wadi Howera, here very narrow, apparently running from east to west. Here we camp. Barometer, 28.38 in.; at Makalla, 29.16 in.; thermometer in the shade, 100° Fahr.

At 4.15 p.m. we go on in Wadi Howera in a westerly direction. On the left of our road, north-north-east to south-south-west, is a considerable mountain-chain, called Geran, having the aspect of a huge stronghold, which I estimate to be 2000 feet above the valley.

Next day, setting out in a westerly, respectively north-westerly, direction, we cross after an hour Wadi Reheba, apparently a tributary to Wadi Howera from the left. After this a plain, and, rising behind it, a high and steep mountain-chain, Shedba, apparently in a south-westerly direction. After having passed by several small wadis, we finally pitch camp at 8 a.m. in Wadi Abut. Here we are surprised in the afternoon by a very violent thunderstorm, combined with a heavy rain lasting all night.

Next day we leave at 7 a.m. Having passed several small wadis, we take a northerly direction, marching in the midst of a plain, surrounded by low ranges of hills. To the east is the mountain-chain

called Serhan. We approach Wadi Howera from the left, descending into its bed, bordered on both sides by steep walls of yellow sandstone, great blocks of which are scattered in the watercourse. Several narrow streamlets of water run in it; direction west. We encamp till 3 p.m., when we continue in a westerly direction in Wadi Howera. After an hour, on our right Jebel Kernum rises to about 1200 feet above the valley. Later on a high chain of mountains, running apparently from south to north, becomes visible—Kor Saiban. Shortly after on the left Jebel Howera rises to about 1800 feet above the valley; and to the south before us, Jebel Aram, about 3000 feet high; direction south-west. We encamp in Wadi Smur, which enters Wadi Howera from the left.

Next day, setting out at 3 a.m. in a north-westerly direction, a high mountain, Karn Mendub, rises before us. We turn north, keeping it on our right. Afterwards the road takes alternately a northerly and north-westerly direction. At 5 a.m., on our right we see a high and steep chain of rocky mountains, the highest tops of which are called Shedba and Yaara. Shortly afterwards we take the direction of the distant wild and high mountain-chain of Hegga, at the end of the large Wadi Hegga, the latter entering Wadi Howera on its northern side near Jebel Hesusa, a single elevation, forming an angle common to both wadis. On the east, at a moderate elevation, a small place, Girwid, with numerous palms, becomes visible.

The region of Wadi Hegga is considered by the Bedwins as containing gold and lead. Of course I cannot judge. I only saw that the interior of the rock, the crust of which made it appear to be a yellow sandstone, was to a very considerable extent clear transparent quartz, and the extremely fine sand with which the valley is covered far and wide here must be the result of its disintegration. Going on in the afternoon in Wadi Howera, the direction alternating from north-west to south-west, we see before us Jebel Halfa, a very steep mountain-chain, accompanying us in a north-westerly direction. Then on our right Jebel Ghail, of the same character, running north. The ground gradually rises, and at 6 p.m. we pitch camp in Wadi Howera in front of the palms of Ghail Halka, rising on its right bank in terraces to a considerable height. On our left were perpendicular walls of a very soft sandstone.

Next day we begin to ascend the akaba of Ghail from Wadi Howera. The valley becomes very narrow, between gigantic blocks, the palms of Ghail accompanying us for nearly half an hour. The road winds upwards in a continual zigzag. The highest mountains, bordering the valley on both sides, are called Battih or Bartih. We encamp at 6 a.m. on a flat spot, overtopped on all sides by steep mountain-walls. Barometer, 24.82 in. From our camp Jebel Hegga is situated east 108° ; the Kower or small Kor south to south-west; at the side of the wadi, and

behind it, surmounting it by far, south-west 200–250°, the wall of the Kor Saiban. This entire mountainous district in the upper course of Wadi Howera is called Ghail and Halka. In the afternoon we continue our way on in Wadi Howera in a westerly direction, Kower and Kor Saiban being in front of us. After one hour Jebel Battih lies just before us; we follow a north-westerly branch of it, and reach, after one hour more, Battih, a small village of about twenty houses at its foot, with a few palms and two elevated forts. The valley runs here in a rather northerly direction—on its left, Jebel Battih; on its right, Jebel Tabah or Tabeh, of nearly the same formation.

On the following day, setting out at about 4 a.m. in a northerly direction, we first ascend Jebel Battih on the left side of Wadi Howera, the direction of which is north-west. After an hour we see from its right Wadi Riyema join it, coming from north-north-east. We descend to the bed of Wadi Howera, making our way now over its pebbles and stones, marked by a white crust formed by the action of the water, and now on one of its banks, continually crossing it from one side to the other. At 7.30 a.m. we ascend the last acclivity, and reach the large plateau called the Jol or Magad, surrounded in a wide arc by elevations, which are surmounted in the south-east by the chain of Kor Saiban. The surface of this whole plateau consists of a crystalline limestone in thick plates, several layers one upon the other, resting upon a reddish rock of volcanic origin, as may be seen wherever the waters have torn away the upper layers, hollowing out a way for themselves. This plateau is the watershed between the wadis flowing south to the sea, and those going north and discharging themselves into the large Wadi Masila. The number of wadis rising here is very considerable, and the name of those we met in our road, and other particulars, can only be given at more length in the detailed account which is soon to appear in book form from the press of Mr. E. J. Brill at Leiden. The Jol is occupied everywhere by low platform hills, which, when ascended, give the idea of a further story, a perfect level surrounding us again. We marched on this vast plain, which generally creates a feeling of extreme desolation by its lifelessness and the scantiness of its vegetation, mostly in a north-westerly, partly in a westerly direction, and reached on the evening of the third day its border towards Wadi Doan.

If there is anything fit to destroy the suspicion that Wrede might not have penetrated these regions, but given us reports collected from natives, it is the fine description he gives of the view of Wadi Doan from the height of the Jol. We descend from the right side by Wadi Mishergi, a wild ravine, filled everywhere with loose boulders, and apparently passable only for the waters. We reach Wadi Doan opposite Sif (not Seif), a town under the Amudi sheikhs, the same place where Wrede was suspected as a spy and forced to return.

Next morning we set out at 5 a.m., after having engaged for greater

security two other Bedwin sayyirs of the Amudi and Sari tribes. Along the fertile ground of Wadi Doan, covered with plantations of palm-trees and Dom (*Rhamnus nabeca*). After half an hour, on our left, Wadi Gaidun (not Qahdūn), with plantations which extend for miles. The town of the same name is not visible; in it is the tomb of the revered first sheikh of the Amudis, Said bin Isa el Amudi. Other wadis follow on both sides, generally with plantations and small towns at their entrance. Shortly after 8 a.m. we encamp in Wadi Arsima. From here we see the elevated rocks of Hajaren directly north. In the afternoon we march again through Wadi Doan, reaching the far-extended plantations of Hajaren after about two hours. The town is situated on the side of a mountain, the name of which is Munesur, and its hum on a steep rock looking down Wadi Ghabr which flows north-east, and unites with Wadi Doan just before Meshhed Ali, situated about three hours from here north-north-east.

I delivered my letters from Makalla to the Nagib Abdallah Ambarik, one of the Kaaity family, and was welcomed and lodged. After one day's rest I undertook a trip to Meshhed Ali, which belongs to the sayyid family of Hadun, to whom one of them, Sayyid Husein bin Omar, living near Hajaren, and considered a great saint, favoured me with an introduction. Our way is in the Wadis Ghabr and Doan. At the end of two hours, at the foot of the left-sided Jebel Naam we come upon ruins of an aditic town, of which some house-walls, erected from considerable blocks of hewn stone, are pretty well preserved. There are no inscriptions here. Farther on more ruins, but of smaller stones, so as to justify the opinion that they are less old. Approaching Meshhed Ali, we turn to a structure covered with cupolas, and containing the tombs of the Welis Ali bin Hasan and his son Hadun, besides that of an inferior sheikh. From this Sayyid Ali the city received its name, and there is a pilgrimage every year to his tomb. In order to show me the ruins of Ghaibun, mentioned by Wrede, one of the sayyids accompanied me to the place. Wadi Ghaibun is connected with Wadi Mikh, but does not reach Wadi Doan. The ground covered by the ruins is very extensive, and a great city it must have been when it was destroyed or left by its inhabitants. I did not find the royal tombs reported by Wrede, and no complete house at all, but several well-preserved walls of houses, and some fragments of stone with Himyaritic characters clearly visible, though of no coherent meaning. I took a few of these fragments, and carried them to Berlin. No doubt systematic excavations would give more valuable results.

I returned to Hajaren the same night, and set out for Shibam the second day after this trip, passing Meshhed Ali another time, but without stopping there. Behind Meshhed are other extensive ruins of former stone buildings, but the stones used cannot be said to be in the least gigantic, or aditic, as the Arabs have it. Wadi Doan runs here along

the left mountain range, Wadi el Ain along the right in a large curve. After an hour, at some distance on the left is Ghabden, with considerable plantations. At 10.30 a.m. we dismount at the house of a Sheikh ba Vezir, at Adib, a poor place in the Wadi of the same name.

At 3 p.m. we continue in Wadi el Ain, direction north-west to north-north-west, three wadis running here in the same valley-ground, one parallel to the other: Wadi Doan, Wadi Adib, and Wadi el Ain. After three-quarters of an hour Wadi Adib enters Wadi el Ain, and we proceed in the latter. On our right is the mouth of Wadi Jemale, with a town Rodha and numerous plantations of palms. We pass many other towns on the right, all of them with well-cultivated surroundings: Sedba, Kerany, Bedra. Near this place Wadi Amd bursts out from the left mountain range, in order to unite with Wadi Doan north of us. Other cultivated places follow. Having passed into Wadi Hora, running parallel with Wadi el Ain, we reach the city of Hora, with a large husn on the top of a steep mountain. We dismount at a private house, where soon the governor of the places comes, to offer the usual welcome. Hora, as well as Shibam, belongs now to the Kaaitys.

But I have far exceeded the space kindly afforded me, and must come to an end. From Hora I turned to Hota, which is the proper name of the town, whilst the usual designation, El Katn, is that of the whole district in which Hota is situated, and which is a very fertile one, producing every kind of trees, vegetables, jowari, and even wheat. The soil is carefully irrigated from wells, and the water-channels run everywhere. Here I met Jemadar Selah bin Mohammed bin Amr el Kaaity, who treated me with a gentlemanlike and kind hospitality. Having stayed with him one day, I proceeded to Shibam, the capital proper of Hadramaut, of about 6000 inhabitants, situated amidst well-cultivated environs. Shibam is a narrow-built town; its houses are large, its streets dirty, and it is surrounded by a clay wall. Very near Shibam begins the dominion of the Kathiris, the bitterest enemies of the Kaaitys. Therefore, in order to pass to the territory of the latter, a guide of the Kathiri tribes must be procured. After having got the man required and two camels, I set out for Saiun and Terim, the principal cities of the Kathiris. The way, generally east, leads by the great valley Masila, called here Serr-Masila, a large Wadi Serr having entered from the north between el Hota and Shibam. It would be useless to give names only. In short, I reached Saiun, extending far along on the right of the valley, with many gardens and numberless mosques in it, and surrounded by extremely well-cultivated ground, in about four hours, and was invited to see the Sultan Mansur bin Ghalib bin Muhsin el Kathiri, who reigns here, while his brother Muhsin, whom I had not the pleasure to see, lives at Terim. The sultan received me politely, though not in a very friendly manner, and gave me, at my

request, one of his slaves as an escort to Terim. I soon left for Tariba, having got an introduction to the Sheikh Bu Bakr Zubedi at that place, and was very hospitably received by him. Tariba is at a distance of $4\frac{1}{2}$ hours from Saiun, and the whole district is extremely fertile, the soil being laboriously cultivated. From Tariba I turned to Terim, reaching it after about 4 hours. Sheikh Bu Bakr had given me an introduction to the Sayyid Hasan bin Aluwi bin Shehab, at Terim, who is an enlightened man, having lived for many years in Java. He received me well, but was intimidated by his sayyid brethren, who threatened even to destroy his house, if he would not turn the Kafir out. He did not want to do so, but after I had perceived the sultan to be powerless, and not inclined to protect me against the sayyids, I made up my mind to leave immediately, but not before the sayyid had afforded me from his ghulb—a small square tower on large houses—a survey of the town, and given me valuable information about it and its surroundings. I returned the same day to Tariba, and the following to Shibam, where I was again well received.

My return to Makalla was by Wadi bin Ali, going there to a place Mesanat; from here by the Akaba el Herma up to the Jol. Down again by the Akaba Gerosa, a very wild wadi, to Ghail Omar, a fertile place at the junction of Wadi Gerosa and Ody. Here I found aditic buildings, but no inscriptions. Then along Wadi Ody, which is very well cultivated in its whole length, to Sah, where we took new sayyirs from the Hamumis, one of the Ma'ri, the other of the Yememi tribes. We continue in Wadi Ody, till we have to ascend the akaba of Jebel el Ghuz, leading again to the Jol, which shows the accustomed character. Then the Fgra, an aggregate of mountains with several names, must be surmounted with many hardships, till at last, after an arduous descent, we go astray in one of the wild pathless wadis. Finally we get out of the difficulty and reach Nega, a small town, the environs of which are highly cultivated. Besides, the Jem'adar is boring here, near Wadi Riyan, for coal, in which work he had reached, at the time of my stay, a depth of about 130 feet. Samples of the coal obtained were shown to me, apparently of inferior quality. The road from Nega to Ghail Ba Vezir leads for $1\frac{1}{2}$ hours under palms in the most luxuriant vegetation that can be seen, yielding every produce wanted. The tobacco cultivated here is highly prized. Setting out from Ghail early in the morning, I passed the night in the valley of Harshiyat, and arrived at nine o'clock in the next morning at Makalla, which I entered while Jemadar Munassar, having taken in the mean time his residence there, rode out of it with solemn pomp, followed by his retinue, in order to pass a holiday at Bagren.

GEOGRAPHICAL WORK IN CANADA IN 1893.*

NEARLY all the geological work of the Geological Survey of Canada implies a certain amount of concurrent geographical work; for even in the better-known parts of the country the existing maps are seldom sufficiently accurate or detailed enough to serve without addition as a basis for the geological features. When, however, reconnaissance surveys are carried into new districts, the geographical part of the work frequently becomes as important as the geological. During the season of 1893 a larger proportion than usual of such exploratory surveys was undertaken, and their aggregate result, when properly laid down, will serve to add very materially to the existing maps of the northern part of the dominion.

The following is a brief note of the more important of these surveys.

A geological and geographical reconnaissance survey across the whole width of the Barren Grounds has been successfully executed by Mr. J. B. Tyrrell during the past summer. When on Athabasca Lake, in a previous year, Mr. Tyrrell had acquired such information as was to be got from the Indians about their hunting-routes into the Barren Grounds. They reported the existence of a river of some size beyond the height of land, which flowed to the north-westward, and, as they supposed, into Hudson Bay. This, it appeared, might probably afford a means of making the desired exploration.

Leaving Ottawa in the spring, Mr. Tyrrell travelled with canoes from Athabasca Landing, near Edmonton, to the east end of Athabasca lake, which was to be his initial point. The lake was left about the end of June, and a river, named Black River, was ascended to its head in a small lake. A local Indian, who had been taken as a guide for this part of the journey, deserted after a couple of days, but after some difficulty a portage route was discovered to a stream which was believed to be that previously reported. The Peterborough canoes, in which the journey was made, were accordingly launched on this new river, and its descent was begun. It was surveyed as the expedition progressed, and after a winding course of about 800 miles it was eventually found to discharge into the head of Chesterfield Inlet, which was reached about the 1st of September.

It was now necessary to make all convenient speed to Fort Churchill, the nearest outpost where supplies of any kind could be obtained. A running survey of Chesterfield Inlet, some 200 miles in length, and of a considerable part of the west shore of the northern part of Hudson Bay, was made *en route*; but so much delay was experienced from storms, during which it was impossible to proceed along this open coast in light

* Communicated by Dr. George M. Dawson, C.M.G.

canoes, that when still 250 miles from Fort Churchill it was found necessary to abandon further surveys. The provisions of the party being exhausted, a *câche* was made of all camp equipages and instruments, and it was attempted to reach the fort in a couple of light canoes. On October 16 the ice formed along the shore, and the remainder of the route had to be pursued on foot. During the whole journey along the shores of Hudson Bay the party suffered considerable hardship from want of food; no game of any kind could be procured. From Fort Churchill the return journey was continued to Winnipeg as soon as the rivers and lakes became sufficiently well frozen to admit of winter travel. Winnipeg was reached about the 1st of January.

Mr. Tyrrell has not yet had time to make any report of his work, but his account of the geography and geology of the previously unexplored part of the Barren Grounds will be looked forward to with much interest.

An important exploration through the practically unknown interior of the great Labrador peninsula has been accomplished by Mr. A. P. Low, who left Lake St. John on June 17, with a supply of provisions for the entire season (which it was necessary to carry with him), for Lake Mistassini. Thence, by way of the upper waters of the Rupert River, the East Main River was reached. This was ascended for some distance, and then, by means of portions of some of the branches of this river, with numerous intervening portages, the upper part of the valley of Big River, which also flows into Hudson Bay, was gained. This was followed down for a short distance to Nichicoon Lake, 30 miles in length, where there is a small trading outpost of the Hudson's Bay Company. From Nichicoon a devious route, with many portages, was followed to Lake Caniapiscow, 40 miles in length. From this lake South River, flowing to Ungova Bay, discharges. In the descent of the South River many wild rapids and several high falls were encountered, and in one of these a canoe was lost with much of the remaining provisions of the party, but fortunately without any loss of life.

The distance traversed from Lake St. John to Ungova Bay was, by the route followed, more than 1200 miles, of which 750 miles lay through a country previously unsurveyed. Mr. Low's route has been laid down partly by means of the micrometer telescope, partly by track surveys checked by sextant observations.

Most of the country crossed was found to be occupied by granitic rocks, with gneisses and crystalline schists referable to the Laurentian system; but the lower part of South River, for 120 miles along its course, traverses an area of Lower Cambrian rocks, like those of the Manitounuck formation of Hudson Bay, abounding in hæmatite ores. The Laurentian rocks recur before the mouth of the South River is reached. Mr. Low's observations lead him to believe that the central

parts of the Labrador peninsula constituted a great *nevée* during the Glacial period, and the direction of glaciation was found to be to the northward after passing the height of land.

The country travelled through is by no means so entirely barren as had previously been supposed. Much of it is well wooded, though the trees are of small size.

On reaching Ungava Bay, Mr. Low, finding a great scarcity of provisions to prevail there, took advantage of a steamer belonging to the Hudson's Bay Company, to proceed to Hamilton Inlet, on the east coast of Labrador, where he is now wintering, and whence in the spring he will set out on a second line of exploration, from east to west.

Mr. R. G. McConnell spent the past summer in carrying out a preliminary geological exploration of the Finlay River, which in reality represents the main upper stream of the Peace River to the west of the Rocky Mountains. This involved a concurrent geographical survey through the region, and has resulted in the correct delineation of the Finlay from its mouth, in approximate latitude 56° , longitude 124° , to its source in Chutade Lake. Though indicated on previous maps, the course of the Finlay has heretofore been laid down in the vaguest way only.* It is now found to follow, for about 150 miles, the line of the remarkable valley which everywhere appears to lie to the west of the Rocky Mountain range proper.† Further up, its main stream enters this valley from the westward, after having pursued a circuitous course to the north from its source, through a very mountainous country.

The upper portions of the Finlay are extremely rapid, so much so that the canoes were abandoned eventually, and Chutade Lake was reached by crossing an intervening range of mountains on foot.

The geological formations met with in this region are very varied. In the continuation of the Rocky Mountains proper, to the east of the Finlay, they extend from the Triassic to the Lower Cambrian; and these mountains very closely resemble, both in composition and structure, that part of the same range which is crossed by the Canadian Pacific Railway five degrees of latitude to the south. Further west, granites, gneisses (probably Archaean), and Cambrian rocks were found; also a great series composed of green and blackish schists and old eruptives, with associated limestones and serpentines, resembling the Cacte Creek rocks of Southern British Columbia. There are here the gold-bearing rocks. Strata referred to the Cretaceous were also found, as well as some which are probably of Tertiary age.

The Omineca district is drained by a western branch of the Finlay, and here for a short time gold-mining was actively prosecuted, but has

* See Butler, "Wild North Land," p. 275.

† See "Descriptive Sketch of the Physical Geography and Geology of Canada," p. 34. Geological Survey of Canada. 1884.

now become much reduced in importance, owing to the impossibility of introducing appliances for the working of the more difficult and poorer ground on a large scale. There is reason to believe, however, that extensive placer mining may eventually be made very remunerative in the Finlay valley, while the quartz reefs have not yet even been touched.

Another exploration which has yielded geographical results of some interest is that carried out by Mr. J. McEvoy, who, after examining the geological features of a part of the West Coast, near the southern end of the Alaska "coast strip," ascended and surveyed the Nasse River for some distance, and eventually left that river with the intention of proceeding overland to the northward to the Stikine River. Though it proved to be impossible to complete this journey with the means at disposal, some useful information respecting that part of the province of British Columbia to the east of the "coast strip" was gained. It was found, in the course of this work, that that part of the Nasse above tide water is quite incorrectly shown on all existing maps. A lava flow, which has long been reported to exist on the Nasse, was examined. It was found to be, as affirmed in local Indian traditions, of recent date, probably not more than a couple of hundred years old. The river was at one time blocked by it, but has since cut through, forming a small cañon. This is the first known instance of a post-Glacial eruption in British Columbia, for, though basalts and such rocks abound, they are elsewhere of Tertiary date, or older.

In the course of geological work undertaken by Mr. D. B. Dowling, to the east of the southern part of Lake Winnipeg, considerable lengths of some rivers and numerous lakes were surveyed for the first time.

THE TREELESS PLAINS OF THE UNITED STATES.

By JACQUES W. REDWAY.

Nor the least interesting feature of the broad valley between the Appalachian folds and the Western Highlands of the United States is that vast area that practically is a treeless region. The area in question extends from the timber belt that in the north crosses the northern tier of states as far south as the "Cross-timbers" of Texas.

It must not be assumed that this region is absolutely timberless, however. East of the Mississippi River there are many small areas covered with deciduous trees; besides, there are the forest-covered flood-plains of the numerous streams. West of the Missouri River, however, the forests decrease rapidly, not only in area, but in the number of species as well; and on the level plateau commonly known as "The Plains," there is

little or no growing timber save the few straggling cottonwoods that grow along the stream beds.

Various theories have been advanced to account for the absence of forestry in this region. Professor Lesquereux is of the opinion that the soil of the treeless regions, being mainly of lacustrine sediments, possesses too much acidity to support tree-growth. Professor Winchell believed that the germs of arborescent forestry were destroyed at the time of the last Glacial epoch. Professor Whitney advances the theory that the extremely fine texture of the soil is unsuited to the growth of trees, and points to the fact that the forest areas are nearly coincident with the Glacial gravels. In a paper before the British Association, Mr. Miller Christy takes the ground that the absence of forestry is due to prairie fires.

That there is something in each of these theories supported by facts cannot be denied; that no one of them is sufficient to account for the problem is also equally evident. Mr. Christy attacks the opinion of Professor Lesquereux by claiming that trees once planted in the treeless regions grow readily. This is true only in part. They grow in the sedentary soils, but they do not thrive nearly so well as in the gravelly soils. Whether their feebler growth is due to the acidity of the sedentary soils, however, is a question that Professor Lesquereux fails to demonstrate. The sandy area along the Atlantic coast is highly acid in a chemical sense, while the shingly soil of the *Hauteurs des Terre* is as positively basic; yet each area is densely covered with conifers. The sandy soil of the coast, however, is not sedentary, like that of the prairies.

Professor Winchell has urged the opinion that all germs of arbore-scent life were destroyed during the Glacial epoch—for which he has been unjustly and undeservedly criticized. A moment's consideration will convince any impartial critic that no vegetation could survive a burial under one hundred feet or more of detritus. It is by no means certain, however, that while Glacial detritus destroyed some existing species, it did not disseminate others. The flora of the higher summits of the Adirondack and the White Mountains is an instance in question. These summits were above the highest level of glaciation, and they abound in species that survived the Glacial epoch. Moreover, although they survived at the summits in this locality, they disappeared from the lower slopes and the valleys. They perished during the long Glacial winter.

The opinion advanced by Mr. Miller Christy, in support of a theory that the treelessness of the prairies results from prairie fires, seems at first to be a tenable one. There are, however, fatal objections to it. In the first place, fires will not exterminate forestry, even if the aerial growths of the latter be burnt off yearly. If the roots of trees are in the soil, neither prairie nor forest fires will destroy them. The fires will destroy that part of the growth above the ground, but the roots, in the mean time,

are simply storing up energy for the future. In California there are large areas now covered with dense growths of manzanita and other trees that were formerly bare of vegetation. Year after year the fires started by the Indians kept these areas denuded of forestry, and smooth as the surface of the prairies. But when the Indians were supplanted by the white settler, there was an end to the fires. The long dormant forestry sprang into activity at once, and soon covered the slopes and mesas with a vigorous growth. The fires had not destroyed the species; it had simply kept the growth of the trees below ground instead of above it. In many instances the underground growth formed a continuous matting of knots, gnarls, and buttocks, extending over many acres in area. As a matter of fact, no small part of the fuel used in the southern part of California is obtained, not by cutting the trunks and branches of trees, but by digging out their enormous overgrowth of roots.

A similar development of root-growth is noticeable, not only throughout much of the area of the Appalachian Highlands, but in the Western Highlands as well. The removal of the pine timber from the wooded slopes is followed by a growth, not of pine, but of scrub oak. A large part of the forest lands of Pennsylvania, formerly covered by conifers, is now timbered with oak; the same is true of considerable areas in Washington and Oregon. As fast as the merchantable pine, fir, and cedar fell before the woodsman's axe, the long-dormant roots of the oak waked into new life and availed themselves of their opportunity.

Now, the cause of this supplanting of one species by another * is not a difficult one to find. For a long period, possibly in Quarternary, certainly in Recent times, the two species have struggled for sole possession of the soil. When by reason of fire or other cause the aerial growth of one was destroyed or checked, the other, which in the mean time had been storing up energy in the form of root-growth, began to expand this energy in a vigorous above-ground growth. And so the two species have survived all the attacks upon them, whether by natural or by human agencies.

Thus we must admit that prairie fires are utterly unable to account for the treeless condition of the prairies. Moreover, how can we account for the escape of the grass itself from destruction if the burning of its aerial growth destroyed the invading forestry?

Professor Whitney is, I believe, the first to point out the fact that the forestry of the United States, the coast belt excepted, is confined almost wholly to the gravelly soils. In the main this is the case with respect both to the stream and the Glacial gravels. It is also true of the mountain slopes. The sedentary soils, on the contrary, are free from forestry.

Now, I cannot quite agree with Professor Whitney in assuming that

* I have many times heard it declared a special act of creation.—J. W. B.

sedentary soils will not support forestry. As a matter of fact, they will ; but they will not readily support the species that in Quarternary and Recent times have been extending their area southward ; nor am I at all sanguine in expressing a belief that glaciation had any direct effect in the distribution of the forest areas of the United States. If, however, for Glacial we substitute Champlain times, the case has a different aspect. Both now and in the past, water has been an important, if not the chief, agent in the distribution of trees. The flood-plains of rivers are tree-covered, not because of their gravelly soil, but because running water has scattered the seeds of those same trees over the flood-plains. In the same manner, many of the younger timber-growths of the prairie states may be traced directly to inundations. Not only can the origin of the inundation be determined, but the outlines of the area covered by the flood are equally well defined. Only a few years ago I saw a case in illustration. Between Sos Angeles and San Pedro, California, is a low plain so recently lifted above sea-level that the bones of marine animals caught in the detritus have not yet lost their organic constituents. Excepting the willows along the banks of the Santa Ana River, there was hardly a stick of timber growing in the entire plain. But in the seventies, during an unusually rainy winter, the Santa Ana rose above its banks and inundated an area many square miles in extent. The flood carried with it the seeds of a species of willow unknown in the immediate locality, and in the course of a few years the inundated area was covered with a forest of willow.

Now, the reason that no trees are found in the treeless region of the great central plain of North America is mainly because forestry has never been brought to the plains in question. In other words, water has been the chief agent in the distribution of trees, and the treeless regions are the greater part in regions that have not been disturbed by physiographic agencies. From the southern limit of glaciation to the made lands along the coast of the Gulf of Mexico, the central plain of the United States is the level bed of a Palæozoic sea. Excepting such places where the streams of Champlain times have cut channels through the upper strata, the surface of this vast plain is undisturbed ; it is at once a sedentary soil of Silurian disintegrations and a Quarternary epoch. Throughout much of its extent it is treeless, not because of prairie fires, nor yet of unwholesome conditions of the soil, but from the simple fact that the seeds of forest trees have never been distributed over its surface at fortuitous times. Prairie fires have doubtless had more or less to do with retarding the distribution of forestry ; so also have unwholesome conditions of the soil. Neither condition, however, is sufficiently potent to prevent the *emboisement* of a treeless area ; it is still less able to deforest a timbered area. The hardier species, such as the pines and the oaks, will withstand almost any treatment excepting prolonged drought. They are easily acclimatized ; they are with difficulty extirpated.

Had the treeless regions ever been the habitat either of these or of other species, some traces of their growth would be found in the soil. But nowhere can any evidence of their existence be found. And the reason therefor is plain—the area in question was never timbered.

THE GREAT EARTHQUAKE IN JAPAN.*

THE scene of the great disaster in the autumn of 1891 was the low plain of the twin provinces of Mino and Owari. This flat has the appearance of a basin bounded by mountains, except at its rim on the south, which is open to the Bay of Ise. Lake Biwa is separated from the plain by the meridional ridge of Suzuku, built up of palæozoic formations. The primary strata dip towards the north-west, and their strike is north to south. At the north-west corner of the plain the strike changes to north to east, then east to west, and finally, at the north-east corner of Mino, north-easterly far into the mountainous province of Hida.

The twin provinces are bounded on three sides by masses of mountains, and in their centre lies a monotonous plain inclining slightly towards the foot of the Yoro ridge. The formation of the plain is largely due to sediment deposited by the River Kiso. It is generally supposed to have once been an immense swamp; now it is foremost among the rice-producing districts of Japan, the chief commercial centres being Nagoya, Gifu, and Ogaki. The low-lying tracts experienced the shocks to the greatest degree, not because they were at the epicentre of the earthquake, but because of the sandy nature of the ground—the deposit of the Kisogawa. The deposits of the Rivers Ibi and Nagara are heavier; the western part of the plain is composed of their silt, and that district received but slight damage from the earthquake. The north of Mino is a mountainous region, and the valleys there are not attributable to mere erosive agencies, but to deep-seated dislocations in the Earth's crust.

It was on October 28, 1891, at 6h. 37m. 11s., that the first and by far the worst shock was experienced. In the alluvial plain, especially near Nagoya, the ground was riven with myriads of fissures, small mud volcanoes being thrown up along the Shonagawa. Near Nagoya fractures appeared in the banks of the river, and a bamboo grove slid 60 feet back, the bamboos and trees remaining upright. From Nagoya to Gifu there is a nearly continuous street of 20 miles, and along its whole length every house was overthrown. Gifu, the provincial capital, was for the greater part overthrown; Ogaki, Kasa-

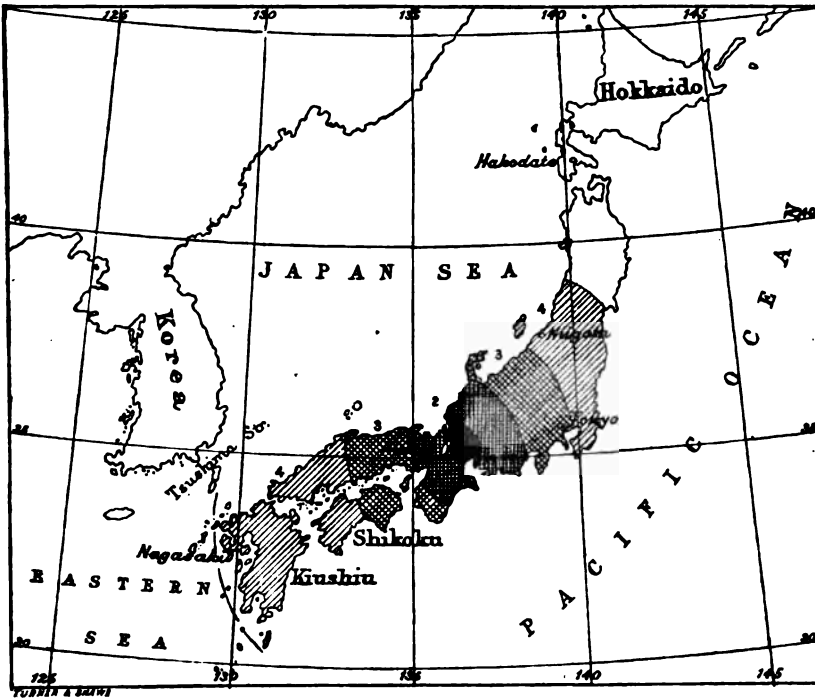
* "The Cause of the Great Earthquake in Central Japan, 1891," by B. Koto, PH.D. Professor of Geology, Imperial University. Reprinted from the Journal of the College of Science, Imperial University of Japan, 1893.

matsu, and Takegahana shared the same fate. Even greater convulsions occurred in the mountainous district of Mino, traversed for 40 miles by a new line of fault, where everything that lay near the great throws of strata was destroyed. The mesoseismic area includes all the plain of Owari and Mino, the mountainous district in the latter, and in Echizen. By the disturbance in October the land became a sea of waves, the movements being greatly magnified in the soft alluvial plain. Here the waves were short and rapid, and overthrew the strongest engineering structures.

The damage was well-nigh complete in the epicentral district, which included Mino and Owari, about 4200 square miles. The seismic area of the second order reached as far as Kobe on the west and Shizuoka on the east, about 18,000 square miles, and here several houses fell, walls, bridges and embankments were damaged. In the seismic area of the third order (20,000 square miles), walls were fissured, crockery fell off shelves and clocks were stopped. In the fourth order of seismic area (50,000 square miles), disturbances were distinctly felt from Sendai in the north to the west coasts of Kyushu. These areas are shown by the degree of shading on the accompanying map, copied from Professor Koto's memoir. The earthquake was in fact felt over 60 per cent. of the surface of the Japanese Empire. From October 28 to the end of March, the number of shocks felt in Gifu was 2588. In Nagoya it was 1495.

On hearing of the disaster Professor Koto at once started for the scene of the earthquake in order to discover any lines of fault that might have been produced. In the Neo Valley, which was said to contain the origin of the earthquake, he found the conditions of things very remarkable. Near Kimbara the sides of the valley had slid into the river, and in the upper dale great parts of the mountain slopes had slipped away. One feature of the earthquake was the formation of a huge earth-*rent*, which cuts across hills and paddy-fields, raising the soft earth into a ridge, like the pathway of a gigantic mole. The old Japanese idea that earthquakes are caused by the burrowing of a gigantic insect might well be suggested by such a phenomenon. This earth-*rent* was traced for more than 40 miles. It starts from the village of Katabira, and runs north-westwards up to Fukui in Echizen, through the Neo Valley. In this region there exist a number of shifted lines of dislocation, stretching from north-west to south-east across the north of Mino. Professor Koto concludes:—"The event of October, 1891, seems to have been a renewed movement upon one of these pre-existing fissures—the Neo Valley line of fault—by which the entire region lying to the right of it not only moved actually downwards, but was shifted horizontally towards the north-west for from 1 to 2 metres along the plane of dislocation. This vertical movement and horizontal shifting seem to me to have been the sole cause of the late catastrophe."

In this great earthquake it has been possible to measure the height and length of the fault. At Midori the flat bed of the valley was split longitudinally and one side was tipped off so that there was an abrupt step measuring 18 to 19½ feet vertically. In tracing the course of the great fault Professor Koto begins with the south end. In Nishi-katabira a hill with a monastery which stood on it has slipped down into a paddy-field, which in turn was sharply cut by a line along which the north-east side had slightly subsided, and had been shifted horizontally towards the north-west for 3 to 4 feet. The action in this case was not a mere vertical throw in inclined beds, for the horizontal shifting can be traced



ISOSEISMAL LINES OF THE GREAT EARTHQUAKE.

in perfectly even ground. The line taking a N.N.W. direction crosses the bed of the Kisogawa, and at Katsuyama some terraced ground was turned over from the very bottom—it appears as if the loose soil had been violently jerked off from the solid crust below. The main line now points N. 10° W., passing through the villages of Osugi and Nishitabara; after a sinuous curve it crosses the Tsubogawa, and then the Nagara-gawa by Toda to Ishiwara. At the town of Takatomi the destruction was complete. Near this place a river-bed was considerably lowered and the sites of two villages were turned into a deep swamp. Some houses on the border of the swamp escaped collapse—a fact which may be due to

a low hill which absorbed the wave motion. The fault line goes right through the village of Toba to Omori, where the whole system of drainage was deranged, thence to Kimbara, where it enters the Neo Valley. Here there was no trace of the road left, and for days after the first great shock, masses of rock fell at intervals from the precipices around. The rent now runs east of Hinata to Midori, and here a large road has been cut in two, the lower end with surrounding fields having sunk about 20 feet below the level of the rest and the east half being pushed about 13 feet northwards. At Itasho the river has become a lake, and at Nagashima the ground was shifted bodily $8\frac{1}{2}$ feet forward. At Nogo the rent strikes away from the Neo and depressing the upper part of the bed of a mountain torrent converts it into a sluggish stream. On a hill to the north the temple of Gongen was overthrown; it was erected in 1673 and its fall proves how exceptionally violent the recent shock has been. The rent proceeds up a side valley to Fujitani. Here the face of nature was entirely changed, and this is supposed to be the source of the earthquake. A hole from 3 to 7 feet in diameter had existed here, said to be of unfathomable depth. Professor Koto believes that the sunken gully at Fujitani is only a prolongation of the rent. The earthquake crosses the ridge of Shijugaradake and enters the Shiratani Valley, which is stripped of its woods and green slopes. Professor Koto was not able to follow the fault line further, but from the reports of others it appears that it continues as far as the city of Fukui in Echizen.

He concludes that the sudden formation of the great fault of Neo was the actual cause of the earthquake. "The backbone of South Japan traverses the boundary between Mino and Echizen in the east-west direction, the prevailing dips being towards the north. A system of parallel, transverse valleys intersects the axis of the mountains, and the Neo Valley is one of these. A sudden falling of the palæozoic strata on the right wing along the line of the fault of Neo, accompanied by lateral shifting toward the north-west, caused the shaking which constituted the catastrophe in Mino, Owari, and Echizen. The effect of the earthquake, or of the faulting which was accompanied by the earthquake, was to modify the topography of the country greatly, rendering existing surveys practically valueless in some cases."

THE CENSUS OF INDIA.*

By C. E. D. BLACK.

THE second general census of India was taken on the night of February 26, 1891, and in every respect was a very remarkable undertaking. It was

* General Report on the Census of India, 1891. By J. A. Baines, Census Commissioner for India. Presented to both Houses of Parliament. Eyre and Spottiswoode (C.—7181).

the heaviest enterprise of the sort ever set on foot, and the vast majority of the total of 287,228,431 persons, were told in less than four hours, while the total cost was at the rate of a little under 15s. per 1000 persons. The results of this huge numbering of the people were primarily recorded in a formidable series of provincial reports; but for those with less avidity for statistics and only moderate time at their disposal, the present general report has been conveniently put together by Mr. Baines, Census Commissioner to the Government of India. But even the summary is bulky, for it runs curiously enough to just over 287 pages, or at the rate of one folio page of printed descriptive text for every million souls. Nevertheless it will well repay perusal, for the author has reviewed the dry statistics of the census returns with a literary deftness and wealth of illustration which might furnish a wholesome example to the compilers of British Blue-books, a class of literature which, in its present form, seems designed to repel rather than attract purchasers.

Books on India seem ever destined to commence with the inevitable geographical description of the Empire, and perhaps this is even more essential in a census report than other works. It is, however, skilfully drawn in the present instance, and serves at all events as a useful preliminary where a statement of the inclusions and omissions from the census returns ranges over an area of such enormous extent and varied form. In semi-civilised tracts like the Shan States and the independent valleys of Baluchistan, detailed enumeration was impossible. Nepal and Bhutan were altogether excluded from the operations, and in the case of Manipur, the northern Burma frontier, the Kakhyen country and part of Rajputana, the registration was more or less informal. It is satisfactory to read that the French authorities gladly co-operated with ours, and ordered a simultaneous census of Pondicherry, Chandernagore, and their other possessions which are *enclaves* within the provinces of Bengal and Madras. Portugal seems to have been disinclined to follow this useful example, perhaps because a census of her possessions had been held as late as 1887. With the inclusion of these additional territories the grand total foots up to 289,187,316 or about one-fifth of the population of the whole world, and the largest appertaining to any single country with the exception of China.

Some striking comparisons are made by Mr. Baines *en passant*. Bengal has a population about equal to that of the United States of America and Mexico put together. But it is even more surprising to learn that the whole population of Brazil, whose area is so enormous, could be accommodated with room to spare in the Central Provinces, one of the smaller and least important of the administrative divisions of India. The mean density of the population of India is 184 per square mile, or rather less than that of France which is 188; but the component parts differ so widely *inter se* that a mean is rather misleading. For instance, in the case of Oudh, the density is 522, while in Kashmir it is

only 31. Closely connected with the question of density is that of the pressure of the population on the land. Herein we find ourselves confronted by serious economic problems hinging on means of sustenance, communication, irrigation and other far-reaching and intricate conditions, admitting of but scanty generalisation in a census review. Nevertheless the views of an expert like Mr. Baines cannot but command attention, and we note with satisfaction that in his opinion the agricultural class (which forms of course the bulk of the population) is not pressing too closely on its means of subsistence except in a few special localities, viz., part of Behar, in a small tract on the Bombay coast, in parts of the Deccan, and in the centre of the Gangetic valley.

One striking point of divergence between India and England lies in the distribution of the urban population. In England, 53 per cent. of the whole population is found in the 182 towns of 20,000 and upwards, but in India, though there are 227 such towns, under 5 per cent. of the population reside in them. To this extent the large town is less attractive in India than with us. It is no surprise to students of statistics to learn that after it was decided to restrict the census inquiry to a return of the inhabited houses only, difficulty arose as to the definition of a house. The variety of structure was so great that a precise definition, such as satisfied census authorities in other parts of the world, became an impossibility in India. In the Hill tracts one meets with collections of leaf-huts that are here to-day and gone to-morrow. Again, there is a portable arrangement of matting and bamboo that is slung on a donkey by the vagrant classes, though sometimes stationary on the outskirts of a village for months together. Then comes the more stable erection for the cultivator while engaged in watching his crops, and so on to the really permanent abode of the lower grades of village menials, with wattle and daub walls which last for years, and a roofing of thatch or palmyra leaves, renewed as necessary, before each rainy season. In some parts of India a considerable space is walled in with a thick hedge of thorn or rattan, and the family expands in separate buildings as the sons marry, but all is considered to be a single "house." Pitched roofs, tiled or thatched are usual in the moister tracts; flat-topped mud or brick buildings are almost universal in the dry plains of the Deccan and Upper India. Climate and the scarcity or plentifulness, as the case may be, of material are the main causes of the diversity of building; while social custom and the relative prevalence of the "joint" or "divided" family life amongst the Brahmanic classes, often determine the interior construction and arrangement.

The increase in population since 1881 amounted to nearly 28,000,000, a number exceeding the whole population of England and nearly equal to that of Italy. The percentage of increase however is 10·96, and the annual rate 9·3 per million, a rate which does not rank high, for in a list of twenty-eight of the chief countries of the world, India comes out only

twentieth in respect of rapidity of increase of population, New South Wales being the highest and France the lowest. The present rate of increase, in Mr. Baines's opinion, is well within the means of subsistence of the people of India.

One of the most interesting chapters is that devoted to the occupations of the people. From a perusal of this an excellent notion of the routine of Indian rural life may be gathered, and the extent to which the people are immediately dependent on the land may be realised from the fact that the landholders and tenants, agricultural and general labourers, graziers, shepherds, and wool and cotton workers account for over 70 per cent. of the population. The ethnological position—another important aspect in the discussion of the returns—is thus summed up. In the extreme north-west the predominating element in the population is a strain from West Central Asia, but received at different times and probably from different sources. Adjoining it, along and across the frontier comes a community of still more western origin, but much mingled with the former. The Himalayan tracts bordering on the plains of the Punjab and North-West Provinces also preserve a considerable element of northern origin but in the same tracts further to the north and east, the population owes its ancestry to the eastern side of Central Asia, which seems to have peopled the whole range along the British frontier and in the eastern section of Upper India, the greater part of the valley also. Across the Ganges basin the predominant element is that of a lower race of darker complexion and different physiognomy, which stretches with few interruptions to the point of the Peninsula and over the north of Ceylon. The strain from West Central Asia, first mentioned, is found in more or less purity in the Punjab. It rapidly deteriorates from admixture with dark blood the farther it gets eastward of the first settlement on the plains, until it meets the north-eastern strain in the Delta. Admixture with the yellow races seems confined to a few submontane tracts along the Central Himalaya, where special influences have been at work, and to the eastern portion of the Delta. The strain of northern blood south of the Central Belt of hills is of the thinnest, and hardly extends into the plains at all. On the west coast, however, specimens may be found in which it is probably pure, and the general average of the dark type throughout the Peninsula has apparently been raised by prosperity and long settled quiet, considerably above the level in which we find it amongst the tribes that have been content to remain in the hills and forest.

The chapters dealing with the distribution of languages and religions are also well worthy of study. In connection with the latter it is noticeable that the Brahmanic followers number 207,000,000, and the Musalman 57,000,000 or 72 and 19 per cent. respectively. But a detailed review of these considerations, important though they be, would land one beyond the geographical scope of a volume which contains, from every point of view, much invaluable information for all interested in India and its people.

THE SIXTH INTERNATIONAL GEOGRAPHICAL CONGRESS, 1895.

At the last International Geographical Congress, held in Bern in 1891, a strong and unanimous desire was expressed that the next Congress should be held in London. In deference to this desire the Council of the Society consented to nominate an independent Organizing Committee to make the necessary arrangements. This Committee has been at work for more than a year. Her Majesty the Queen has graciously consented to be Patron of the Congress, and H.R.H. the Prince of Wales, Vice-Patron. The Honorary Presidents are His Majesty the King of the Belgians, H.R.H. the Duke of York, and H.R.H. the Duke of Connaught. The following are the members of the Organizing Committee: The President and Secretaries of the Royal Geographical Society; Right Hon. Sir George F. Bowen, G.C.M.G., etc.; Colonel Sir Charles W. Wilson, R.E., K.C.B., F.R.S., etc.; General J. T. Walker, C.B., R.E., F.R.S.; Dr. R. N. Cust; E. Delmar Morgan; Halford J. Mackinder, M.A.; Cuthbert E. Peek, F.R.A.S.; J. Y. Buchanan, F.R.S.

The above were nominated by the Society. Besides these the following are representative members: Sir Frederick A. Abel, Bart., C.B., F.R.S., representing the Imperial Institute; Sir Henry Barkly, G.C.M.G., K.C.B., F.R.S., representing the Royal Colonial Institute; Faithful Begg, representing the Royal Scottish Geographical Society; General Sir J. F. D. Donnelly, K.C.B., representing the Society of Arts; and the Rev. T. W. Sharpe, representing the Education Department.

Major Leonard Darwin, M.P., is Chairman of the Organizing Committee, and Mr. J. Scott Keltie and Dr. H. R. Mill, Secretaries (honorary).

Many men of position and eminence at home and abroad have consented to be Honorary Vice-Presidents; the Honorary General Committee is now being formed.

The Organizing Committee have recently issued a circular indicating generally the programme on which they desire the Congress should be conducted. At present we need do no more than reproduce this programme.

The Organizing Committee cordially invite all who take an interest in any of the various aspects of Geography to attend the Congress, and to assist in making it a scientific success.

As the Congress is INTERNATIONAL it is proper that the subjects submitted for consideration should be of wide importance and of permanent interest. The Organizing Committee, assisted by specialists, are now arranging a programme of subjects suited for discussion, and are in communication with geographers of several nationalities.

Communications, intended for the Congress may be made in French, German, Italian, or English.

At present it is only considered necessary to announce the general heads under

which the various subjects to be dealt with at the Congress will be grouped. They are as follows:—

I. Mathematical Geography, including Geodesy. II. Physical Geography, including Oceanography, Climatology, and Geographical Distribution. III. Cartography and Topography. IV. Exploration. V. Descriptive Geography; Orthography of Place-names. VI. The History of Geography. VII. Applied Geography—with special reference to History, Commerce, Colonization, etc. VIII. Education.

At a later period it will be decided to what extent, if at all, the Congress will be divided into groups or sections for the purposes of holding meetings. But in any case business will be so arranged that as far as possible all the subjects for discussion and consideration will be brought before all the Members of the Congress. When necessary, Committees will be appointed to deal with special subjects.

The Organizing Committee reserves to itself the privilege of determining the order and nature of the proceedings on each day.

Geographical problems connected with Colonization will probably be dealt with in some detail at the Congress, and therefore those interested in or connected with the Colonies of all European countries, are specially invited to attend.

The subscription payable by Members is £1, or 25 francs. On payment of 10s. or 12·50 francs, the wives and daughters of Members can obtain all the privileges of membership, except the right to receive copies of any publications which may be distributed to Members.

All communications should be addressed to The Secretary, International Geographical Congress, 1, Savile Row, London, W.

There will be a Geographical Exhibition in connection with the Congress.

MR. ERROL GRAY'S JOURNEY FROM ASSAM TO THE SOURCES OF THE IRAWADI.

WE have been favoured by the Secretary of State for India with a copy of the "Diary of a Journey to the Bor Khamti country and sources of the Irawadi, made by Mr. I. Errol Gray, season 1892-93, from Assam."

Mr. Errol Gray is a tea-planter, who has long resided in Assam, and interested himself in the development of the trade of that country with the adjoining regions beyond the British frontier. His object in making the present journey was to travel from Assam into Western China, through the country which had been first explored by Lieut. Wilcox in 1827, and afterwards by Col. Woodthorpe and Major MacGregor in 1884-85, until he reached the Nam-Kiu river, the western source of the Irawadi, which was the extreme eastern limit of their explorations; he was then to push further eastwards, crossing an utterly unknown region of mountains and valleys, which tend southwards from the eastern extension of the great Himalayan ranges, and which contain within their folds the eastern affluents of the Irawadi, and the Salwin and Mekong rivers. Could this journey have been completed as it was projected, it would have had very important geographical significance, for it would have conclusively shown whether the Lu river of Tibet is the source of the Irawadi or the source of the Salwin river, about which question there is still much doubt.

Mr. Errol Gray travelled with a small unarmed party of natives of the country, Khasias and Khamtis, and was entirely dependent on the friendliness of the

inhabitants of the villages through which he passed for supplies of food and other necessaries. He could not pass through the lands of any tribe without conciliating its chiefs in the first instance. He pushed further eastwards than any of his predecessors, crossing the Nam-Kiu, and getting into the valley of the Tisang river, another important affluent of the Irawadi, as large as the Nam-Kiu. He was then in the vicinity of the Khaku Singphos, with whom he opened communications with a view to passing through their country; but they positively refused their consent, regarding him with great suspicion as an emissary of the British Government, whose power in Burma they were already beginning to dread. Being unarmed, and having no means of forcing his way further, he was compelled to return. But his diary gives much interesting information, which is worthy of record in the Geographical Society's Journal. Some mapping, too, was executed in the course of the journey by two native surveyors, with whom he was supplied for the purpose. It appears to have been chiefly in extension of Col. Woodthorpe's mapping in Sheet 22 of the North-Eastern Frontier (on the scale of 8 miles to the inch), showing parts of the Lakhimpur district, the Singpho-Naga hills, and the Hukong valley; but this new mapping does not yet appear to have been published.

Mr. Gray started from Saikwa—opposite Sadiya, on the Lohit Brahmapatra in Upper Assam—on November 24, 1892, with the intention of taking the direct route to the Bor Khamti country, which follows the course of the Dehing river to its source, and then crosses the range of mountains which separates Assam and Burma by the Chaukang pass. This route is somewhat formidable. It has to be traversed wholly on foot, and, as there is no road practicable for laden animals, all the camp equipage has to be carried by men; the villages to be met with are few and small, and often so far apart that a supply of food for many days is sometimes an essential item of the equipment. The route frequently crosses rivers, and is sometimes closed for days when these rivers are in flood. It passes through great forests, where the traveller has often to cut a way for himself through the dense jungle, and thinks himself fortunate when he comes across a glade opened out for him by the passage of a troop of wild elephants. Mr. Gray's journal is a record of great hardships patiently endured, and difficulties constantly met with and successfully overcome in his five months' journeyings to and fro. He says, "The journey is a difficult one and not likely to tempt many travellers; the Khamtis have a saying that a man was an old man who had journeyed to Assam three years consecutively, because of the difficult nature of the path and the privations endured *en route*."

The first village met with outside British territory was Borria-pothar, on the left bank of the Dehing, under a Singpho chief, Ningro Samon, who receives a small salary from our government for acting as political jemadar on this frontier. He supplied a couple of boats to cross the party over the river, one of which was rather crank and nearly upset by the ignorance of the Khassia carriers, who were very ignorant of anything about boats, and overbalanced the crank craft by all leaning over to one side. Ningro Samon calls himself a rajah, and has considerable influence over his people; but his dress did not differ in any way from theirs, either in material or cleanliness. The porch of his house was between two and three hundred feet in length, supported on posts, on all of which a number of buffalo heads were suspended, which were said to be the heads of animals sacrificed to the Singpho deities, and not trophies of the chase. He is reported to be wealthy—that is for a Singpho, with whom ready cash is generally a rare commodity, their riches consisting in slaves and copper gongs.

At Khagam, the next village of importance, it was found necessary to give the two headmen a present of half a seer of opium each, and a quarter seer each to the two "kobokis" (an Assamese term signifying interpreter), men retained by the chiefs.

of villages to mediate in quarrels and settle disputes ; they are generally chosen for their controversial powers, and, having considerable influence, it would be possible for them, unless bought over, to prove obstructive in a variety of ways. It is impossible to get through the Singpho villages without making presents at each of them, for unless this is done the villagers are not allowed to sell the traveller any rice, fowls, eggs, or other necessaries, so that he has no option but to give presents.

At the next village, Bishi, Mr. Gray had a long conversation with the chief, who told him that his ancestors had come there from the Khaku country, east of the Nam-Kiu, with the idea of preying on the Assamese, whose villages they used to raid, seize the people, and sell them into slavery in the Khaku country. But since the British administration of Assam this trade had altogether ceased, and there was no longer any reason for remaining there except long association. Mr. Gray advised him to go down and settle in British territory, where there were facilities of various kinds, instead of staying where there was no market to buy or sell, and where the commonest necessaries of life were obtained at much trouble. He seemed afraid of taxation and a loss of the freedom of his present unconventional life, and seemed surprised to learn that taxation in moderation is good for people, and that the taxed subjects of the British Government in Assam were vastly better off in the comforts of life than himself.

At Bishi an old woman broke through the crowd around Mr. Gray's tent, shouting in Assamese, "Make way for an old slave woman who has come to see the sahib." Though she was dressed in Singpho costume and wizened with age, her features were unmistakably Assamese, but her accent had lost its original purity. Forty years ago, when she was a young child, her village was raided by the Singphos, and all her people taken into slavery in the Khaku country. She had managed to retain a knowledge of her mother-tongue, and long years had not effaced the bitterness of her bondage, and the remembrance of her former freedom made her burst into tears. But she did not wish to be released ; at her age where should she go to, and what should she do ?

The Singphos are great opium-eaters ; they grow their own opium, every village having a certain amount of poppy cultivation. The women of the better classes have their legs, from the knee downwards, tattooed in parallel bars ; other women are without mark of any kind. Men do not tattoo, except very slightly, and then only on the arm or shoulder. The dress of the men is a cloth worn like a kilt, and a short jacket ; they tie the hair in a knot on the top of the head, round which they wind a short turban. The jackets are of cotton dyed blue ; the kilt and turban of the same material, but different colour, always in checks. They carry their "dhas" (a short sword two feet long) in a wooden scabbard slung round the neck, and wear them continually, the "dha" lying under the left arm. The women wear a cloth resembling the Assamese "mekela" in shape ; it is in one piece, and reaches from the breast to a little below the knee. Maidens invariably cover their breasts, but after marriage, and the birth of a child or two, the cloth is as frequently tied round the waist as over the breasts. These clothes are of a dark blue colour, with parallel bars of red at intervals running horizontally. The women wear large pieces of amber in their ears ; the men occasionally small earrings, more often nothing. Though not a handsome race, many of the men have fine physique. The women are decidedly plain, and soon age owing to the hard work they do, the bulk of the labour falling on their shoulders, even to the cutting and carrying in of firewood.

The country is dense forest absolutely without break excepting where a stream has cut its way. In travelling along the paths, one has no idea of being close to a habitation until he stumbles up right against it. The Singphos here grow very few dry crops ; the "sali" rice on irrigated land is what they chiefly depend on. The

land being high, the streams do not rise sufficiently to flood it; consequently the people dam up the streams and make conduits to their fields to irrigate them. The soil does not appear to be rich, being sandy in character; yet the crops are good, grain being heavy and straw light. All ploughing is done by female buffaloes, the males being killed off for the various sacrificial offerings given by the Singphos to their deities. A few cattle are to be seen in the villages, but they are only utilized for killing and eating; neither cows nor buffaloes are milked, Singphos not drinking milk in any form. As a race the Singphos are extremely superstitious, and have numerous "nats" and spirits which they are constantly propitiating by sacrifices of various kinds. Every petty ailment is ascribed to the influence of some evil spirit, which has to be propitiated before the sick person can recover. Buffaloes, cows, pigs, fowls, and even dogs are used in their sacrifices.

In features the Singphos have little of the Mongolian type, and in this respect differ both from the Khamtis and the Burmese, who are their neighbours to the north and south. Their language is also entirely distinct; it has no written character, and appears to be easily learnt. It has not the harsh guttural sound of the Khamti, but, on the contrary, is not unpleasant to the ear, there being much alliteration of dentals and labials. The Singpho men have a particularly loud and haughty way of speaking. It is the reverse with the women; their accents are mild and gentle, and their address to strangers extremely civil and agreeable. This difference in the manner of expression is very noticeable.

The Singphos deal largely in slaves, the wealthy among them possessing large numbers; but they do not ill treat them, and the slaves appeared to have no harder time than the other members of the family. They all eat together, work together, and sleep together, and to an outsider there is nothing to show social inferiority.

In travelling onwards, halts had to be made at the principal villages in order to secure a sufficiency of food for the party while passing over the tract without villages. Mr. Gray left Khomang, the last and highest village in the Dehing valley, on the 6th of January, and working up the valley crossed the Chaukang pass, 8300 feet above sea-level, on the 12th of January, travelled for three days over a region which a heavy snowfall renders impracticable, and then descending the Phangma valley for some distance and crossing various hill-ranges, he reached, on the 17th of January, the two Langnu villages, which are situated a few miles to the west of the Nam-Kiu river, and are of much importance.

Mr. Gray had an audience with the Langnu rajah, whose village was surrounded by a double palisade, from 12 to 14 feet high, of split trees roughly hewn to the shape of planks and interlaced with bamboo plinths; it did not appear very strong, but doubtless answered the purpose for which it is erected—to stave off a sudden rush of an enemy in the dark. From the entrance of the gateway to the rajah's house there was a continuous one-plank bridge, raised about a foot above the ground, to avoid soiling the feet in the mud and dirt. The houses were large commodious structures built on piles 4 to 5 feet above the level of the ground, and far superior to the buildings of either Khamtis or Singphos in the villages on the Assam frontier. The rajah's house did not differ materially from the others, but was larger and more solid looking, and built on higher piles. The approach to the audience-chamber was up a very massive flight of stairs made of squared logs; the chamber was a room about 40 by 50 feet in size, with a half-dome-shaped roof; it had two large fireplaces, in both of which fires were burning. Opposite the door the rajah's throne was situated, in an enclosure which was entered by a narrow gate, on either side of which were stands containing guns, spears, swords, and other warlike paraphernalia. The throne was merely a raised dais covered over with a rug, on which the figure of a tiger was embroidered. While Mr. Gray was taking

his place, a large Burmese gong was sounding with monstrous regularity ; it ceased when he was seated, and presently Chownoi Chowsai, the rajah's brother, entered. He was dressed in a Chinese coat of black silk, very full in the sleeves, and a kilt of red silk reaching a little below the knee. In his mouth was a long pipe, at least 3 feet in length, with a metal bowl, a bamboo stem, and silver mouthpiece. He was immediately followed by the rajah himself, dressed in a very similar fashion, his Chinese coat being of a blue colour instead of black, and his kilt a silk tartan ; his pipe was somewhat longer than his brother's. Mr. Gray opened the conversation (through an interpreter) by stating that he was on his way to the Chinese frontier, and wished for assistance to get there. The rajah replied in a long speech, intimating suspicions of Mr. Gray's party being merely the advance guard of a larger party to follow in a few days, and raising various objections, and eventually declaring that "in this part of the world friendships could not be formed by mere words ; it was customary in contracting such bonds to give a more practical proof of sincerity in the shape of gifts to both chiefs and people." Mr. Gray promised to do so, and then opened the question of the Singpho country, and asked if it was possible to get through to the Chinese frontier. The rajah replied that it was a very difficult undertaking, and in his opinion impossible, as the Khakus were a very wild lot. The Khamtis themselves were afraid of them, and did not go more than four days' journey into their hills. They were very numerous ; each village had its own headman and was independent of any other, and all would demand tribute. If Mr. Gray was prepared to spend large sums he might get what he wanted, but if it was known that he was in possession of much money among such a lawless people as the Khakus, he could scarcely escape being robbed. There was a powerful Khaku chief, named Alang Chowtong, living four days' journey to the south, whose consent it would be absolutely necessary to obtain before attempting to enter the country. Beyond him were numerous other powerful chiefs who would have to be conciliated, but it was imperative that this man should be made friendly to begin with. The Khakus were divided into numerous clans, and the further east you went the more the language changed, until, in the east of the Phungmai (the eastern branch of the Irawadi), the language was quite distinct and so were the people.

Mr. Gray tried to induce the Singpho guides, who had accompanied him from Assam, to take his messages and presents to Alang Chowtong, the Khaku chief ; but they would not, fearing to be murdered for having guided him into the country. So he asked the rajah's brother to do this, and he consented, though somewhat reluctantly.

While waiting for an answer, Mr. Gray went a day's journey to the north of Langnu, to the village of Putu (Woodthorpe's Padao), to visit the Lukkun rajah, who is the chief rajah in Khamti. Arriving at the village late in the evening, he was for a while unable to get any firewood, until he brought out some opium to barter for it ; in a few minutes this produced a pile of wood sufficient to last for several days, and people came pouring in with supplies of all kinds to barter for opium.

Here it was very cold of a night and in the morning (January 21), and a dense fog hung over the valley till near midday, when a very fine view was obtained. "Whichever way one looks one sees nothing but hills, hills, hills ; we can see snows to the west, snows to the north, and snows to the east. The only open country is to the south, down the valley of the Nam-Kiu ; but the hills are still there, only they are not so high, and recede slightly from the river on each side. All these hills, up to an elevation of 4000 feet, are dotted with the cultivations of the hill tribes—the Khunnongs to the west, north, and north-east, and the Tureng or Duleng Singphos to the east and south-east."

Mr. Gray had an audience with the Lukkun rajah, who was dressed in the usual loose silk Chinese coat and a pink-coloured kilt of the same material. He advised him not to enter the Khaku country, and pointed to his own villages, which were strongly stockaded, with houses packed closely together, for protection against the Khakus. He had no influence over them, but his authority extended over the Khunnongs, who inhabited the Tisang valley beyond the Nam-Kiu, which no white man had yet entered. Mr. Gray might go where he pleased over the country subject to his authority, and might make maps of it; but he could give him no protection beyond, and strongly dissuaded him from attempting to go further.

In a very few days Mr. Gray found he had no alternative but to act in accordance with the advice of the Lukkun rajah, for Alang Chowtong, the Khaku chief, to whom he had sent presents and asked for permission to travel through his country, returned the presents, with an intimation that "he was not wanted there, that his coming would please neither the chief nor his people, that their fathers and forefathers had lived without accepting the white man's presents, and that they too could similarly do without them."

Though unsuccessful in the primary object of his journey, Mr. Gray remained for upwards of two months in the Khamti country, exploring it in various directions, and meeting with much friendliness from the villagers, which was doubtless owing in some measure to his liberal payments for all he received. He found that the Khamtis were generally very much afraid of their neighbours the Singphos, who are a hardier race, and constantly marauding in their country. Dwelling with the Khamtis were people of other tribes—Nogmungs and Pansus—who had sought protection among them, and fled from their own country because of the oppression of the Singphos, "who constantly bullied them and took their people into slavery." At one village, Lunkieng, the headman expressed a wish to go to Assam with his whole village, provided Mr. Gray would take them under his protection, otherwise they dare not go for fear of the Singphos.

At Manchi, a village visited by Wilcox in 1827, Mr. Gray saw a very massive and heavy four-wheeled cart, the wheels cut solid out of great tree-trunks, lying apparently discarded in the open. He was informed that the cart had been constructed for the funeral obsequies of the late rajah, whose body was placed on it, and a "tug of war" was played over the dead body, all the males of the village seizing a rope attached to one end of the cart, whilst the females seized a rope attached to the other end, each party striving to move the cart in its own direction; a curious custom.

Some people were met with of the Maru tribe settled on the borders of China, twenty-one days' march from Putou; for the first eight marches the right bank of the Nam-Kiu is followed, then the river is crossed, and in seven marches the Phungmai Kha (eastern branch of the Irawadi) is reached. Three marches further the Lashi country is entered, whence Chinese territory is distant three marches to the east, and the Maru country three marches to the north. The road is circuitous, because the direct line is barred by a high range of snow-clad mountains separating the eastern and western branches of the Irawadi.

Every Khamti village has a large extent of poppy cultivation, generally in its immediate vicinity; very few Khamtis are abstainers from this drug. About the middle of February the capsules, of which there are three or four to a plant, begin to ripen; a small incision is now made with a sharp knife in each capsule, and the sap oozing out is wiped off on a piece of clean cloth; the following day the plant is given a rest, and on the third day another incision is made, and the sap wiped off as before, and this process is continued every other day until the capsule is exhausted. The cloth is carefully set aside in long strips, about three inches wide,

until required; then a small piece is cut off and steeped in tepid water, which extracts all the drug, and has an intoxicating effect. For smoking purposes the water is boiled away until a viscid residue remains; this is mixed with finely cut plantain leaves dried to crispness at a fire, and the mixture is made up into little pellets, which are put into a pipe one at a time, and being set alight, smoke is inhaled into the lungs and expelled through the nostrils; the smoke is passed through water before it is inhaled, on the principle of the Indian hubble-bubble. It requires a greater amount of the drug to intoxicate when smoked than when taken in the liquid form.

There is little unity among the Khamtis. They are split up into clans, each caring only for itself. If one village is raided by the Singphos, the neighbouring villages will not help to defend it. The Lukkun rajah, though nominally the ruler of the valley, has practically little authority outside his own community. Yet in grave matters his opinion is looked for, and his decision is regarded as final. He is greatly respected by his people because of his extreme piety; he spends a great portion of each day in religious duties, and neither eats flesh of animal or bird, nor permits any blood to be shed by members of his own household. He is an old man now, and on his death there is certain to be trouble in Khamti-land.

The Khaku country is said to be fairly well populated, seven or eight villages being sometimes met with in a day's march; they usually contain twelve to twenty, but sometimes as many as a hundred houses. Each village has its own headman, but occasionally a chief or "dhu" is met with who exercises a certain amount of control over his neighbours. As a race the Singphos are extremely treacherous; they are in a constant state of feud one tribe with another, and revenge is an heirloom handed down from generation to generation. Assassination is a trade, and the assassin will treacherously become the guest of the man he is to murder, and while eating his salt take the first opportunity offered to execute his object. Suspicious of strangers, they show great distrust of one another. Two Singphos meeting in a narrow path, one will not allow the other to pass him to the right, as this affords either party a facility of drawing his "dha" (which is carried in a wooden sheath under the left arm) and attacking with a backward stroke as he passes, the drawing of the sword and the cut being effected in one motion; whilst if they pass one another to the left, there is less chance of either party being taken at disadvantage, as now two distinct motions are necessary to make the cut—first the drawing of the sword, and secondly the stroke in a contrary direction to the draw.

A curious fact was noticed in the valley of the Nam-Kiu: to the east of the river creepers twined round trees from right to left, while to the west the twining was in the opposite direction.

Mr. Gray crossed the Nam-Kiu river and made his way into the valley of the Tisang river, which is somewhat larger, and also has its sources in the mountains of Tibet, which form the southern boundary of the valley of the Lohit Brahmaputra. He wandered about with his surveyors, making a point of getting up to the summits of the peaks, from which good views of the surrounding country could be obtained, and has thus obtained valuable additions to our knowledge of the topography of the country.

Buddhist temples were met with on the Nam-Kiu river. One at Kongmulung was a brick building 95 feet high, 125 feet in circumference at base, with a gilded cupola at its summit 18 feet in circumference. All the dimensions, and the dates of commencement and completion, are written in an arched vault inside the temple. A basement raised 4 feet above the level of the ground, surrounds the temple, and there are four flights of steps leading up to it, each guarded by gigantic figures of fabulous beings. There are four niches or vaults in the temple, each containing an image of Buddha, one of which was carved out of a solid block of marble, and

showed excellent workmanship, the god being in a sitting posture with legs crossed, and about 4 feet in height ; the dais or pedestal on which the god is seated is a very gaudy piece of art, resplendent with stones, mirrors, and gold plastering. The temple was built by the present Lukkun rajah, and took fifteen years to complete.

On the 27th of March, Mr. Gray commenced his return journey, first calling on the Lukkun rajah to say farewell, and thank him for his hospitality. He is an extremely large-minded man, totally devoid of petty prejudices ; his piety is without question, and not only makes him slow to take offence, but merciful when offended. He said he was very pleased at Mr. Gray's visit, and did not mind informing him that he had formed a great friendship for him. It could not have been a mere matter of chance that had brought Mr. Gray so many thousand miles of land and water to enter into friendly relations with him ; they must have met in a former life, and been intimate there. This was the only explanation of their meeting now, and also for the great pleasure he derived from it. Friends in one existence would be friends in another, though it was not necessary that both should have the same form, for one might be a wild animal and the other a human being ; and if in a previous existence two beings in human shape had been on friendly terms, they would still remain so. He then went on to say that he was an old man now, and must soon pass away ; he now spent most of his time in religious duties, and there were three things he wished to accomplish before he closed his eyes for ever. The first was to build a temple on the Noichenam hill, and plaster it entirely with gold-leaf ; the second, to raise a pillar in front of the large temple at Kongmulung as high as the temple itself, and on its summit to place the gold image of a duck, the Buddhist god being said to have assumed this image in one of his existences ; the third was to connect Putou with Langtao by a raised road throughout. When he had accomplished these three tasks he would be ready to go to his grave ; his coffin he had already prepared, and was then sitting on ; it was an oblong box, elaborately ornamented, studded with small coins, coloured beads, and diamond-shaped mirrors, and profusely gilt.

Mr. Gray reached Sadiya on the 23rd of April, the return journey being performed very much more rapidly than the outward journey, though with much privation and many difficulties. His party consisted of fifty men, of whom one had died at Bishi on the outward journey ; the others all returned in good health, and none the worse for the journey, which was a piece of great good fortune, considering the nature of the country traversed and the privations which they had all endured.

MOUNTAINS.

By DOUGLAS W. FRESHFIELD.

THE Lectures to Young People, instituted by the Council, were given according to announcement on the 6th, 9th, and 11th of January at the Hall, 20, Hanover Square, by Mr. Douglas W. Freshfield, Secretary R. G. S., and President of the Alpine Club.

The subject "Mountains" was divided into three sections: (1) The structure and features of mountains, and of snow-mountains in particular. (2) The discovery of the High Alps. (3) The exploration of the Caucasus.

The following is a partial summary of the three lectures:—

The Royal Geographical Society exists not only for the discovery of unknown lands and the promotion of scientific research; it is also part of the duty it owes to the country to see that all useful geographical knowledge is disseminated as widely as possible, and that geography as a science holds its proper place in national education. Owing to the misconception of the subject in teachers' minds, it had long failed to do so, and the first steps taken by the Society were comparative failures. In the lecturer's schooldays, strings of names of capes, islands, and provinces were forced on the memory of boys. Geography was a mere "saying-lesson." So acute a critic as the late Dr. Jowett had asked the Society's delegates at Oxford, "Is Geography a study by which you can teach a man to think?" Certainly it was; modern geography not only supplied a vivid picture of the Earth's surface, but showed how each of its features, navigable seas, dissociating oceans, rivers, mountains, climate, influence human communities, and man as an individual.

Mountains were among the features of the Earth most conspicuous to human eyes, and most important in their influence on human history. They might be mere wrinkles on the face of the globe, but "These little things are great to little man." "How were mountains made?" was a question natural for an intelligent child to ask, but one which men of science still hesitated in answering.

Great ranges were now generally allowed to be wrinkles caused by the gradual contraction of the globe in past ages along lines of weakness in the Earth's crust. Deep-lying rocks, such as granite, had been forced up by pressure, and the overlying sedimentary rocks, limestone and others, thrown back and contorted on either hand. A great mountain range was not, as sometimes depicted on maps, a narrow line or a caterpillar-like object, but a broad uplifted tract, where the crust had been squeezed into parallel ridges and hollows, each ridge being found on close inspection to be formed (like a watch-chain) of a succession of imperfect circles or horseshoe-shaped groups. Tension acting at right angles to the forces of upheaval often split the central chain, as in the gorges of the St. Gothard, and the rivers enlarged such clefts. Water carved everywhere deep into the mountain-sides, ice rubbed off their asperities. Atmospheric influences attacked the summits and slopes. The great peaks were all more or less ruins. Every winter, every summer-night frost entered into the rocks, caught hold of the moisture contained in them, swelled it by freezing and split the crags; every spring the streams, swollen by snow-meltings, swept down with them tons of soil to form fan-slopes and deltas in the hollows of the hills.

Snow-mountains were those which rose above the level at which more snow falls than melts in the course of the year. This surplus snow was got rid of mainly in two ways: where the slopes were steep enough, by snow-slides or avalanches; where they were comparatively gentle, by the gradual overflowing of the upper reservoirs in the streams of frozen stuff known as glaciers.

The lecturer proceeded to describe the chief phenomena of glaciers from their source to their end among the earth-heaps or moraines that rise like railroad embankments among the orchards and cornfields of Savoyard valleys. Whence did such mounds come? Was their material excavated by the moving ice, or did the glacier serve as a sledge to transport the rocks and rubbish that fell from the peaks and ridges that surrounded its cradle? The matter was one capable of direct observation. It was not the largest glaciers that had the greatest moraines, but rather those that lay under lofty ridges, and particularly those where the surrounding rocks were specially susceptible to disintegration by weather. He agreed with such competent observers as the late Mr. John Ball, Professor Bonney, Mr. William Mathews, and Sir William Dawson, who, from close and frequent study, regarded

glaciers as polishers rather than diggers, and drew a distinction between abrasion and erosion. The formation of lake basins could be accounted for without the agency of ice. In fact, lake basins did not occur where they ought to, if Sir Andrew Ramsay's theory were correct. Alpine tarns often occupied basins which had been preserved by a frozen covering from being filled up by the action of torrents. Professor Heim, of Zurich, whose important works had not been enough studied in this country, had laid down that "glaciation was equivalent to the relative cessation of valley formation." Snow and ice protected the ground they covered from disintegration by weather and floods. At the same time, sub-glacial torrents performed singular feats in cutting deep and narrow rock channels, and thus contributed to the soil they carried. The colour of their water was, however, mainly due to the fineness of the particles of the mud derived from the mutual grinding of the boulders subjected to the glacier mill. In winter the water that flowed out of a glacier was clear. It was not supplied, as had been supposed, by the continual melting of the ice, but was the issue of deep-seated springs in the glacier's bed. Among the slides shown in illustration of the lecture were some very remarkable views taken by the late Mr. W. F. Donkin and Mr. Holmes among the tops of the Chamoinix Aiguilles; and some beautiful representations of the winter aspect of the Alps, lent by Captain Abney, F.R.S., and Mr. Clinton Dent.

In his second lecture Mr. Freshfield dealt with the relations between men and mountains, chiefly as illustrated by Alpine history and literature.

The Roman poets, Virgil, Horace, and Ovid, showed a thorough appreciation of the scenery of the Apennines and the Italian lakes. They had an affinity for wild scenery, but in the case of the High Alps, juxtaposition was wanting. They never were brought into permanent contact with them. The object of the Roman in the Alps, as of the Russian to-day in the Caucasus, was not to live among the mountains, but to get over them. Possibly, had the *Pax Romana* endured, the amenities of the High Alps might have been discovered earlier. But the invasion of the barbarians on the north, followed by the incursions of the Saracens on the south, utterly checked any such tendency.

In the ninth and tenth centuries the Moors, starting from their lair at Garde Freycinet, on the coast west of Fréjus, haunted all the western passes. Every forest became full of terror, and every rock hid a robber to the unhappy traveller whom piety or business drew to Rome.

The terrors of the Alps to our early English pilgrims were very great. It should be borne in mind that, in order to be at Rome by Easter, they frequently crossed the passes at the very worst season. The St. Bernard, the Mount of Jove, was their ordinary route. A scribe in the reign of Athelstan invented, as a curse on any one who should break the terms of his charters, the following formula: "May he be tortured by the bitter blasts of glaciers and the Pennine army of evil spirits." The great baths took people to the Alps in the Middle Ages. Pfäfers was discovered A.D. 1242. Its waters were said to be good for those who had been tortured, and its frequenters were described in the fifteenth century as very dissipated. Leukerbad was established by a Bishop of Sion in 1501. But the founders of the modern love of the Alps were men of science. Amongst them Leonardo da Vinci and Conrad Gesner were pre-eminent. Leonardo was in thought and method a modern—a Baconian. He was insatiable in the investigation of nature. His notebooks and sketches proved his interest both as a physiographer in the structure of mountains and as an artist in the atmospheric effects seen among them. Gesner (1516–85) was known as a botanist, a lexicographer, and a humanist. His ascent of Pilatus was a turning-point in the exploration of the Alps. From that time down to the middle of the last century there had been a continuous succession of

Swiss *savants* engaged in mountain research. In 1669 and 1673 the first communications were made to the Royal Society with regard to glaciers by Swiss correspondents. In 1686 Bishop Burnet spoke of Mont Blanc as "a mountain called Cursed" said to be two miles in perpendicular height. In 1709 his son gave a fuller account of the Grindelwald glaciers to Sir Hans Sloane. About the same time Scheuchzer published a great book on the wonders of the Alps, including their dragons, under the patronage of Sir Isaac Newton. Gruner in 1760 published what was the standard work on glaciers, until it was superseded by De Saussure's "Voyages." But as yet there was no "fashion of visiting the glaciers." Mrs. Thrale compared the Mont Cenis to Derbyshire, Lady Mary Wortley Montagu compared the scenery of Lago d'Isco to Tunbridge Wells. The return to nature in the eighteenth century, which found a voice in Rousseau, was directed to the High Alps by De Saussure, whose ascent of Mont Blanc and scientific publications attracted the attention of Europe. In a less degree De Saussure's predecessors at Chamonix, the first British tourists Poocke and Windham, and the worthy but ponderous Archdeacon Coxe, attracted visitors to the glaciers. De Saussure's followers at Geneva, Bourrit, Bordier, and De Luc, kept up the general and scientific interest in the new wonders of nature. In Graubünden Placidus à Spescha, a monk of Dissentis, spent a lifetime in mountain exploration. The poets, Byron and Scott in particular, taught and spread the taste for wild scenery. Professors J. D. Forbes and Agassiz and Herr Studer opened the peaks, passes, and glaciers by their Oberland excursions about 1840. Railways brought the Alps within the reach of summer holiday-makers. Albert Smith and John Tyndall in their very different lines popularized Switzerland and created an interest in Alpine phenomena by their lectures. Mr. Ruskin described the beauties of the Alps in prose of unsurpassable truth and eloquence. With such influences in its favour, the little snowball, set rolling when, in 1857, a few friends in a room in Lincoln's-inn called themselves the Alpine Club, had grown beyond all the expectations of its founders.

The Alps in the last half-century had been explored, mapped, and climbed. They had been conquered from Nature and annexed to the domain of humanity and of science. An observatory had even been erected on the top of Mont Blanc.

The lecture was illustrated by many slides, including some curious facsimiles of illustrations to old Alpine works, and some graphic representations of mountaineering incidents and perils by Mr. H. G. Willink.

The subject of the concluding lecture was the exploration of the Caucasus during the last quarter of a century. Mr. Freshfield gave some account of the inhabitants of the mountains and of the physical characteristics of the Caucasus and its glaciers as compared with those of the Alps. Eleven of the Caucasian peaks were higher than Mont Blanc, and, owing to the excessive snowfall, more snow and ice clung to the range. There was no glacier as long as the Aletsch, in Switzerland, but there were many greater than the Gorner. The flower and forest regions were of extraordinary beauty. Where pastures would be found in the Alps, in the Caucasus the traveller waded in virgin fields of flowers; lilies, primulas, ranunculuses, and wild roses blossomed up to the edge of the moraines. The hillsides were bright with the creamy heads of the rhododendron, the woodland with the golden masses of the azalea. In the glades the herbage was often high enough to conceal a laden horse. The characteristic charm of Caucasian scenery lay in the close conjunction of mountain splendour with sylvan beauty. This was best seen perhaps in Suanetia, the upper valley of the Ingur, a Caucasian Val d'Aosta, only accessible to animals by a pass higher than the Great St. Bernard, and closed for eight months in the year. Now the country was perfectly safe, and Englishmen, with the friendly help of the Russian officials, which had been uniformly extended to them, wandered where they pleased.

He had on his last visit, in 1889, been able to pass even through the wilds of Abkhasia, where his party wandered for a week without seeing a human habitation, except a hut in the heart of the pathless forests inhabited by individuals who had good reasons for temporary retirement from the world, but were very friendly to the travellers. The result of the labours of Russian cartographers and Alpine clubmen had been that the central part of the chain was now adequately mapped and described. The new one-verst map of the Caucasus, undertaken under the superintendence of the late General Shdanof, would be, when completed, one of the most remarkable specimens of mountain cartography. The lecturer, after giving some account of his own adventures in his three Caucasian journeys, said he trusted he had shown that a knowledge of mountains was essential to any complete geography. Such knowledge could be obtained only by means of mountain-craft, which was as much a result of experience and skill as seamanship. In the mountains many branches of physical science could be followed up. They served as a playground for the strong, and a health-resort for the weak and jaded. On the heights men found refreshment from the turmoil of cities and daily life.

The lecture was illustrated by numerous slides from photographs taken by Signor Vittorio Sella, M. de Déchy, Mr. Donkin, and other members of the Alpine Club, illustrative of Caucasian scenery, people, and architecture, as well as by a very large map of the chain, showing the results of recent surveys and explorations.

THE MONTHLY RECORD.

THE SOCIETY.

Supplementary Papers—New Series.—The first four volumes of the Supplementary Papers having been completed, it has been resolved by the Council to issue those memoirs and narratives which are too long for publication in the *Geographical Journal*, in a somewhat different and more tasteful form. Each paper will, as a rule, be issued as a separate book, in a smaller octavo than the Supplementary Papers. These separate publications of the Society will be published in two forms—in a paper cover, and also in a strong and handsome half-calf binding; for the latter a small charge will be made to Fellows to cover the cost of binding. The first volume is now ready—"The Topography of the Battle of Plataea," by G. B. Grundy, B.A.

EUROPE.

The Tidal Wave in the Wye and Severn.—Mr. H. C. Moore has recently issued a small pamphlet, dealing with the height of the tidal wave in the river Wye. According to recent measurements, 46 feet may be taken as the rise of the highest spring tides in the Wye at Chepstow. After giving a series of measurements of the Bristol Channel, Mr. Moore goes on to explain the cause and course of this gigantic tidal wave as follows: "It will be observed, from the configuration of the channel, that a large volume of the tidal wave must be deflected from its much longer southern side by currents impinging upon its northern coast, and if measured in a direct line along the shorter northern shores, the tidal wave has, in the distance of 120 miles, become narrowed from 100 miles to less than two miles, or to a width of but little more than half a mile at the mouth of the Wye. The

rocks at Aust on the southern side of the channel and the rocks at Beachley Point protrude far into the Severn, by their obstruction deflecting the current and impelling the flow with increased velocity up the Wye. The numerous horseshoe bends of the first ten miles, and the contraction near Chepstow to a width of little more than a hundred yards, all tend to retard its progress and to raise the waters into a heap, thus accounting for the very high tidal wave at Chepstow." In sweeping up the river Severn, the tidal wave creates at spring tides the well-known "bore." The height of the bore varies with the lunar phase, and also with the width of the river, running up at Newnham, where the river is about one mile wide, as a wave 6 feet high, and on some occasions very much higher. It is increased in size if a south-west wind be blowing in the direction of the channel currents. In some places the first wave is succeeded by a second, and even by a third bore. The tidal wave of the Wye is considered as next in height to that of the Bay of Fundy, in Nova Scotia.

The Sonnblick Observatory.—We are glad to learn from our Vienna correspondent, Dr. Peucker, that the financial difficulties which for some time threatened the existence of this observatory have been cleared away, thanks to the help afforded to the Austrian Meteorological Society and the German-Austrian Alpine Club at the critical moment by the "Sonnblick-Verein." The report of the Sonnblick Verein contains an interesting review, from the pen of Dr. Hann, of the work of the Observatory since its foundation in 1886. The mean pressure at the summit (10,170 feet above sea-level) is 20·457 inches, with an annual range of 1·31 inch, the maximum occurring in summer and the minimum in winter. February is the coldest month, with a mean temperature of 8°·6 Fahr., corresponding to the winter extreme of Central Canada. The lowest actual temperatures are associated with northerly wind and low barometer, with which the mean depression reaches—19°·8 Fahr., and these minima are most frequent during March. The temperature during the two warmest months averages 33°·3 Fahr., and the total period during which it exceeds the freezing point sixty-six days (June 27 to September 1)—a week less than is found in Northern Greenland. The mean for the year is 19°·6 Fahr., a temperature remarkable as being identical with that estimated for the summit of Chimborazo (21,000 feet). Dr. Hann draws an interesting comparison between the temperature curves of the Sonnblick and of Ben Nevis Observatory. On the Sonnblick the fall of temperature in the latter half of June, well marked over Central Europe, forms the chief irregularity in the annual march of temperature; while on Ben Nevis the averages for the same period show a sudden rise of temperature in the middle of June. High barometer means clear warm weather on Ben Nevis; but in Central Europe it is associated with cold winds from north and north-west, and snow on the mountains, especially if pressure be low to south or south-east. Relative humidity attains its maximum, eighty per cent., in June, and its minimum, forty-six per cent., in December, and corresponding to this there is registered one quarter and one half of the possible sunshine in these months: the three summer months have only three clear days, and on twenty-three is the summit wholly enveloped; the "tourist months," August and September, average only one clear day in ten. Eighty-five per cent. of the precipitation measured between May and October (amounting to 45·28 inches) falls in the form of snow. The prevailing winds are south-west and north, giving a mean direction almost due west, and a mean velocity of 18·3 miles per hour—corresponding to force 4·5 of Beaufort's scale: stormy winds average some one hundred and eleven days in the year.

Alpine Rivers.—Most of the scenery of the present surface of the Earth is due, directly or indirectly, to river action, but while full attention has been given to the influence of rivers in transporting material in suspension, the character of the

dissolved solids contained in the water has never been properly investigated from season to season. Such observations as have been made, notably those of the British Rivers Pollution Commission, have been studies in hygiene rather than in physical geography. M. A. Delebecque gives an account of an elaborate series of observations carried out on the water of the Rhone and Dranse in the first number of the *Comptes Rendus* for 1894. The Dranse is a torrential stream flowing into the Lake of Geneva, and not receiving any glacier tributaries. Analyses of the water were made every fortnight from December, 1891, to June, 1893, and the amount of dissolved matter was found to vary regularly (floods being disregarded) with two maxima, in winter and in summer, and two minima, in spring and autumn. The minima are due to snow melting and carrying a large amount of pure water into the river; the maxima occur at the low-water periods of summer and winter, when the small volume of water acts upon the rocks of its bed. The quantities of dissolved matter are, in parts per 100,000: in winter, 35; in spring, 18; in summer, 30; and in autumn, 25. The actual minimum and maximum observed were 13 and 47. In the glacier-fed Rhone, where the melting of ice all summer keeps up a nearly constant supply of water, only one minimum and one maximum occur, as there is, generally speaking, only one period of highest and one of lowest water. In January the amount of dissolved matter was 33 parts per 100,000, which gradually diminished to 10 parts in July and August, after which it again increased. Sulphate of lime predominates in the Rhone water in winter, when most of the water comes across gypsum-bearing ground in the lower part of the river course, and alkaline salts are more important in summer, derived from the felspathic rocks of the higher valleys whence the glacial drainage is derived. M. Delebecque calculates that 750,000 tons of dissolved matter are carried into the Lake of Geneva by the Rhone every year, and 400,000 tons by other streams, this affording some index of the amount of erosion by solution.

ASIA.

Mr. Bent's Expedition to Hadramaut.—A letter has been received at the Society from Mr. Theodore Bent, dated Shibam, January 15. Shibam, as will be seen from Herr Hirsch's narrative in the present number, is the chief town of Hadramaut. Mr. Bent's party met with considerable difficulties in the first part of the journey, but were very well received by the Sultan at Shibam; he is described by Mr. Bent as a very enlightened man, who has been many years in India. Mr. Bent had every hope of being able to go a great deal further, and to return by a different route. He has done much good work among the ruins so far, and Imam Sherif, the native Indian surveyor, has surveyed the country all along, and been of great service with the natives. Mr. Bent hopes to be in England by the end of April or beginning of May.

Narcondam and Barren Island.—An interesting paper by Mr. D. Prain, curator of the Herbarium at Calcutta, on the Flora of Narcondam and Barren Island, visited by him in 1891, appears in the *Journal of the Asiatic Society of Bengal* (vol. lxii. part ii. p. 39). Besides the purely botanical matter, the paper contains some valuable remarks on the physical geography of the area in which the islands occur. The writer first calls attention to the distinction which should be drawn between the Bay or Sea of Bengal and that east of the Andaman Islands, which possesses a distinct individuality, and to which the name "Andaman Sea," suggested by Dr. Alcock, may be well applied. The above-mentioned islands lie in this sea, to the east of the Andamans, Narcondam being the more northern. Both are volcanic, and rise abruptly from the sea-floor; but while Barren Island consists of a huge ancient crater (breached to below sea-level), with a more recent cone in its centre, Mr. Prain thinks that there has never been any crater on the

peak of Narcondam, this having perhaps been produced merely by the extrusion of viscous lava. The island is oval, the longer axis lying north-north-east and south-south-west, the highest point being 2330 feet above the sea. The sides are furrowed by deep ravines, so that in any case the volcano has not been active for a very long time. Cliffs form the coast in many parts, and landing is generally difficult owing to the surf. Almost the whole is forest-clad, the trees on the peak being bearded with moss, an indication that a mantle of cloud usually wraps the summit. On the shores of several bays visited the "sea-fence" of *Pandanus*, *Hibiscus*, etc., is as a rule poorly developed. Behind this occurs the "beach forest," consisting of species of *Pisonia*, *Terminalia*, *Ficus*, etc.; while at one spot is a grove of coconuts, and another of plantains. The former were almost certainly introduced by a deputation which visited the islands in 1866, and the author considers it probable that both here and at Barren Island the latter have been introduced indirectly, at least, by man. Strange to say, they are mentioned by none of the few earlier visitors who effected a landing. The inner cone of Barren Island (on the top of which is a crater) is merely a cinder heap with hardly any vegetation, the ash from this also covering some of the inner slopes of the ancient crater. Elsewhere these, where not too steep, are covered with trees and shrubs; a forest similar, though more weather-beaten, occurring on the outer slopes also. *Terminalia catappa* and species of *Ficus* are the commonest trees. South of these islands, and almost in the same straight line with them, is a rock ("Flat Rock") only just appearing above the surface, which seems to be the highest point of an extensive ridge whose axis points towards the other islands. The rock is probably coral, though the foundation is almost certainly a submarine volcanic peak. Mr. Prain's remarks on the contours of the Andaman Sea, and the relation of these peaks to the main line of volcanic activity, are of special interest, though his criticisms of certain maps in Stieler's Hand Atlas do not apply to the latest edition of that work, and he even seems in one of them to have mistaken metres for fathoms. Points to which he calls attention are the comparatively shallow channels between the Andamans and Nicobars, and between the latter and Sumatra; and the deep water which penetrates westward between Narcondam and Barren Island, though on the exact line between the two, is a slight indication of a connecting ridge. There seems little doubt that these islands with Flat Rock form a northern continuation of the line of volcanic activity which passes through Java and Sumatra; but while some have held that a still further prolongation is to be found in the mud volcanoes of Ramri, off the Arakan coast, the writer follows Blanford in finding it in the extinct volcanoes of Popah and Han-shuen-shan in Burma and Yunnan respectively. In this case the line runs throughout parallel to the eastern base of the tertiary ridge which passes through Arakan and the Andamans, the western volcanoes in Ramri belonging to a system of vents of a different type, running parallel to that ridge to the west. Such evidence as there is appears to indicate that the three peaks are the sub-aërial portions of a continuous ridge, there being, as noted above, some indication of such even in the deep water between Barren Island and Narcondam (which, moreover, is not nearly so deep as that between Bali and Lombok). There may be some connection between this deep water and the fact that south of it only have the volcanoes been recently active, and at this point, therefore, if anywhere, the subdivision of the volcanic range should be effected. As regards the relations between the floras of the islands and their origin, the conformity between them is most marked in the case of trees and shrubs, while the diversity is greater in that of climbers and herbaceous plants. In the common element the sea-introduced species, and in the special elements those introduced by birds,

form the dominant class. An estimate is given of the numbers of those due to the various agencies respectively.

Russian Trade with Central Asia.—It seems, from a communication by M. Kuroff, that Baku is the chief port for the export of Russian textiles. Yearly 17,500 bales of cotton and other textile goods (value, 2,625,000 roubles) are brought thither from the Moscow manufacturing region, and 5000 from Poland (value, 750,000 roubles). They are exported chiefly to Persia (1,350,000 roubles from September, 1892, to September, 1893), to Transcaucasia, and the Transcaspian territory. Nearly 1000 bales (value 1,350,000 roubles) were exported to Khorasan from Askabad, which has been an important centre both for interior trade and trade with Persia, as far as Herat and Kabul, as well as an *entrepôt* for the trade with Khiva, Bokhara, and Turkistan. Nearly 50,000 cwt. of Russian manufactured goods, and very few Polish, are sent every year to Bokhara. Samarkand is the chief centre for Russian trade in Central Asia, the amount of nearly 100,000 cwt. of manufactured goods being brought thither every year.

AFRICA.

The Surface Water of the Sahara.—Dr. Gerhard Rohlfs, the well-known African explorer, gives very valuable information (*Zeitschrift* of the Geographical Society, Berlin, 1893, vol. xxviii. Heft 4) as to the origin of the water which comes to the surface in many parts of the Sahara. The rainfall in this great desert is on the whole very scanty, and there are localities in which it does not rain for years. Yet even in such districts oases with perennial wells and springs are by no means rare. In explanation of this singular fact, Rohlfs correctly points out the very great importance of Dr. Nachtigal's discovery of the Bahr-el-Ghazal, which in former times was an outflow of Lake Chad towards the north-east, and in connection with which even now large quantities of underground water flow in the direction of the great desert, providing such widely extended regions of the Southern Sahara as Egei, Bodele, and Borku with a plentiful supply of water. Rohlfs finds that the northern boundary-line of the tropical rains of the Central Sudan regions runs from the oasis of Air to the Belkashiferi well (Bilma-Chad route), and from there along the northern boundaries of Wadai, Darfur, and Kordofan; and he gives reasons for concluding that many of the oases north of this line derive their underground water supply from the Sudan, as the Bahr-el-Ghazal districts do. The oases of the Northern Sahara, Taflet, Tuat, Rhadames, Fezzan, Aujila, and many others, obtain most of their water from the neighbouring mountain ranges. Rohlfs shows that the western oases depend in this respect chiefly on the Atlas range, whilst the oases more to the east derive their water from the Hogar Mountains, the Jebel Nefus, and J. Soda, and the Libyan coast plateaux. Moreover, it follows from Duveyrier's observations that various parts of the Northern Sahara have more rainfall than is generally assumed. About the oases to the west of the Nile, viz. Chargeh, Dakhel, etc., Rohlfs is not prepared to say whether they are in any connection with the Nile or not. To decide this important question, he recommends comparisons between the different levels of the wells and springs of the oases in question, and the rise and fall of the Nile. There remain those oases that are situated in the very centre of the great desert, such as Bilmar, Kawar, Wanjanga, Kufra, and others. We have at present not sufficient data to give a satisfactory explanation of the origin of their water. Rohlfs has found certain indications which render it possible that Kawar derives its water from Tibesti; but to suggest, as he does, that Kufra (Kebabo), which is situated in 24° 30' N. Lat., derives its water from the Sudan by some peculiar process of suction, is a mere hypothetical assumption which seems hardly justifiable in face of the fact that Kebabo lies 500 feet

higher than the Sudan territories round Lake Chad. Rohlf's correctly emphasizes the great meteorological importance of mountains and plateaux, like those of Tibesti, Air, and Hogar, and it is not impossible that similar orographical features exist in the entirely unknown eastern territories of the Central Sahara, and if such be the case the enigmatical appearance of water in the surrounding districts would be easy of explanation.

Von François' Journey in the Kalahari.—Kiepert's map embodying the results of this journey appeared in the *Mitt. aus Deutschen Schutzgebieten* for 1893, part i. This has since been followed (1893, part iv.) by some notes on the country traversed, which comprises the Western Kalahari on both sides of the Anglo-German boundary as far as the trade-post Lehutitang. The region is an extensive plain, reaching to the foot of the Nama and Damara hills, traversed in its western part by lines of sand-dunes, and dotted over with hollows where alone is any considerable covering of clay or loam, the rest of the surface being almost entirely sand. The tops of the dunes are covered with trees and bushes, which, east of the Nosob, increase in numbers until they form regular forests. This, as well as the luxuriance of the grass, is evidence of a favourable rainfall. Considerable quantities of beans, maize, millet, and kafir melons are cultivated, the two former having been introduced by Bechuana immigrants. In spite of plentiful rain from August to April, little water (and that often bitter and unwholesome) remains the whole year, owing to the porous nature of the soil. Of the inhabitants, the Bakalahari and Bechuana (both of whom came originally from the Transvaal) live by agriculture and cattle-rearing, the Hottentote by cattle-rearing and hunting, and the Bushmen by the latter and on wild fruits. The customs, etc., of the Bakalahari much resemble those of the mountain Damaras in the German territory, and the account given by a chief of the former, that at the time of the immigration of his forefathers the rest of the tribe had proceeded further west, may help to elucidate the doubtful origin of the latter. Game, formerly so plentiful, has of late years become more scarce, the giraffe and eland being nearly exterminated. The employment of dromedaries for the post from Walfish Bay to Windhoek has been a failure, owing to improper treatment.

AMERICA.

United States Surveys.—The Washington Letter published in the *Bulletin* of the American Geographical Society states that the topographical work of the U.S. Geological Survey was extremely successful in 1893. Thirty-three surveying parties were in the field, and surveyed 33,500 square miles; 118 sheets on the scale of one mile to an inch and 16 sheets on the scale of two miles to an inch being laid down. Most of this work was in the region of the great plains, the greatest progress being made in Nebraska, Oklahoma, South Dakota, North Dakota, Kansas and Texas. Important work has also been done in California, including the peninsula and Bay of San Francisco. Several of the State legislatures, especially that of New York, have co-operated with the Geological Survey of the United States in order to produce an accurate survey of their own territory. During last year no less than 5000 square miles of the State of New York were surveyed on the scale of one mile to an inch for the first time. By means of similar co-operation between the legislatures of the individual states and the general government, the surveys of Massachusetts, New Jersey, Connecticut and Rhode Island, have been completed and the maps published. The municipal authorities of Baltimore are engaged on a complete survey of the city on a scale of 1 : 2400, or about 26 inches to a mile, with contours at every 5 feet of vertical height. The built portion of the city will also be shown on the scale of 1 : 480, thus approximating in scale

to the parish and Town plans of the Ordnance surveys, although surpassing them in the minute delineation of vertical relief.

Explorations in Mato Grosso.—During the year 1887, further explorations of this remote province of Central Brazil were undertaken by Drs. C. and W. von den Steinen, P. Ehrenreich and P. Vogel, a report of which has quite recently appeared in the *Zeitschrift* of the Berlin Geographical Society, vol. xxviii., 1893, pp. 243–295. It is well known that in 1884 the first two of these travellers, together with Dr. O. Clauss, performed a remarkable journey in following the whole course of the Xingu river from one of its source-rivers, the Batovy, to its confluence with the Amazon. The expedition of 1887 was undertaken with the object of exploring the Kulisehu, another source-river of the Xingu, and acquiring further knowledge about the natives inhabiting these districts. In both respects the expedition was successful. Starting from Cuyabá, the capital of Mato Grosso, the travellers first proceeded northward and reached the valley of the Upper Cuyabá river between the Serra Tombador and Serra Azul. Turning to the east, they crossed the Paranatinga river, which they regard as one of the tributaries of the Tapajoz, and not of the Shingu, as has been assumed. Continuing their journey to the east, they arrived (August 29, 1887) at the Kulisehu in $14^{\circ} 7' S. Lat.$, and followed the course of this river and of another, the Kuluene, to their confluence with the Ronuro, where the united rivers take the name of Xingu. The Kulisehu is a beautiful river with a very winding course. In its upper part it has numerous rapids, and the lower part has many lagoons on both sides of the river bed. Not far above the confluence with the Ronuro it was discovered that the Kulisehu is joined by another source-river of the Xingu, the Kuluene coming from the south-east. Both the Ronuro and the Kuluene are still unexplored. On the banks of the Kulisehu a number of Indian tribes were met with, viz. the Bakairi, Nahuqua, Mehinaku, Aucto, Yaulapiti, Kamayura, and Trumai, with all of whom friendly relations were established. The most interesting tribe of them are the Bakairi. They live in a very primitive state, have neither domestic animals of any kind—not even the dog—nor are they acquainted with metal tools and weapons, or with alcoholic beverages. Their only implements are stone axes, shells, fish-bones, etc. Their chief occupation is the growing of maize, mandioca, and tobacco. The expedition returned to Cuyabá by a somewhat more eastern route, crossing the Paranatinga higher up, and discovering the sources of the Rio Manso, an eastern tributary of the Rio Cuyabá.

POLAR REGIONS.

Reported High Northern Latitude.—We noticed on p. 463 of vol. ii. the report which was cabled to this country, and given a prominent place in all the newspapers, that an American whaler, the *Newport*, had reached the remarkable position of $84^{\circ} N.$ We pointed out at the time that the statement could not be received unless fully corroborated. We now find from the new number of the *Bulletin* of the American Geographical Society that “all these particulars were invented by the conscientious reporter.” Professor George Davidson saw the captain of the *Newport*, who was greatly annoyed at the circulation of the false report. His farthest north had been 73° , and when there he saw no ice-blink, so concluded that the sea was open for forty or fifty miles farther. It is curious that no correction of a mistake which was very widely circulated had previously been made in this country.

Antarctic Whaling.—While the Dundee whalers, which made a trial trip to the Antarctic Sea last year, are returning this spring to their old whaling-field off

Greenland, Norwegian vessels are continuing the experiment in the south. We have already referred to the voyage of the *Antarctic* to the seas south of New Zealand, and a recent telegram from Port Stanley states that, on January 23, the Norwegian ships *Jason*, *Castor*, and *Hertha* returned to the Falkland Islands from a visit to the southern sealing-ground, and, after landing their catch, intended to proceed south for a second cargo.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Physical Geography in France.—The present activity in research amongst French workers in physical geography, was somewhat strikingly illustrated at the meeting of the Academy of Sciences on January 22 (*Comptes Rendus*, vol. 118, No. 4, 1894), when no fewer than seven papers on special problems were read or referred to. M. R. Boissière called attention to the importance of exploring Kerguelen Island more thoroughly, and his memorial was submitted to a committee for report. M. Gustave Hermite described experiments on the temperature of the atmosphere at great heights by the use of free balloons carrying self-registering instruments. On March 21, 1893, the balloon, judging from the barometric diagram, reached a height of 52,500 feet; but at this elevation, the ink of the thermograph was frozen; at 41,000 feet the temperature was -60° F. At the surface the temperature at the same time was 63° F., giving a difference of 123° for 41,000 feet or 1° F. for 333 feet of ascent. A second ascent in September was less satisfactory, the registering instruments having got out of order. M. Pruvot described the submarine geography of the coast of the Gulf of Lions, and M. de Lacaze-Duthiers gave a most interesting sketch of the equipment of his marine station in that region, to which Prince Roland Bonaparte has recently presented a steam yacht. A new examination of the fresh-water fishes of Borneo made by M. Léon Vaillant shows that of the 322 species now known in that island, 22 per cent. are peculiar to it, 39 per cent. are common to other islands in the western part of the archipelago, 35 per cent. are found in the islands and on the continent of Asia, and 4 per cent. are found in Asia and in Borneo, but have not yet been found in other islands. These observations have an important bearing on the history of the formation of the Malay Archipelago. Two papers dealt with the origin of land-surface features by disturbances of the crust; M. Zurcher explaining his grounds for believing that the folds of the Earth's crust are similar to those of a thin sheet or membrane, the thickness of which may be neglected compared with its surface; and M. Marcel Bertrand discussing the structure of the French Alps with reference to their folding and the resulting metamorphic action.

Changes in River Courses.—Dr. E. Dunker of Halle has recently published (*Mittel. Ver. Erdkunde*: Halle, 1893) his investigations on the causes which produce the changes in river courses. He comes to the conclusion that the Earth's rotation has much less influence in the matter than has hitherto been assumed, even if a river flows due south or due north. The amount of pressure and the difference of the levels near the right and left bank, produced by the rotation of the Earth, are stated to be quite insufficient to account for the great changes which have been attributed to them. Dr. Dunker explains that the distribution and varying velocities of the water in different parts of a river-bed are the main causes of these changes. This follows from the fact that the water molecules in the concave parts of river-bends have a greater velocity, and produce more vigorous friction and pressure against the hollow sides of the banks, than is the case on the convex sides. The consequence is a loss of soil at the concave and an accumulation at the convex parts of the bends.

GENERAL.

Instructions for Travellers.—Dr. L. Ambronn develops in the *Deutsche Geographische Blätter* the idea of a special institute for giving the necessary instruction to intending travellers. The geographical journeys of former times required from the traveller some special qualities of general insight, cleverness, and some pluck. Now, the problems are becoming quite different. Researches have to be made in a certain well-defined region, according to a determined plan. All means and methods of modern science have to be called in aid, if useful material is to be gathered, in both descriptions and scientific collections, so as to be available either for scientific purposes, or as hints for colonization. One knows, however, how difficult it is to fulfil these requirements. Of course, excellent books containing most useful hints for travellers have recently been published; but Dr. Ambronn very justly finds book-teaching insufficient; the teaching must be practical, and it is quite astonishing to see how much the practical use of instruments and the practice of observing is neglected by many travellers. Full series of observations have already been lost for science, simply because the traveller neglected to note some one element of observation. The amount of time which often is spent in vain because the traveller had not been accustomed to record his observations systematically, is enormous. Even mercantile interests could be much forwarded if preliminary instructions were given to the intending traveller. The traveller of our own time must not only know how to describe in words what he sees, but he must be able to determine his exact position; he must know how to make astronomical determinations, to map, to measure heights and depths, and so on, as well as how to describe the flora and fauna of a country, and the *habitus* of every useful plant. Dr. Ambronn proposes therefore to have a special institute for this purpose, either in one of the great commercial towns, or in connection with a university. The subjects of studies ought to be:—(1) Physical geography, meteorology, and short demonstrations in hydrography; (2) botany and zoology—a review of the *habitus* and properties of useful plants and animals, as well as lectures about botanical and zoological collections; (3) study of the soil and the rocks; (4) lectures on ethnography, observation of types of man and anthropological measurements; (5) geographical determination of position by means of the simplest instruments available, mapping and sketching; (6) lectures on commercial and political geography; practical teaching of the art of travelling, necessities for a journey in a given country, hygiene. Instruction in each one of these subjects might be given in one half-year, and the pupil might easily follow three or four of them at the same time. Appropriate teachers could be found in each city who would accept this teaching as an incidental occupation, while one chief instructor would devote his full time to the institute. Another important point is to have wide collections of maps and of instruments, as well as a larger museum of ethnography. One cannot but fully approve Dr. Ambronn's proposal, which is sure to be warmly supported by every one who has had to begin geographical research in his early years, without finding any possibility of receiving anywhere the necessary practical instruction. Similar courses of instruction have already been instituted in France (see *Geographical Journal*, vol. ii. p. 176), and the Royal Geographical Society has for a long time provided instruction for travellers in various branches.

Solar and Lunar Halos.—In the November number of the *Meteorologische Zeitschrift*, Dr. G. Hellmann publishes some notes on the frequency of occurrence of solar and lunar halos, collected in the course of preparing his recent book on 'Snow Crystals.' There is considerable difficulty in obtaining reliable information

about the geographical and seasonal distribution of these appearances, a difficulty which tends to increase with the more general adoption of self-recording instruments. Only two meteorological observatories, Ben Nevis and Tiflis, continue to make hourly "eye observations," and the entries in the "Remarks" column of most records become excessively meagre. The statement of Aristotle, that lunar halos are more frequent than solar, seems still to find its way into text-books, although not now always associated with his reason that the greater warmth of the sun more readily dissolves the secretions of the atmosphere. In order to test the accuracy of the current belief, Dr. Hellmann examined the records of Upsala Observatory before the days of self-recording, of a series of observations collected from various stations in New York State, by F. B. Hough, of the Polar Expeditions of 1882-83, and of ten stations in Japan. All the records agree in showing that the frequency of occurrence of halos and allied phenomena depends, for the most part, on the presence of ice-prisms and on the length of the day. Solar halos are least often seen in midwinter; the number increases steadily till the end of spring, and then rapidly diminishes through lack of ice-crystals. Lunar halos, again, are most common during the long nights of winter. During the seven years 1866-72, the Upsala records show about five times as many entries of solar phenomena as of lunar, and in most cases the preponderance also lies with the sun. The Japanese stations are remarkable for the large total observed. This is a subject to which the attention of travellers might well be drawn.

Death of Herr L. J. Schrenck.—L. J. Schrenck, member of the St. Petersburg Academy of Science, and well known for his ethnographical, anthropological and zoo-geographical works on Siberia, died at St. Petersburg on January 20. His chief works of geographical interest are embodied in his great '*Reisen und Forschungen im Amur-Lande in den Jahren 1854-1856.*' For a number of years he was the editor of the well-known *Beiträge zur Kenntniss des Russischen Reichs*, published by the Academy of Sciences.

The Fifth Centenary of Prince Henry the Navigator.—The municipality of Oporto proposes to celebrate, on the 4th of March next, the fifth centenary of Prince Henry the Navigator, the initiator of that splendid series of voyages which, in the space of about eighty years, laid down the contour of the coast of Africa.

OBITUARY.

General Sir Charles Pyndar Beauchamp Walker, K.C.B.

BY LIEUTENANT-GENERAL W. H. GOODENOUGH, B.A., C.B.

THE Geographical Society has lost an old and valued friend and counsellor by the death, on the 19th of January, of Sir Beauchamp Walker. A Fellow of thirty years' standing, he was on the Council for a third of that time, and was Foreign Secretary from 1892, an office in which he succeeded Lord Arthur Russell. Sir Beauchamp was a zealous and active member of many of our committees, and took a special interest in the Library and Map Department. The extension of the Society's usefulness in the sphere of education had his warmest approval; and his conversance with the teaching of geography on the continent, as well as his experience of its practical results in the wars in which he took part, and his position as Director-General of Military Education—1878 to 1884—combined to give weight to his counsel in this important field. His singular geniality and great charm of manner were as noticeable as his grand physique; springing from wide sympathies, and

an extensive knowledge of the world, these qualities endeared him and gave encouragement to younger men. With all his remarkable *bonhomie*, his subordinates and co-workers in administrative office soon found, perhaps somewhat to their surprise, that they had an exact and methodical worker at their head, whose thorough education and varied training gave him a quick and comprehensive grasp of the subject in hand.

This education was given him at Winchester, where he "did well." Young Walker clearly took a broad view of the well-known legend writ on the wall in Winchester school—*aut disce, aut discede, aut cædi*, with the emblems, the mitre, the sword, and the birch rod apposed to each—for he combined the *discere* with the sword to "go for a soldier."

He entered the army in 1836, in the 33rd Duke of Wellington's Regiment, at the age of nineteen, having been born on October 7, 1817. After leaving school, the study of German at Hanover and Brunswick for a year took the place of a university or military college training. Nor did young Walker misuse the opportunities his father had wisely given him; he then obtained that thorough mastery of German which was afterwards to serve him in such good stead, and, besides, made lifelong friends, the last Duke of Brunswick, in particular, becoming his friend and correspondent.

Going abroad with his regiment at twenty-one, he passed about ten years in the Colonies, where at that time so much larger a proportion of the army was posted than now,—at Gibraltar, in the West Indies, at Halifax, and in New Brunswick. In 1849, as a captain of three years' standing, Walker transferred his services to the cavalry, and in 1854, in the Crimea, he was first aide-de-camp to Lord Lucan, commanding the cavalry division. In 1858 he was specially selected for service as lieutenant-colonel with a cavalry regiment in India, then engaged in the field; and in 1859, in the Trans-Gogra campaign, he conducted a pursuit of the broken forces of the mutineers. This service led to his being taken by Sir Hope Grant, himself a cavalry officer, as quartermaster-general of cavalry, with the army proceeding under Sir Hope's command to China.

His experience in the campaign in China was perhaps of higher personal interest than any in his varied career. After the capture of the Taku Forts at the mouth of the river Pei-ho, and during the advance towards Peking, a number of Englishmen and some French, who had trusted the Chinese, were, through (to say the least) the conflict of parties about the throne, taken prisoners; some were slain, others died through the untold hardships of their captivity. The Chinese commissioners had brought about a conference, and had agreed to our army being advanced to a certain ground and camping there, pending the reception at Peking of our ambassador. Colonel Walker, with a cavalry escort, went with our negotiator Parkes,* who was accompanied by Loch.† and several others, to take up the ground the army was to occupy. On traversing it on their way to meet the Chinese commissioners, certain circumstances roused Colonel Walker's suspicions, which he communicated to Parkes, and, on his return, the increasingly large bodies of Chinese troops seen on the same ground intensified them. In the result, Mr. Parkes shared Colonel Walker's view, and went back to demand an explanation, leaving Walker to watch the ground and await his return. The great object now was to avert a collision between the armies, by this time in presence, until our people were in safety. But it was not to be. The Chinese, growing bold, mobbed and wounded first a passing French officer, whom Walker felt bound to help, and then mobbed the colonel himself, and would have dragged him to the ground; but, with rapid

* Sir Henry Parkes.

† Sir Henry Loch.

decision, calling to his troopers, whom he had previously enjoined to patience under provocation and the strictest attention to his signal, to "ride for their lives," he "gathered his good horse together," a favourite hunter, and, bursting the throng, escaped amid a storm of bullets and artillery fire. The dreaded collision, now inevitable, ensued. Parkes, Loch, and the others were captured on the same ground scarce half an hour later; of the whole party, these two named alone, with some of the Sikh escort, were eventually released. Sir Henry Loch, in his "Narrative of Events in China" (1869), does justice to Colonel Walker, who, "with a patience and courage deserving of great praise, remained in a position which required much calmness and judgment."

But the position in which Beauchamp Walker became best known was still to be assumed. After the friction produced by the Danish war of 1864, a happy selection was made when, in 1865, Colonel Walker was appointed military *attaché* at Berlin, a post he held till 1877. He quickly became a *persona gratissima* to all, and particularly at Court, and in the *entourage* of the Crown Prince, with whose staff he made the campaign of 1866. Again in 1870-71 he was at the head-quarters of the German army. His despatches during the war were singularly accurate and good. He rarely speculated on coming events, but described what he saw and what he heard. He was constantly under fire. His intimacy with many officers of the Crown Prince's staff enabled him to send home much information that it would have been otherwise difficult to obtain; but he was scrupulous and generous, and never sent information which a man in his position should not have done.

At the conclusion of the war our Department of Military Intelligence was still in embryo, being in process of development, under a quite junior officer, from the older Topographical Department. To this development General Walker, both privately and officially, gave a cordial assistance which was of the greatest service. A special business of this department is the provision of maps. There was a tendency to demand large scale maps for military purposes, and to think that these could supply almost every want in war, but General Walker demonstrated the results of the experience of the Germans, and their conclusion that their maps were too large; that, in the hands of subordinate officers, they led to officers looking more at the maps than at the ground itself; and that they should be confined to the use of the leaders. The despatch he wrote on this subject gave the right direction to our work at the time, and is still regarded as authoritative.

Sir Beauchamp was an active supporter and a vice-president of the Royal United Service Institution, where also he was known for his lectures: "Königgrätz," 1868, vol. xii.; "The Fifth Corps before Versailles," and "Outposts during the Investment of Paris," 1871, vol. xv. He produced also "Organization and Tactics of the Cavalry Division" (Blackwood, 1876).

Sir Beauchamp's grandfather was in the naval service of the old East India Company; his mother of the Pyndar, connected with the Lygon, family. He leaves a widow, and one daughter—Baroness von Alvensleben.

The general's letters to his family, constituting almost a journal of the stirring events in which he took part, have been carefully preserved, and, it is to be hoped, may be given to the world.

Sir Gerald H. Portal, K.C.M.G., C.B.

THE life of Sir Gerald Herbert Portal, the close of whose brief but brilliant career has evoked such a universal sentiment of regret, was remarkable not only for its promise, but also for its actual achievement. In a profession in which the younger

members have seldom the opportunity of undertaking the graver responsibilities, he emerged from the body of his contemporaries and most worthily justified his selection. Born in 1858, he had hardly concluded his thirty-sixth year, when, returning in the full flush of success from his arduous march of nearly 2000 miles through Equatorial Africa, he fell a victim to a disease bred of city life, with which a constitution, undoubtedly for the time enfeebled by tropical climates, was unable to do battle, and died in the flower of his days with an honourable record of duty done—rich, if we may say so, in the devoted affection of his friends, and the sorrow of all his countrymen.

Sir Gerald Portal was a typical Englishman in the best sense of that name. His earliest laurels were won in the playing-fields of Eton, where so many of England's best have first tasted the inspiring sense of success; he was a keen sportsman, a fearless rider, and a true lover of horses. Although a man of wide reading, with considerable literary taste and ability, he afforded another instance in support of the theory that examinations are not a final test of capacity, and abandoned a University career, which offered little prospect of success, to enter the Diplomatic Service. After the usual period spent in the Foreign Office, he was sent, in 1880, to Rome, where he remained for a couple of years. He was transferred to Cairo at that crisis of Egyptian history which arose in 1882, and was present at the bombardment of Alexandria. Here, in the able school of Sir Evelyn Baring (Lord Cromer), he gained that insight into Oriental life which was later to serve him in such good stead, and, having won his spurs as Acting Agent and Consul-General during the absence of his chief, was entrusted in 1887 with the perilous mission to King John of Abyssinia, the object of which was to pave the way for a peaceful solution of the difficulty with Italy arising from the disastrous episode of Dogali. The story of that most difficult and eventful journey has been recorded by himself in the simple, unassuming narrative of the "English Mission to Abyssinia," originally printed for private circulation among his friends, and subsequently published by Mr. Edward Arnold. In 1889 he was entrusted with the temporary charge of the agency at Zanzibar, and gained such golden opinions in his six months' tenure of office, that in March, 1891, he was definitely appointed to succeed Sir Charles Euan Smith at that post. Zanzibar had in the mean time become a British Protectorate. Here he found ample scope for his energy and ability, and succeeded in an incredibly short time, in spite of all the difficulties and obstacles which presented themselves, in reducing the chaos of an Arab despotism to something like order. After his Abyssinian journey he had been made a C.B. His services at Zanzibar and on the coast were rewarded with the K.C.M.G.

When the question of the future of Uganda came before the public, and the British East Africa Company had definitely decided to withdraw from that region, Sir Gerald Portal was instructed to proceed thither, and to report on the best means of dealing with the country. Although deep in the unceasing labours occasioned by the Zanzibar administration, his preparations for the expedition were made in the briefest possible space, with the assistance of General Mathews, of whose helpfulness and kindness he never tired of speaking. Accompanied by Colonel Rhodes, Major Owen, and his brother, Captain Portal, he set out on the first day of 1893 on the eventful mission, the story of which has yet to be told. The sad death, at Kampala, of Captain Portal, an officer less known to the world than his younger brother, but not less appreciated by his friends and contemporaries, cast a deep shadow on an otherwise successful enterprise. The temporary arrangements made by Sir Gerald in Uganda, with rapid decision, are already known to the public, and at the end of May he started on that homeward journey which especially entitles him to a place in the records of this Society. His object was to ascertain the practicability of an alternative route to Uganda by the Tana, and in company

with Colonel Rhodes he diverged from Kikuyu, some 350 miles from the coast, breaking new ground in a northerly direction with a view to striking the upper waters of that river. The maps and journals recording their experiences will, no doubt, before long be issued; it may suffice here to say that the journey was one of exceptional difficulty, owing to the marshes which had to be traversed, in which the expedition wandered for upwards of a week, losing many of their loads and all the live stock brought down from Uganda, a loss which reduced them to considerable straits for food. When once the stream was reached, the worst of their troubles were at an end. H.M.S. *Swallow* was waiting to receive them at Lamu, and on the 22nd of October the expedition reached Zanzibar in the best of health and spirits.

Sir Gerald then came to England, and expected to return almost immediately to Zanzibar in order to give effect to whatever decisions might be come to by her Majesty's Government with regard to Uganda. But this was not to be, and after three weeks of illness, which did not at first give rise to anxiety, the fatal symptoms of typhoid declared themselves, and the end came painlessly and swiftly.

To few men of recent times has it been given to do so much good work in so short a time, and his record must be gauged by results and not by years. He had been entrusted with two most difficult and delicate missions, and had reached the first rank of his profession. He was ambitious, but as a man should be in the cause of his country, and took all hard service with a ready welcome. His acts were characterized by rapidity of decision and energy in execution, and his name will always be associated with the infant development of Zanzibar, the Free Port of Equatorial Africa. He was a man who inspired the warmest friendship; no one could be freer from all littleness or more chivalrous in all his thoughts, no one more cordial in his appreciation, more generous in his estimate of the work of others. His friends will mourn him long and sincerely, and the empire is the poorer by the untimely death of a brave and faithful servant.

Richard Spruce.

By CLEMENTS R. MARKHAM, C.B., F.R.S.

RICHARD SPRUCE, whose death was announced last December, was eminent as a botanist, but he was also an accomplished geographer, and a most careful and accurate observer of Nature. His great but ill-requited services—as one of my colleagues in the work of introducing chinchona cultivation into India—ought not to be forgotten. He was born in 1816, the son of the village schoolmaster at Ganthorpe (parish of Terrington), in the North Riding of Yorkshire, near Castle Howard, and early showed that talent for mathematics which afterwards led to his appointment as a master in St. Peter's School at York. From early youth he also studied the plants of his neighbourhood, his first publication being a paper on the *Musci* and *Hepaticæ* of Teesdale, in 1841. Several other papers on mosses and ferns appeared in the *Phytologist* in 1845 and 1846. In 1845 he made a journey to the Pyrenees, the results of his field work in those mountains being embodied in two papers in the Edinburgh Botanical Society's *Transactions*, entitled "Notes on the Botany of the Pyrenees," and "The *Musci* and *Hepaticæ* of the Pyrenees."

In 1849 Mr. Spruce sailed for South America, and devoted many years of his life to a comprehensive study of the flora of the basin of the Amazona. He sent his collections to Kew from 1849 to 1864, so that the Kew Museum became very rich in the vegetable products of that part of the South American Continent. Mr. Jackson, of the Kew Museum, has very truly remarked that nothing escaped Spruce's notice in connection with the uses of plants. Food products, native medicines, and

manufactures all received a full share of his attention, and his notes were written in a small clear hand, every scrap of information referring to any special object being recorded. During these years he also explored the courses of unknown rivers, constructed maps, and brought together a great mass of valuable geographical information. In 1856 he was at Tarapoto, in the valley of the Huallaga, and in 1857 he descended that river to the Marañon, thence ascending the Pastaza and Bombonasa, and traversing the vast forests of Canelos to Baños in Ecuador. In January, 1858, he removed to Ambato, which, for more than two years, was his point of departure for excursions in the Quitoian Andes.

The history of these labours will be found in numerous papers contributed to *Hooker's Journal of Botany*: "Botanical Excursion on the Amazon," 1852; "Journal of a Voyage up the Amazon and Rio Negro," 1853-55; "Objects contributed to the Kew Museum from the River Amazon;" "Edible Fruits of the Rio Negro;" "Letter on Vegetable Oils;" "Notes on the Indiarubber of the Amazon." He also contributed several valuable papers to the *Journal of the Linnean Society*. The researches of Mr. Spruce into South American vegetation have been the most important since the days of Humboldt, not merely for the number of species collected—amounting to upwards of 5000—but for the number of new generic forms with which he enriched science. He also investigated the economic uses of plants, and his discoveries cleared up several doubtful questions of origin as to interesting genera and species. Two admirable articles in the *Geographical Magazine* of July and August, 1873, on "Some Remarkable Narcotics of the Amazon Valley and the Orinoco," and "Personal Experiences of Venomous Reptiles and Insects in South America," are good examples of the care and accuracy of his observations and of his charming style as a narrator. He also collected vocabularies of twenty-eight native languages of the Amazon valley, took meteorological and hypometrical observations throughout the vast region he traversed, mapped three previously unsurveyed rivers, and made notes of the aspects and capabilities of the various districts he visited, and of the customs, food, trade, and agriculture of the inhabitants.

From Ambato Mr. Spruce sent us a paper on the mountains of Llanganati in the eastern cordillera of the Quitoian Andes, which was published in our *Journal* (xxxi. p. 163); and another on the volcanic tufa of Latacunga at the foot of Cotopaxi, and on the *cangána*, or volcanic mud, of the Quitoian Andes, which appeared in the *Geological Society's Quarterly Journal* (xxi. p. 249).

Owing to the strong recommendation of Sir William Hooker, I was so fortunate as to secure the services of Mr. Spruce to collect plants and seeds of the red bark (*C. succirubra*) in the forests along the banks of the rivers Chanchan, Chasuan, and San Antonio, on the western slopes of Chimborazo, for introduction into India. The red bark species of chinchona yields a larger percentage of febrifuge alkaloids than any other. In 1859 Mr. Spruce made a preliminary reconnaissance of the forests, and in 1860 he commenced his collecting operations, while suffering from the effects of fever and rheumatism. He says, "Although upheld by a determination to execute to the best of my ability the task I had undertaken, I was but too often in that state of prostration when to lie down quietly and die would have seemed a relief." Assisted by a gardener named Cross, he overcame all the numerous difficulties, collected 100,000 well-ripened and well-dried seeds, and established 637 plants in Wardian cases, which were conveyed to Guayaquil on a raft, and shipped for India in January, 1861. In his report, dated January 3, 1862, Mr. Spruce gave a most interesting narrative of his proceedings, his observations on the "red bark" tree, a minute account of the vegetation of the forests, remarks on the climate and soil, and a complete meteorological journal.

The fever, followed by partial paralysis, which was contracted in this service,

completely disabled Mr. Spruce from any further active work. In 1863 he went to Payta, in the north of Peru, to recruit his health, and made a careful examination of the physical geography of the coast desert of Peru, and of the Peruvian system of cotton cultivation. These observations were embodied in a report drawn up at my request, "On the valleys of Piura and Chira, in Northern Peru, and on the cotton cultivation therein (1864)." I know of no other work in which the geology and the vegetation of the Peruvian coast deserts are so well and so graphically described.

In 1864 Mr. Spruce returned to England, with his health completely shattered, and I had the great pleasure of receiving him in my house until he went, for a short time, to Hurstpierpoint. Arrangements were eventually made, through the kindness of Lord Carlisle, for his removal to Welburn, near Castle Howard. He had the great and laborious task before him of arranging and describing his splendid collection of mosses and hepaticæ of the Amazon. For several years he was obliged to lie on his back, and in this position he had to examine each plant microscopically, and to write his notes. The results of his labours were 'Palme Amazonicæ,' published by the Linnean Society, and 'Hepaticæ Amazonica et Andinæ.' A small pension was granted to him by Lord Palmerston, through the intercession of Lord Carlisle and his sister, and, after years of importunity—not from Mr. Spruce, or with his knowledge—another small grant was at length, in 1877, obtained from the India Office, making together £100 a year. Mr. Spruce afterwards moved to a cottage in the village of Coneysthorpe, just outside the gates of Castle Howard Park; and here he continued to receive unvarying kindness from the Howard family. Here he at length completed his laborious work on the hepaticæ of the Amazon—a monument of industry and perseverance, and here, within a short distance of the place of his birth, he ended his days.

Mr. Spruce had been a Fellow of this Society for thirty years; and those who are acquainted with his writings, with his conscientious accuracy, his scholarly style, and his great powers of description, know well that if he had been given health and strength, he would have been second to no man in this century as a writer on geographical subjects.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1893-94.

Fifth Ordinary Meeting, January 29, 1894.—Captain W. J. L. WHARTON, R.N., F.R.S., Vice-President, in the Chair.

ELECTIONS.—Colonel Lord Belhaven and Stenton; Captain Arthur Burgess, R.N.R.; Wm. Davis; Henry Newton Dickson; Alfred Charles Wm. Harmsworth; Lieut. Arthur Havergal, R.N.; Henry Van Joel; Wolfred Nelson; Rev. Thomas Pearson; Lieut. C. P. Powney (Grenadier Guards); Edward Francis Riddell; Captain Jocelyn FitzGerald Ruthven; Edward Bouchier Savile; Dr. Sidney Jebb Scott; The Right Rev. Wm. Procter Swaby (Lord Bishop of Guiana); John Prandon Tyrrell; William Wickham, M.P.; Henry White Wickins.

The late Sir C. P. Beauchamp Walker.

Captain Wharton made the following remarks with reference to the death of Sir Beauchamp Walker, the Society's Foreign Secretary:—

Before proceeding to the business of the meeting, I must refer to the very regrettable death of General Sir Beauchamp Walker, an irreparable loss to the

Society. Sir Beauchamp Walker has served during the last ten years as a member of Council, as a Vice-President, and latterly as Foreign Secretary. Being a man of very great experience and most sound judgment, his advice has been of the utmost use to the Council of the Society. In the movement the Society has made to encourage geographical education, he took a foremost place, and his loss is, as I say, almost irreparable to the Society.

The Paper read was :—

“A Journey through Iceland.” By Dr. K. Grossmann.

There was an exhibition of photographs, maps, and curios in the tea-room.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

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

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

A. = Academy, Academie, Akademie.	Mag. = Magazine.
Ann. = Annals, Annales, Annalen.	P. = Proceedings.
B. = Bulletin, Bollettino, Boletim.	R. = Royal.
Com. = Commerce, Commercial.	Rev. = Review, Revue, Revista.
C. R. = Comptes Rendus.	S. = Society, Société, Selskab.
Erdk. = Erdkunde.	Sitzb. = Sitzungsbericht.
G. = Geography, Geographie, Geografia.	T. = Transactions.
Ges. = Gesellschaft.	V. = Verein.
I. = Institute, Institution.	Verh. = Verhandlungen.
J. = Journal.	W. = Wissenschaft, and compounds.
M. = Mitteilungen.	Z. = Zeitschrift.

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.

EUROPE.

- Alps.** *Ann. G.* 3 (1894) : 150-172. **Haug.**
 Les Régions naturelles des Alpes, par Emile Haug. Avec carte en couleur.
 This interesting paper will be noticed in the Monthly Record.
- Alps—Rutor.** *Annuaire Club Alpin Français* 19 (1892) : 29-72. **Ferrand**
 Le Massif du Rutor. étude géographique sur la chaîne frontière franco-italienne entre l'Aiguille de la Grande-Sassière et le col du Petit Saint-Bernard. . . . Par M. Henri Ferrand.
- Austria—Croatia—Meteorology.** **Gavazzi.**
 Konstante srednje dnevne temperature zraka za hrvatske postaje. Napisao :
 Dr. A. F. Gavazzi, U Zagrebu, 1893. Size 9¼ × 6½, pp. 6. *Presented by the Author.*
 The constants of the mean daily temperature for the Croatian stations.
- Austria—Croatia—Rainfall.** **Gavazzi.**
 Die Regenverhältnisse Croatiens. Von Dr. Arthur Franovic Gavazzi.
 Wien, 1891. Size 9¼ × 6½. *Maps. Presented by the Author.*
- Austria—Croatia—Sleme.** **Gavazzi.**
 Meteorologijski odnosi na Sljemenu god. 1888. Sastavio A. F. Gavazzi.
 Size 9¼ × 6½, pp. 8.
 The same for 1889. Size as above, pp. 7. *Presented by the Author.*
 Meteorological observations on the Sleme for 1888 and 1889.

Austria—Dalmatia—Kerka River. Gavazzi.

Ušće Rijeke Krke. Napisao: Arthur Franović Gavazzi. Zagreb, 1890.
Size 9 × 6, pp. 12. *Presented by the Author.*

A paper on the mouth of the Kerka river, Dalmatia.

Austria—Dalmatia—Lake Vrana. Gavazzi.

Vransko Jezero u Dalmaciji. Napisao Artur Franović Gavazzi. U Zagrebu, 1889. Size 9½ × 6, pp. 11. *Map. Presented by the Author.*

Balkan States. Annuaire Club Alpin Français 19 (1892): 322-355. De Launay.

De Gettinjé à Nijni Novgorod par la Bosnie et la Transylvanie. Par M. L. de Launay.

Illustrated from photographs by the author.

Caucasus—Daghestan. Globus 64 (1893): 253-259, 270-275. Seidlitz.

Pastuchows Besuch der höchstgelegenen Ortschaften des Daghestan und Besteigung des Schach-Dagh. Mitgeteilt von H. von Seidlitz.

Abstract, illustrated by maps and photographic reproductions, of a paper read to the Caucasian Section of the Russian Geographical Society in March, 1893, and not yet published. Pastuchov's visit to the villages of Chirakh and Kurush and the summit of the Shah-Dagh here recounted took place in September, 1892.

Denmark—Magnetic Conditions. Paulsen.

Institut météorologique de Danemark. Annales de l'Observatoire Magnétique de Copenhague. Publiées par Adam Paulsen Année, 1892. Copenhague G.-E.-C. Gad., 1893. Size 13½ × 8½, pp. 52. *Presented by the Danish Meteorological Institute.*

Contains sketch-maps showing the isogonic lines of Denmark and Bornholm for the period 1891-5, and the records of the magnetic observatory at Copenhagen.

England and Wales—Census.

Census of England and Wales, 1891. Vol. iv. General Report, with summary tables and Appendices. London, Eyre and Spottiswoode, 1893. Size 13½ × 8½, pp. vi. and 143.

—— ditto. Index to the Population Tables of England and Wales. London, Eyre and Spottiswoode, 1893. Size as above, pp. 218.

England and Wales. Brabner.

The Comprehensive Gazetteer of England and Wales, edited by J. H. F. Brabner, F.R.G.S. Vol. i. Aar-Cat. London, William Mackenzie, not dated [1893?]. Size 10½ × 7, pp. 552. *Maps and Plates. Price 10s. to subscribers. Presented by the Editor.*

The prospectus of this new gazetteer enumerates several important features, which are intended to make the compilation useful and trustworthy. The first volume appears to have been put together with care and with special regard to convenience of reference. Ecclesiastical information is particularly conspicuous. There are serviceable maps of the counties treated of, and plans of the large towns. A series of characteristic etchings of architecture and scenery is also given. The work will be completed in six volumes, but is only supplied to subscribers.

France—Cevennes, etc. Ann. G. 3 (1894): 201-212. Gallois.

Mâconnais, Charolais, Beaujolais, Lyonnais (2 coupes, 1 cartou), par L. Gallois.

An attempt to unravel the somewhat confused geography of the region sometimes called the Central Cevennes, and to trace the limits of the four districts mentioned by considering their orographical and geological structure.

France—Frontier. Ann. G. 3 (1894): 183-200. Sopheau.

Les variations de la frontière Française des Alpes depuis le XVI^e Siècle. Par Pierre Sopheau. Avec une carte en couleur.

The map shows by different lines the position of the Alpine frontier of France as determined by treaties in 1500, 1601, 1631, 1713, 1760, and finally 1860.

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France—Le Liron. *B. S. Languedocienne G.* 16 (1893): 217-236. **Bourguet.**

Le Liron. Essai de monographie d'un Chainon des Bases Cévennes.
Par M. le Docteur Bourguet.

A neat monograph on a small but interesting mountain group.

Germany—Unstrutthal. *M. V. Erdk. Halle* (1893): 78-138. **Grössler.**

Führer durch das Unstrutthal von Artern bis Naumburg für Vergangenheit und Gegenwart von Prof. Dr. Hermann Grössler in Eisleben.
Zweiter Teil—Das untere Thal von Vitzsburg bis Grossjena.

Greece—Bœotia. **Grundy.**

The Topography of the Battle of Platœa; The City of Platœa; The Field of Leuctra. By G. B. Grundy, B.A. *With Maps and Plans.* London, John Murray, 1894. Size 10 × 6½, pp. 76. Price to Fellows of the R.G.S., 2s. 6d.; to others, 7s. 6d.

This is the first of the series of separate volumes which takes the place of the Supplementary Papers of the R.G.S. The work described was done for the Oxford Studentship in Geography in December 1892 and January 1893, and the memoir would have been read as a paper to the Royal Geographical Society but for the fact that it was impossible to reduce the matter to the dimensions of an hour's lecture without so far sacrificing the closeness of the argument as to deprive it of much of its value to the scholar and historian.

Holland. *Tijdschrift Nederlandsch Aardrijks. Genootschap* 9 (1892): 581-588. **Kuyper.**

Kaart van de Dichtheid der Bevolking van Nederland met toetichtenden Tekst door J. Kuyper. *With map.*

This note is in explanation of a large scale-map of density of population, which it supplements by tabulated statistics of the distribution of population in 1829, 1859, and 1889.

Hungary—Tatra. *M. G. Ges. Wien* 36 (1893): 473-527. **Behmann.**

Eine Moränenlandschaft in der Hohen Tatra und andere Gletscherspuren dieses Gebirges. Von Dr. Anton Behmann.

A study of the glaciation of the High Tatra, with a map showing the former extension of glaciers in that region.

Levant. **Bent.**

Early Voyages and Travels in the Levant. I. The Diary of Master Thomas Dallam, 1599-1600. II. Extracts from the Diaries of Dr. John Covel, 1670-1679. Edited, with an Introduction and Notes, by J. Theodore Bent, F.S.A., F.R.G.S., London. Printed for the Hakluyt Society, 1893. Size 9½ × 6½, pp. xiv. and 305. *Portrait. Presented by the Hakluyt Society.*

The present volume forms No. LXXXVII. of the Hakluyt Society publications. Both Dallam and Covel resided in Constantinople, and their diaries convey a good idea of the state of the country at the time of their visit. In his Introduction Mr. Bent gives some account of the Levant Company of Turkey Merchants.

Russia—Amber. *Petermanns M.* 39 (1893): 249-253. **Köppen.**

Vorkommen des Bernsteins in Russland. Von Fr. Th. Köppen.

An abstract of a large Russian memoir on the places where deposits of amber occur in Russia, with a map of European Russia showing the way in which amber deposits occur amongst the lower tertiary rocks from the Baltic to the Caspian, and from the Caspian, east of the Urals, to the Arctic Sea.

Russia—Industries. **Crawford.**

The Industries of Russia. Agriculture and Forestry, with coloured Maps . . . for the World's Columbian Exposition at Chicago. Editor of the English Translation, J. M. Crawford, U.S. Consul-General to Russia. Vol. iii. St. Petersburg, 1893. Size 10½ × 7, pp. xxxii. and 487.
Mining and Metallurgy, with a set of Mining Maps, by A. Heppen, etc. Vol. iv. St. Petersburg, 1893. Size as above, pp. ix. and 97.

These volumes complete the valuable treatise on Russian Industries compiled for the Chicago Exhibition, the other parts of which were noticed last month.

Russia—Steppes.**Dokuchaev.**

The Russian Steppes. Study of the Soil in Russia, its Past and Present, by V. V. Dokuchaev, Professor. Published by the Department of Agriculture Ministry of Crown Domains for the World's Columbian Exposition at Chicago. Editor of the English Translation, John Martin Crawford. St. Petersburg, 1893. Size 10½ × 7, pp. 61.

Russia—Volga.*Ausland* 66 (1893): 705-707, 726-728.**Gross.**

Die handelspolitische und volkswirtschaftliche Bedeutung der Wolga-Strasse im Sommer und Winter. Von Friedrich Wilhelm Gross (Dresden).

Sweden—Aaland Isles.*Globus* 65 (1894): 41-45, 64-67.**Deecke.**

Reiseerinnerungen von den Aalandsinseln. Von W. Deecke, Greifswald.

An account, with maps and illustrations, of the remarkable little archipelago of the Gulf of Bothnia.

ASIA.**Banka—Tin-Mines.***Monatschrift für den Orient* 19 (1893): 125-129.**Zelle.**

In der Zinnbergwerken der Insel Banka. Von L. J. Zelle.

Captain Zelle, of the Dutch East Indian army, here gives a practical description of the great tin-mining operations carried on in the island of Banka, the richest store-house of that metal in the world.

India—Calcutta.*J. Asiatic S., Bengal*, 62 Pt. 1. (1893): 104-127.**Wilson.**

The Topography of Old Fort William. By C. B. Wilson.

Mr. Wilson succeeded by means of a copy of an old plan of Fort William preserved in the British Museum in tracing out the remains of the old Fort in the excavations recently made for the foundations of new Government offices between the General Post Office and the Custom House in Calcutta. The identification of sites appears to be correct.

India—Petroleum.*J. S. Arts* 42 (1894): 145-156.**Oldham.**

The Petroleum Fields of India: Their Present Condition and their Probable Future. By R. D. Oldham, Superintendent Geological Survey of India.

A comprehensive description of the resources of India in petroleum, accompanied by a sketch-map showing the position of the several fields.

Indo-China.**Orléans.**

Autour du Tonkin, par Henri-Ph. d'Orléans. Paris, Calman Lévy, 1894.

Size 9½ × 6½, pp. iv. and 650. Price 7 fr. 50 c. *Maps and Illustrations.*

The title hardly indicates the scope of this book, which recounts a journey from Hongkong to Bangkok through Tonkin. It contains a series of itineraries and lists of natural history collections in an appendix. The narrative and a chapter on the future expansion of Tonkin are written from the standpoint of French interests, which Prince Henry has much at heart.

Luchu Islands.*T. Asiatic S. Japan* 21 (1893): 271-289.**Chamberlain.**

On the Manners and Customs of the Loochooans. By Basil Hall Chamberlain.

A light essay descriptive of a visit to the Luchu Islands, *The Land of Propriety*, according to native sentiment, and a country of rare climatic and economic advantages.

Malay Archipelago, Damma.*J. Anthropological I.* 23 (1893): 134-141.**Bassett-Smith.**

Damma Island and its Natives. By P. W. Bassett-Smith, Surgeon, R.N. *Plates.*

Damma Island, in the Banda Sea, is one of the Serwati group, and has rarely been visited. A summary of the paper appears elsewhere in the *Journal*.

Oxus.*Ausland* 66 (1893): 657-662.**Komischke.**

Die Hydrographie des Oxus Beckens. Von W. Komischke, Berlin.

A discussion of Blanc's observations on the Aral-Caspian depression in its relation to the controversy as to the early condition of that region.

- Sikkim.** *Kew B.* Nos. 82-83 (1893): 297-315. **Gammie.**
 Botanical Exploration of Sikkim-Tibet Frontier (in a letter from Mr. G. A. Gammie).
 Mr. Gammie travelled through Sikkim and on the Tibetan frontier during 1892, and, in addition to his botanical observations, records many interesting geographical and ethnological facts. An abstract of his journey will appear in the Monthly Record.
- Sumatra—Battaks.** **Modigliani.**
 Fra i Batacchi Indipendenti. Viaggio di Elio Modigliani pubblicato a cura della Società Geografica Italiana in occasione del primo Congresso Geografico Italiano. Rome, 1892. Size 10 × 6½, pp. 192. *Maps and Illustrations.* Presented by the Italian Geographical Society.
 Signor Modigliani particularly studied the Battaks in the neighbourhood of the great Lake Toba, and gives an account, with many illustrations, of the mode of life and industrial arts.
- Syria.** *T. S. Biblical Archaeology* 9 (1893): 227-254. **Tomkins.**
 On the Topography of Northern Syria, with special reference to the Karnak Lists of Thothmes III. By Rev. Henry George Tomkins (4 plates).
 Identification of names in the Orontes and Euphrates valleys with those inscribed on the ruins of Karnak in commemoration of the victories of Thothmes III.
- Turkey in Asia.** **Cuinet.**
 La Turquie d'Asie. Géographie administrative, statistique, descriptive et raisonnée de chaque Province de l'Asie-Mineure, par Vital Cuinet. Tome Troisième, Fascicule 8. Paris, E. Leroux, 1893. Size 11 × 7½.
 The value of this authoritative compilation of statistics regarding the Turkish Empire has been frequently referred to in announcing the publication of its successive parts.
- Yezo.** *T. Asiatic S. Japan* 21 (1893): 198-240. **Batchelor and Mizabe.**
 Ainu Economic Plants. By Rev. John Batchelor and Dr. Kingo Mizabe. Part I. Ainu Medicinal Plants.
 A list of 137 plants variously applied by the Ainu in cases of illness or injury.

AFRICA.

- Algeria.** **Field.**
 The Barbary Coast. By H. M. Field, D.D. New York, Charles Scribner's Sons, 1893. Size 8½ × 6, pp. ix. and 258. *With fourteen Illustrations and a Sketch Map.*
 The latest of an interesting series of geographical works by the author, brother of the illustrious Cyrus Field. In this, as in his other journeys, Dr. Field never went beyond beaten paths of travel, but he has the merit of having something new and fresh to say of every place he visits. His accuracy and justice are such as are rare in ordinary *impressions de voyage*. The contents of all the author's volumes originally appeared as letters to the *Evangelist*, a New York paper, of which he is proprietor.
- Mashonaland.** *P. Philosophical S. Glasgow* 24 (1893): 29-50. **Swan.**
 The Geography and Ethnology of Mashonaland, with a brief account of the Ruins of Zimbabwe. By Robert M. W. Swan.
- Morocco.** *J. S. Arts* 42 (1894): 157-160. **Rolleston.**
 Morocco and its Races. By Charles Rolleston.
- Somaliland.** *B.S.G. Italiana* 6 (1893): 7-30, 184-204, 294-312, 510-538, 632-680. **Vesme and Candeo.**
 Un' escursione nel Paradiso dei Somali. Relazione dei signori cap. Enrico Baudi di Vesme e Giuseppe Candeo.
 The travellers left Berbera in February 1891, and give a very detailed account, with a map on the scale 1 : 1,000,000 and many illustrations, of their journey southward to Imé on the Webi, which was reached on April 21, and thence by a different route north-westward to Harar, reached on May 23, and Zeila, where the trip ended on June 16.

- West Africa.** *J. Manchester G. S.* 9 (1893): 28-44. **Halligey.**
The Yoruba Country, Abeokuta and Lagos. By the Rev. J. T. F. Halligey.

A fresh and lively account of the regions described from the personal experience of the author as a missionary.

- West Africa, Boundaries.** *Deutscher Kolonialblatt* 4 (1893): 531-534. ———

Abkommen zwischen Deutschland und England über die Abgrenzung der beiderseitigen Interessensphären in dem vom Golf von Guinea nach dem Innern sich erstreckenden Gebieten vom 15 November 1893.

This is the text, in German and English, of the new agreement, with a large-scale map showing the boundary line.

NORTH AMERICA.

- Canada—Assiniboine.** *T.R.S. Canada* 10 (1893): *sect. ii.*, 69-78. **Bryce.**

The Assiniboine River and its Forts. By George Bryce, LL.D.

The history of the fur-traders' forts on the Assiniboine River goes back for one hundred and fifty years, and Dr. Bryce here puts together the principal facts which can be recovered. A map of the river is given showing the sites of the principal forts.

- Canada—Athabasca.** **McConnell.**

On a portion of the district of Athabasca, comprising the country between Pease River and Athabasca River. By R. G. McConnell. Pp. 68. Ottawa, 1893.

Report D in vol. v. of the new series of Canadian Geological Survey Reports. An area of 44,000 square miles of utterly unexplored territory was first visited by Mr. McConnell and described in his report. The country generally was an undulating, wooded plain, diversified with very numerous small lakes. The report is illustrated by maps, views, and sections.

- Canada—Manitoba, etc.** **Tyrrell.**

Report on North-Western Manitoba, with portions of the adjacent districts of Assiniboia and Saskatchewan. By J. B. Tyrrel, M.A., B.Sc. Ottawa, 1892. Pp. 236.

This is Report E of vol. v. of the Reports of the Canadian Geological Survey. It is illustrated by several views and sections, and accompanied by two maps, contoured at intervals of 100 feet, and showing the physical character of the region with remarkable effect. One map is coloured geologically; the other to bring out the distribution of forests, distinguishing continuous wood, isolated trees, burnt forest, and prairie lands.

- Canada—Nova Scotia.** *T.R.S. Canada* 10 (1893): *sect. ii.*, 79-107. **Patterson.**

Sir William Alexander and the Scottish Attempt to Colonize Acadia. By the Rev. George Patterson, D.D.

An interesting chapter in the early history of Nova Scotia.

- Canada—Sudbury.** **Bell.**

Report on the Sudbury Mining District. To accompany Sheet 130, Series of geologically coloured maps of Ontario. By Robert Bell, M.D., etc. 1888-90. Ottawa, 1891. Pp. 96.

This is Report F of the Canadian Geological Survey Reports, vol. v. (1893), published by Dr. A. R. C. Selwyn, Director.

- United States—Dakota.** **Finley.**

Certain Climatic Features of the Two Dakotas, illustrated with one hundred and sixty-three Tables, Charts, and Diagrams. By John P. Finley. Washington, 1893. Size 12 × 9½, pp. 204.

This Report contains a comprehensive collection of meteorological and climatological data bearing on North and South Dakota. The records include the year 1891. Among the results deduced from the present investigation may be mentioned—The

Dakotas must resort to an extensive system of irrigation; forests must be preserved and extensive reforestation adopted; the snowfall is too light and the winds are too heavy to secure from this form of precipitation much, if any, protection to crops; the occurrence of drought in the Dakotas bears such a close relation to the distribution of atmospheric pressure over the north-central portion of the United States that it becomes an inevitable result unless obviated through the intervention of artificial influences.

United States—Indiana. *U.S. Geol. Survey, XI. Report, pt. i.* (1891): 579-742. **Phinney.**

The Natural Gas Field of Indiana. By Arthur John Phinney.

Mr. W. J. McGee gives a brief and picturesque account of "the conquest of the bitumens," or the commercial utilization of the hydrocarbons of the Earth's crust; and Dr. Phinney follows with a detailed description of the natural gas wells of Indiana, and the geological character of the various borings. The memoir, like almost all those of the U.S. Geological Survey, is a model of clear statement.

United States—Iowa. *U.S. Geol. Survey, XI. Report, pt. i.* (1891): 199-567. **McGee.**

The Pleistocene History of North-Eastern Iowa. By W. J. McGee.

This fine report contains a detailed account of the topography of the district and a profound study of the changes which the surface has undergone in assuming its present form. Mr. McGee worked as an amateur, and for nearly twenty years studied the district which he describes. The monograph is very richly illustrated with maps and photographs, the latter delineating with remarkable success the salient features of the scenery of the country.

United States—Local Government.

Bemis and Haynes.

Johns Hopkins University Studies. Eleventh Series, XI, XII. Local Government in the South and the South-west. By Prof. Edward W. Bemis, Ph.D., and others. Popular Election of U.S. Senators. By John Haynes. Baltimore, the Johns Hopkins Press, 1893. Size $9\frac{1}{2} \times 6$, pp. 118.

CENTRAL AND SOUTH AMERICA.

Brasil.

Steinen.

Unter den Naturvölkern Zentral-Brasiliens. Reiseschilderung und Ergebnisse der Zweiten Schingü-Expedition, 1887-1888. Von Karl von den Steinen, Prof. Dr. Mit 30 Tafeln . . . sowie 160 Text-Abbildungen nach den Photographien der Expedition, nach den Originalaufnahmen von Wilhelm von den Steinen und nach Zeichnungen von Johannes Gehrts nebst einer Karte von Prof. Dr. Peter Vogel. Berlin, Dietrich Reimer, 1894. Size $10\frac{1}{2} \times 7$, pp. xvi. and 572.

The author describes the savages of Central Brazil on the river Cuyaba, particularly the Bakairi and the Bororo.

Chile.

Anrique.

Diario del Comandante Benjamin Muñoz Gamero a los lagos de Llanquihue, Todos-Santos y Nahuelguapi, en 1849. Publicado con una introducción biográfica por Nicolas Anrique R., Valparaiso, 1893. Size $9 \times 6\frac{1}{2}$, pp. 58.

Colombia.

Peter.

W. Reiss und A. Stübel: Reisen in Süd-Amerika, Geologische Studien in der Republik Colombia, III. Astronomische Ortsbestimmungen bearbeitet von Bruno Peter. Berlin, A. Asher & Co., 1893. Size 13×10 , pp. xxii. and 327. *Presented by the Author.*

This valuable work will ultimately be reviewed as a whole.

Paraguay.

M. G. Ges. Wien. 36 (1893): 627-655.

Jordan.

Ueber meine Reisen in Paraguay von Dr. Paul Jordan.

A general account of scientific excursions in Paraguay during 1888 and 1889.

Peru.

Middendorf.

Peru, Beobachtungen und Studien über das Land und seine Bewohner während eines 25-jähriger Aufenthalts von E. W. Middendorf. I. Band,

Lima. Mit 21 Textbildungen und 32 Tafeln. Berlin, Robert Oppenheim, 1893. Size $10\frac{1}{4} \times 7$, pp. xxxii. and 640. *Presented by the Publisher.*

This volume commences with a long historical chapter, and then considers modern Lima with reference to the town itself, the people, churches, government buildings, legal and educational institutions, commercial relations, hospitals and charities, and amusements. The various sections are handled in such a way as to throw light on many Peruvian interests which are of a more general character than the title of the volume would lead one to expect.

Porto Rico. *Tour du Monde* 63 (1893): 417-432. **Claine.**
Porto Rico. Par M. J. Claine.

A visit to Porto Rico in 1892, with numerous well-chosen illustrations.

AUSTRALASIA AND PACIFIC ISLANDS.

Kei Islands. *Tijdschrift Nederlandsch Aardrijks. Genootschap* 9 (1892): 619-653. **Planten.**
Die Ewaf of Key-Eilanden. Door H. O. W. Planten.

Lieutenant Planten gives a detailed description of his observations on the Kei Islands off the coast of New Guinea, illustrated by a large scale reproduction of the Dutch Admiralty Chart of the group on the surveys for which he was engaged.

Australian Language. **Threlkeld and Fraser.**

An Australian Language as Spoken by the Awabakal, the People of Awaba or Lake Macquarie (near Newcastle, New South Wales), being an Account of their Language, Traditions, and Customs. By L. E. Threlkeld. Rearranged, condensed, and edited, with an appendix, by John Fraser, B.A., LL.D. Sydney, Charles Potter, 1892; size $8\frac{1}{2} \times 5\frac{1}{2}$, pp. lxiv., x., 228, and 148. *Presented by Dr. A. Reunick, Commissioner for New South Wales at the World's Columbian Exposition, Chicago.*

This is a curiously-paged work, broken up also by apparently objectless supplementary title-pages in the midst of continuous pagination; but, although lacking in the externals of literary form, it is of much value as a complete statement of one of the aboriginal languages of Australia now practically extinct. The linguistic part contributed by Mr. Threlkeld, who worked at the subject from 1827 to his death in 1859, consists of a grammar and vocabulary of the Macquarie Lake tribes, together with a translation of the Gospel of St. Luke, and a glossary to it. The appendix by Dr. Fraser gives a series of grammars and vocabularies of other tribes, including the Minyung, Narrinyeri (South Australia), Wiridari, a West Australian dialect, and others.

Western Australia—Year-Book. **Fraser.**

Western Australian Year-Book for 1892-93. By Malcolm A. C. Fraser. Perth, 1893; size $8\frac{1}{2} \times 5\frac{1}{2}$, pp. viii. and 275.

This edition (the seventh) of the 'Western Australian Year-Book' has been considerably enlarged. Special attention has been given to the short 'History of the Discovery and First Settlement of the Colony.' A new map has been added showing the land divisions, goldfields, stock routes, agricultural areas, steam and mail routes, railways open and in course of construction, telegraphs, lighthouses, water-holes, rainfall, and other features of interest.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Alpine Climate. *Z. Deutschen Oesterreichischen Alpen-V.* 24 (1893): 21-51. **Brückner.**
Ueber den Einfluss der Schneedecke auf das Klima der Alpen. Von Eduard Brückner. *Also a separate copy, presented by the Author.*

A valuable climatological paper, which will be noticed elsewhere.

Bay of Biscay—Currents. *B.S.G. Com. Bordeaux* 16 (1893): 555-561. **Hautreux.**
Golf de Gascogne—Courants. Par M. Hautreux.

An account of further experiments by means of floats in the Bay of Biscay.

Geodesy.

Comptes-Rendus des séances de la Dixième Conférence Générale de l'Association Géodésique Internationale et de sa Commission Permanente

réunies a Bruxelles du 27 Septembre au 7 Octobre, 1892, rédigés par le Secrétaire perpétuel A. Hirsch. Berlin, G. Reimer, 1893. Size $11\frac{1}{2} \times 9$, pp. 695. *Maps and Plates.*

Contains a map of Europe showing the main lines of triangulation connecting different countries.

Gulf Stream.

Thoulet.

M. J. Thoulet. *Les Courants de la Mer et le Gulf-Stream.* [Reprint from the publication of the French Association for the Advancement of Science.] 1893. Size $9\frac{1}{2} \times 6$, pp. 14. *Presented by the Author.*

Ice Age.

Wallace.

The Ice Age and its Work. Part I. By A. R. Wallace, F.R.S. [From *The Fortnightly Review*, November, 1893, pp. 616-633.]

Lake and Sea Levels.

Brückner.

Über Schwankungen der Seen und Meere, Ein Vortrag gehalten auf dem IX. Deutschen Geographentage in Wien im Jahre 1891, von Prof. Dr. Ed. Brückner. Berlin, W. Formetier, 1891. Size $9\frac{1}{2} \times 6\frac{1}{2}$. *Presented by the Author.*

A paper on the variation of lake and sea levels.

Maize Distribution.

Harshberger.

Contrib. Botanical Lab. Univ. Pennsylvania 1 (1893): 75-202.

Maize: a Botanical and Economic Study. By John W. Harshberger, PH.D.

From a variety of considerations drawn from meteorology, botany, archaeology, ethnology, philology, and history, the author satisfies himself that maize is of Mexican origin; but he does not seriously consider the reasons in favour of the plant being indigenous also to Asia and Africa, this part of the work being dismissed in a page and a half. Geographical distribution is also briefly considered, and the map illustrating this section refers only to the American continents. The economic aspect of the use of maize is also treated, and the States of North America classified according to their productivity. It appears that seven "corn-surplus states," viz. Ohio, Indiana, Illinois, Iowa, Missouri, Kansas, and Nebraska, supply almost all the maize that enters commercial channels.

Mankind.

Büchner.

The Origin of Mankind. By Professor Ludwig Büchner. [From *The Fortnightly Review*, January, 1894, pp. 74-82.]

Mountains.

Z. Deutschen Oesterreichischen Alpen-V. 24 (1893): 375-403.

Simon.

Alpine Plaudereien eines Kartographen. Von S. Simon.

In a light and racy strain this Alpine gossip conveys many suggestive facts of mountain relief and geographical forms.

North Sea.

Jukes-Browne.

The Geographical Evolution of the North Sea. By A. J. Jukes-Browne. [From *The Contemporary Review*, November, 1893, pp. 704-712. *Maps.*]

Oceanography.

Walther.

Allgemeine Meereskunde. Von Johannes Walther. Leipzig, J. J. Weber, 1893. Size $7\frac{1}{2} \times 5$, pp. xvi. and 296. *Price 4s. 6d.*

This little book, illustrated by seventy-two blocks and a map, is an attempt to deal systematically with the main outlines of oceanography. It is divided into twenty-five sections, treating of the forms of the sea-bed and its changes, wave-action, the temperature, salinity, colour, and circulation of the water, ice-drift, marine fauna and flora, deposits, islands, and island-life. A short list of books given at the end is very incomplete, especially with regard to English works. The space devoted to plants and animals appears to be somewhat out of proportion in a general work, and it contains an undue share of the illustrations.

River Systems. *Ann. G.* 2 (1893): 1-10, 296-305; 3 (1894): 138-149.

Dubois.

L'Hydrographie des Eaux douces. Méthodes employées pour l'étudier. Recherche d'une meilleure classification. Par Marcel Dubois.

The conclusions of this discussion will be summarized in the Monthly Record.

Tables.

[Curtis].

Smithsonian Meteorological Tables. [Based on Guyot's Meteorological and Physical Tables.] Smithsonian Miscellaneous Collections, 844. Washington, Smithsonian Institution, 1893. Size 10 × 6½, pp. lx. and 262. Presented by the Smithsonian Institution.

In a preface Mr. S. P. Langley explains that this volume will be followed by a volume of Geographical Tables and another of Physical Tables, completing a recast of Dr. Guyot's original work, which is too well known to require recommendation.

Zoogeography.

Simroth.

Nova Acta Leop.-Carol. Deutschen A. Naturforscher 61 (1891): 201-424. Die Nacktschnecken der portugiesisch-azorischen Fauna in ihrem Verhältnis zu denen der paläarktischen Region überhaupt. Von Dr. Heinrich Simroth in Leipzig. Mit. 10 Tafeln.

In the course of his studies of the slugs of the Azores, Dr. Simroth made some geological, meteorological, and hypsometrical observations, which are given as an introduction to the paper. The plates include a map of the distribution of snails in Europe, and four maps of the distribution of different families of land molluscs over the world.

GENERAL.

Biography—Vogel. *Deutsche Rundschau* G. 15 (1893): 569-572. Holetschek. Professor Dr. Hermann Karl Vogel. Von Dr. J. Holetschek. With portrait.

Biography—Von Hauer. *Deutsche Rundschau* G. 16 (1893): 86-88. Umlauf. Franz Ritter v. Hauer. Von Fr. Umlauf. With portrait.

Historical—Maps. *Z. Ges. Erdk. Berlin* 23 (1893): 167-200. Schumacher. Olaus Magnus und die ältesten Karten der Nordlande. Von Hermann A. Schumacher.

This was the last work of the author, who died before completing it for press. It was summarized in the *Journal* for February, p. 149.

Strabo's Geography.

Tozer.

Selections from Strabo, with an Introduction on Strabo's Life and Works. By the Rev. H. F. Tozer, M.A. Oxford, Clarendon Press, 1893: size 9 × 6, pp. xii. and 376. With maps and plans. Presented by the Delegates of the Clarendon Press.

This little book is deserving of special notice.

Travel.

Freshfield and Wharton.

Hints to Travellers, Scientific and General. Edited for the Council of the Royal Geographical Society by Douglas W. Freshfield and Captain W. J. L. Wharton. Seventh edition. Revised and enlarged. London, The Royal Geographical Society, 1893: size 7 × 5, pp. 500. Plates. Price 8s. To Fellows 5s.

The revision to which this well-known work has been subjected has kept it up to date in all particulars, and various important additions have been made.

Travelling. *B.S.R.G. d'Anvers* 18 (1893): 47-112.

De Keyser.

Le Tour du Monde au XX^me Siècle. Les Voyages dans l'Avenir. Par M. l'ingénieur Emile De Keyser.

This has been summarized in the *Journal* for February, p. 146.

NEW MAPS.

By J. Coles, Map Curator, R.G.S.

EUROPE.

Adelsberg.

Martel.

Übersichtsskizze der Umgebung von Adelsberg und Planina. Zur Veranschaulichung des unterirdischen Laufes der Flüsse Poik und Unz. Nach den Untersuchungen v. Schmidl, Kraus, Putick, Martel u. A. 1850-1893, entworfen von C. A. Martel, 1893. Scale 1: 180,000 or 27 stat. miles to an inch.—Der Unterirdische Lauf der Poik Flusses bei Adelsberg in

Krain. Nach den Arbeiten von Schmidl 1850-53, Kraus u. Szombathy, 1835, Putick 1886-88, Kraigher, Dietrich, Schäberu. A. seit 1890 dem neuen Grottenplane v. Schmid, 1892, und den neuesten Anfnahmen von Martel, 1893. Zusammengestellt von C. A. Martel. *Peternann's Geographische Mitteilungen*, Jahrgang, 1894, Tafel 2. Gotha: Justus Perthes. *Presented by the Publisher.*

Austro-Hungary.**Artaria.**

Artaria's Eisenbahn—u. Post-Communications—Karte v. Oesterreich-Ungarn, 1894. Scale 1 : 1,700,000 or 26·8 stat. miles to an inch. Wien: Artaria & Co. *Price 1 fl. Presented by the Publishers.*

On this map all lines of railway in Austro-Hungary are laid down, and are easily distinguished from one another by the manner in which they are coloured. The distances between stations are given in kilometres, and the map is in all respects well suited for the use of tourists.

England and Wales.**Ordnance Survey.**

Publications issued since January 12, 1894.

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ENGLAND AND WALES:—Sheets, 232, 312, 313, 324, engraved in outline, 233, 272. Hills engraved in black or brown, 148, 189, 191, 223, 224, 328, 329. Hills photozincographed in brown, 1s. each.

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25-inch—Parish Maps :—

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Town Plans—10-foot scale :—

Plymouth (Devonshire), CXXIII. 7, 13, 14, 15; CXXXIII. 8, 11, 20, 25, revised, with houses stippled, 2s. 6d. each. Index is not yet published.

Town Plans—5-foot scale :—

Ashton-under-Lyne and Stalybridge (Revision) V. VI. VII, with houses stippled, 2s. 6d. Index is not yet published.

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Sweden.**Sveriges Geologiska Undersökning.**

Sveriges Geologiska Undersökning. Scale, 1 : 50,000 or 1·3 inches to a stat. mile. Sheets: "Glimåkra" and "Simrishamn."—Sveriges geologiska Undersökning. Scale, 1 : 100,000 or 1·5 stat. miles to an inch.

Sheets: "Varberg," "Nyåla," "Lönhofda."—Geologisk Jordartskarta öfver Hallands Län med bidrag af länets Hushållningssällskap utgifven af Sve iges Geologiska Undersökning. Tryckt på underlag af generalstabens topografiska karta i skalan 1: 100,000 or 1·5 stat. miles to an inch.—Agronomiskt Geologisk Karta öfver Torreby i Fosa socken, Bohus län upprättad år 1889 af J. Jönsson. Scale 1: 15,000 or 4·2 inches to a stat. mile. Sveriges geologiska Undersökning, Stockholm. *Presented by l'Institut Royal Géologique de Suède.*

AFRICA.**Natal.**

Superintendent Inspector of Schools, Natal.

Map of the Colony of Natal, drawn in the office of the Superintendent Inspector of Schools, 1893. Scale 1: 385,000 or 60·1 stat. miles to an inch. Stanford's geographical Establishment, London. 4 sheets, Price £1 4s.

This is a general map of the Colony of Natal, on which all means of communication, counties, electoral divisions, mission stations, battle-fields, etc., are laid down. At the foot of the map a section is given showing the mileage and altitudes of all the stations on the main line of railway between Durban and Charleston. This map supplies a want that has been greatly felt, as no good general map of Natal, on a sufficiently large scale, has been previously published.

South-West Africa.

Pfeil.

Joachim Graf Pfeil's Reise im Deutsch-Englischen grenzgebiet Südwest-Afrikas, 1892. Nach den Aufnahmen des Reisenden sowie mit Benutzung aller anderen Quellen, entworfen von Paul Langhans. Scale 1: 500,000 or 7·8 stat. miles to an inch. Petermann's Geographische Mitteilungen, Jahrgang 1894. Taf 1. Gotha: Justus Perthes. *Presented by the Publisher.*

AMERICA.**Facsimile Maps.**

Marcel.

Reproductions de Cartes et de Globes relatifs a la Découverte de l'Amérique du XVI^e au XVII^e Siècle avec Texte Explicatif par M. Gabriel Marcel. Paris: Ernest Leroux, Editeur, 1893.

This atlas contains forty photographic reproductions of maps having some relation to the discovery of America, and is intended as a contribution to the celebration of the fourth centenary of the discovery of America. The originals from which the photographs have been taken are at the present time in one or other of the French Government collections, and date from the sixteenth to the eighteenth century. The series is a most interesting and well-chosen one, and contains the following maps: Globe Vert; Mappemonde de Caneiro; Carte de Viegas; Plan de Manathie ou Nouvelle-York; Carte de l'Amérique Septentrionale; Mappemonde de 1502; Plan de Québec; Brésil Français, par J. de Vaux de Claye; Carte de la Guyane, par de Préfontaine; Plan de Villmarie ou Montréal; Embouchure du Mississipi, Amérique Septentrionale, Cours du Marañon, par le P. Fritz; Rio de la Plata, par J. Ramon; Globe doré; Plan de Boston; Perou; Louisiane; Cours du Tocantins; Les Découvertes de Jolliet; Planche de l'Atlas de Le Testu; Lac Supérieur; La Manitoumie; Carte de Gutierrez; La Nouvelle-Orléans; Les grands Lacs; Les Découvertes de La Verenderye; Le lac Champlain; Cours du Mississipi; Amérique méridionale.

The maps are accompanied by explanatory notes by M. Gabriel Marcel, in which an interesting account of each map is given, together with remarks on the discovery and progress of exploration in the country represented. These maps, having been produced by heliogravure, are exact reproductions of the originals, except in certain cases where the scale on which the originals are drawn has necessitated a reduction being made. Where this has been done it is mentioned in the letterpress, together with the scale of the original from which it has been reduced. Taken as a whole these maps form a most interesting series, and the atlas is a valuable addition to the Society's collection.

GENERAL.**Historical Geography.**

Schrader.

Atlas de Géographie Historique, ouvrage contenant 54 grandes Cartes double en couleurs, accompagnées d'un Texte Historique au dos et d'un grand nombre de Cartes de Détail, Figures, Diagrammes, etc. Par une Réunion de Professeurs et de Savants sous la direction géographique de F. Schrader, Directeur des travaux cartographiques de la librairie

Hachette et C^o. Paris: Librairie Hachette et C^o. Part 4. *Price 1 fr. 50 c. Presented by the Publishers.*

The following are the maps which the present issue of this atlas contains:—Italy at the time of the Roman Republic, the divisions of Europe under the Franks, Turkey and Poland at the time of the eighteenth century. As usual, with this atlas, the maps are accompanied by well-written historical notes, which also contain plans of battles, small maps, and plans of towns.

Oceans.**Schott.**

Übersichtskarte der Reisewege von Dr. G. Schott nach den Ostasiatischen Gewässern, 1891-92. Karte des Salzgehaltes an der Oberfläche des Südatlantischen Ozeans. Nach den Beobachtungen von Buchanan (1873-76), von Schleinitz (1874-76), Makaroff (1886), S.M.S.S. "Moltke" und "Marie" (1882-83), nach Toynbee (London, 1882) und auf grund eigener Messen (1891-92), entworfen und gezeichnet von Dr. Gerhard Schott, 1893.—Ostasiatische Gewässer. Linien gleichen Salzgehaltes an der Meeresfläche, von 0, 5-0, 5°/00. Nach den Beobachtungen des "Challenger," der "Gazelle," der "Vega," des "Witjas," anderen Schiffen, sowie auf grund eigener Messungen, entworfen und gezeichnet von Dr. Gerhard Schott, 1893. Petermann's Geographische Mittheilungen. Ergänzungsheft No. 109, Tafel 3. Gotha: Justus Perthes. *Presented by the Publishers.*

The World.**Johnston.**

W. and A. K. Johnston's Royal Atlas of Modern Geography. Edition in Monthly Parts. Part 28. W. and A. K. Johnston, Edinburgh and London. *Price 4s. 6d. each part. Presented by the Publishers.*

This is the concluding part of the new edition of this excellent atlas, and contains a map of the world on Mercator's projection, on which ocean currents, and routes of steam navigation, together with the distances between the principal ports, are shown, as well as maps of North-West and Central Africa, and a North Pole Chart, the preface and list of contents. The present edition has been more than two years in course of publication, and the maps it contains have been thoroughly revised and brought up to the date at which they were published. Many important additions have also been made in the form of new maps, inset maps, plans, etc.; and as it now stands, both as regards the style in which the maps have been produced, and its general accuracy, it is probably the best atlas of political geography that has been published in this country.

World.**Kiepert.**

Kiepert's grosser Hand-Atlas. Neue Lieferungs-Ausgabe in 45 Karten. Ausgabe in 9 Lieferungen à 5 Karten mit statistischem Material und Namen-Verzeichnis mit Bevölkerungsziffern zu jeder Karte. Dritte, im Zeichen-Institut der Verlagshandlung unter Leitung von Dr. R. Kiepert theils vollständig neu bearbeitete, theils gründlich berichtigte Auflage. Berlin, 1893. Geographische Verlagshandlung Dietrich Reimer. Inhaber: Hofer & Vohsen. Part V. *Price of each part 4 marks. Presented by the Publishers.*

Part V. contains No. 14, Bohemia, Moravia, and Austria; No. 15, The Eastern Alps; No. 16, Switzerland; No. 17, Italy; and No. 29, Greece. Each map is accompanied by descriptive letterpress and an index.

The World.**Vidal-Lablache.**

Atlas Vidal-Lablache, Maitre de Conférences de géographie à l'École Normale Supérieure. Histoire et Géographie, 137 Cartes, 248 Cartons. Index Alphabétique de plus de 40,000 noms (L'Atlas complet paraîtra en 24 livraisons) 22^e livraison. Paris: Armand Colin et C^o, Editeurs. *Price 1 fr. 25 c. each part.*

The present issue contains maps of Madagascar, Northern and Central Africa, a Physical Map of America, the Western portion of the United States, Central and Eastern portion of the United States, and a Geological Map of North America, in addition to which notes are given at the foot of each map.

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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APRIL, 1894.

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The

Geographical Journal

INCLUDING THE PROCEEDINGS OF THE ROYAL GEOGRAPHICAL SOCIETY.

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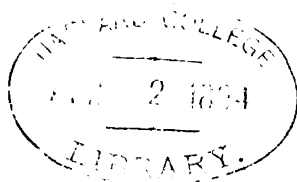
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ACROSS ICELAND.

By KARL GROSSMANN, M.D., F.R.C.S.E.*

It may appear, at first glance, a superfluous task to lay before this Society an account of a journey in Iceland, comprising, as it does to a great extent, ground that has been traversed before. Accounts of Icelandic travelling are by no means scanty; indeed, it almost looks as though a visit to Iceland is necessarily followed by a more or less violent attack of the *furor scribendi*, a complaint from which usually not even those escape who—as Sir Richard Burton somewhat disrespectfully expresses it—have only “done the cockney trip to the Geysirs,” and possibly to Hekla. If in spite of this I think it worth while to bring forward my own experiences, I am led by the following considerations.

First of all, the abundance of interesting physiographical features which Iceland presents is surprising. These are, however, not always accessible, and even the most careful and able observer may miss what another traveller can hardly fail to notice without any effort under more favourable conditions. A great deal has to be left to chance, and under this chapter the weather plays an important part. You may plan a route, with every detail carefully thought out beforehand, and if that one factor, the weather, be unfavourable, you may find yourself taking a direction almost opposite to the one originally arranged. Large tracts of the country may be covered by snow, rivers may be unfordable, heathies turned into bogs, no grass may be found for the horses, clouds may hide the mountains, fogs cover the plateaux; all these obstacles, and others

* Paper read at the Royal Geographical Society, January 29, 1894. Map, p. 356. Figs. 4, 5, 8, and 9 are given by kind permission of the editor of the *Glacialists' Magazine*.

besides, may prevent a satisfactory survey of the parts through which your journey leads you. Hence it is not difficult to see why our knowledge of Iceland is still very fragmentary.

Furthermore, good pictorial representations of Iceland are not plentiful. Any one who examines the illustrated publications on Iceland will find them to contain either very few illustrations, or very incorrect ones, or reproductions of old time-honoured woodcuts, often copied secondhand, and mostly without acknowledgment. Under these circumstances, I think any real addition to our knowledge of Iceland will be welcome.

As for the physical features, there is, to my mind, no better mode at our disposal for taking down notes than photography. True, it cannot always be used, it is not even always unbiassed; but, wherever applicable, we have in it a means of recording an almost unlimited amount of detail with complete accuracy.

It has, therefore, been my endeavour to note down any observations in Iceland, as far as possible, through the medium of the camera, and in spite of very adverse circumstances the result has been thoroughly satisfactory.

The journey which I undertook in company with Dr. Cahnheim, of Dresden, who had visited Iceland three years previously, was signalized by an almost unprecedented spell of bad weather. Of that vaunted clearness of atmosphere, so deceptive with regard to the estimation of distances, I saw nothing; on the contrary, I doubt whether an English summer landscape is often veiled in a bluish haze such as constantly enshrouded Icelandic scenery while we were there. Moreover, the temperature was truly arctic. From my companion's previous experience, and from all known accounts, we had prepared ourselves for a pleasant summer temperature, somewhat like that of the Scottish Highlands. In reality we found an everlasting north wind, opposing our progress northwards with unrelenting force for three weeks, chilling us to the bone, once actually compelling us to stop for three days in the wretched though hospitable farm of Stathir, on the Hrutafjörður. On our way back the wind changed, and, though warmer, still with equal ferocity blew into our faces; once to such a degree that we could not put up our tent, and had no other choice but to urge on our poor horses for twenty-one hours at a stretch.

On June 13, 1892, our steamer came in sight of the Vestmannaeyjar, and landed some passengers at Heimaey, the largest of this cluster of islets, the only one with a settlement; the others are inhabited by numberless sea-birds, and give pasture to sheep.

Although so late as June, the signs of spring had not appeared in Iceland when we arrived at Reykjavik (June 14). The country was in a deplorable state. There was hardly any grass out yet, and the prospects for a journey across country were very depressing. The sun,

very powerful in fine weather, was hidden by heavy clouds which veiled even the lowest hills; of the mountain Esja nothing could be detected, and, although there was no night, neither was there any real bright day.

One particular feature struck me from the first day when we visited the nesting eider duck on the little isle of Engey, opposite Reykjavík—I mean the peculiar hillocks which are seen in Iceland wherever grass grows to any extent (Fig. 1). These mounds have a height of between 1 and 2 feet, and are usually covered by the best grass. Such parts are naturally selected as farmsteads; hence almost all the farms are surrounded by an area studded with low hillocks, over which walking is



FIG. 1.—GRASS HILLOCKS AT SILFRASTATHIR ON THE FIJERATHSVATHN.

as fatiguing as riding is dangerous. The Icelanders, unpractical beyond conception, never dream of levelling these mounds; when ready, the grass can only be cut with a sickle.

In looking out for the solution of this peculiar phenomenon, an explanation soon suggested itself when we entered the Almannagjá. The snow, remaining longer than usual that year at the bottom of the rift, showed on its surface innumerable little conical hills of dark windblown sand, from half an inch to six inches in height. Their mode of origin by the melting of the snow in the heat of the sun is obvious. These sand-cones on the snow are frequently met with in Iceland, and have been described by previous travellers. Their relationship to the ubiquitous lawn-covered mounds, however, has not been pointed out clearly as far

as I could make out. After the formation of the sand-cones on the snow, vegetation takes hold of the loose soil, binds it together, and the form of the future lawn mound is perpetuated.

I think the cause of the great frequency of these sand-cones on the snow must be looked for in the low temperature of the air. The melting of the snow is due more to the direct impact of the solar rays than to conduction from the air around. It is for this reason that we do not find these sand-cones in our own latitudes. We find them, however, in the Alps, where the climate and average temperature resemble those of high latitudes, and where the force of direct solar radiation is strong in a thin, clear atmosphere.

The roads to Thingvellir and to the Geysirs are sufficiently well known to be omitted here. Suffice it to say that both traverse districts showing distinct glacial striæ (not the "signs or markings of snow water," but of ice-carried stones). My observations referring to glaciation have been published in the September (1893) number of the *Glacialists' Magazine*. I may mention here that the traces of ancient glaciation were everywhere apparent on our track, except where covered as by lava-flows and vegetation. I find it necessary to emphasize this, because recently it has been asserted in all seriousness that there never has been any glaciation in Iceland. Such a conclusion could not possibly be arrived at by any one who has either seen the country for himself or is acquainted with the literature of the subject. Glacial traces have been recorded almost over the whole extent of Iceland, and my own observations form a contribution which helps to complete the evidence already noted down so plentifully. It may be objected that these traces are only signs of "local" glaciers. But when we find "local" signs *everywhere*, we usually call them "general."

Of the Almannagjá, of the famous Althing, and of the lake of Thingvellir, Lord Dufferin, who was completely fascinated, and Sir Richard Burton, who was disappointed, have given such graphic accounts, that I need not dwell at length on their appearance.

A very instructive exposure is given in the Almannagjá, showing the different layers of lava as they have flowed one above the other to form the large lava plain whose subsidence afterwards caused the two large rifts (Almannagjá and Hrafnagjá) and the countless minor ones of the Althing plain. The uppermost of these layers has been greatly demolished by weathering, and is only represented in its former height by a few large pinnacles. No artificial exposure could have been more perfect. The top of each layer is marked by very small columns; below these the columns are thicker, and at the base they are thicker still. This is not the rule with all lava-flows. Usually, the upper and lower parts consist of small columns, and the middle portion of thicker ones. Probably, the flows took place at short intervals, and so the earlier ones had not cooled down sufficiently to cause sudden chilling of those that succeeded.

The scenic beauty of the Almannagjá is greatly enhanced by the upper and lower falls of the Óexará. At the upper fall the river leaps into the rift, follows it for a short distance, and emerges at the lower part, to form a little further on the Þíngvallavatn, the biggest lake in Iceland. It is difficult to tear oneself away from this spot, interesting alike from a geological and from an historical point of view.

Our road leads us to the Geysirs. We were not fortunate enough to witness a spontaneous eruption. Although we waited three days, the Great Geysir kept quiet. The Strokkur was fed as a matter of course, and gave a beautiful explosion, about 100 feet high; rain and dark sky unhappily prevented a photographic record of the magnificent



FIG. 2.—SINTER-FRINGED BOWL OF HOT SPRING IN THE GEYSIR GROUP.

display. In the Appendix the measurements and temperatures of the principal springs are given, so as to enable future observations to be compared with them.

The smell of sulphuretted hydrogen is very strong; it seems to be very unequally distributed amongst the different springs. "Blesi" is apparently free from H_2S . When the thermometer was taken out of Strokkur, the metal cover was completely blackened, while in the tube of the Great Geysir it had remained untarnished. It was found that the temperature at 22 meters depth in the tube of the Great Geysir was sufficient to fuse completely the solder with which I had closed the ring at the upper end of the thermometer. Happily, it had been securely

fastened by several loops, or else it would have been lost. It is impossible to describe the exquisite beauty of some of these springs with their marvellous transparent blue-greenish water; only a faint idea of them can be given by a photograph (Figs. 2 and 3).

From the Geysir it is only a couple of hours' ride to the Gullfoss, probably the fullest of Icelandic waterfalls. In a broad cascade the opaque waters of the Hvítá slide down between narrowing walls of basalt until they reach a bend where they suddenly leap into a chasm 80 feet deep.

The state of the country made progress directly north from Haukadalr impossible, so we had to return to Thingvellir. In fine weather



FIG. 3.—SINTER TERRACES FORMED BY THE OVERFLOW OF BLESI, CLOSE TO THE GREAT GEYSIR. THE SINTER IS PALE PINK IN COLOUR.

there can be scarcely a more delightful sensation than that of riding through scenery such as this, so well known to most Icelandic travellers. The dwarf birch has a fragrance which I have never found anywhere else; legions of large grey moths flit about in the balmy air; the sun sends down his warming rays; and in the distance the snowy head of Hekla and the Southern Jöklar stand out from the blue sky. Alas! this delicious picture soon vanished, never to return for the rest of our journey.

The typical Icelandic "forest," skogar, is formed by fragrant dwarf birches, shrubs of about 3 to 4 feet high. Equally peculiar is an ordinary Icelandic road. It is nothing but a rut cut by the feet of the

countless generations of ponies which have been driven along in this direction. These ruts are deep, usually very narrow, and if the luckless rider is endowed with fairly long legs, the riding resembles more a performance on a bicycle than anything else. Often the ruts branch off sideways, and with a jerk the pony may bolt into the branch, when it is difficult to keep in the saddle.

From Thingvellir we take the track called Hofmannaflotr. A glance backwards shows the lake in the distance. At Brunnar, a deserted spot, we see the ice-covered Armannsfell, and to the right we have now the beautiful volcano Skjaldbreith, about which more presently. On we speed, the north wind (truly arctic) well-nigh blocks our progress through the Kaldidalur, a high pass between the vast inland glaciers. As we ascend, the temperature gradually falls, the rain turns into sleet, the sleet into needles of ice, and the storm rages so furiously that our horses can hardly make any headway at all over the vast expanse of sloppy snow, into which they sink often over their knees. The thermometer shows $+0.5^{\circ}$ C. (33° Fahr.). After five hours of hardest experience, we emerge from the clouds and descend to the silvery band of the Northern Hvitá at our feet, which we reach after another hour; then through the icy waters of the river and over a desolate lava-field, until at last the hospitable though expensive farm Kalmanstunga gives us shelter. So desolate was the route traversed that day, that the only signs of life we found in the Kaldidalur were, as my companion expressed it, one bird and one dead moth.

I mentioned Skjaldbreith before. This beautiful volcano, only about 2500 feet high, covers an area of nearly 30 square miles. It is of perfect regularity, a very obtuse cone, the inclination varying between 8° and 9° on the different sides, resembling in this respect the Hawaiian volcanoes. So regular is its outline that it would seem to be easy enough to ride to the top, provided there are no rents of any great width to cross. The top is, however, ice-capped all the year round, and a ride up would probably give no information. Skjaldbreith gives us the key to a number of snowy cupolas in this district. First amongst them for its exquisite regularity is the ice-dome of Ok. Hidden from our eyes by fog and clouds were those two snowy cupolas which Messrs. Preyer and Zirkel describe so graphically (in 1860), the snowy breasts of a young giantess turned into stone, according to an Icelandic legend. We find them again as "Sheba's breasts" in Rider Haggard's novel, 'King Solomon's Mines.' There is, further, the western termination of the Lángjökull, the Geitlandsjökull, showing the same beautiful curve; and also the impressive Eyriksjökull (Fig. 4). (I have pointed out in the notes on Glaciation how this profile of the Eyriksjökull speaks in favour of a south-north direction of an ancient glacier covering the Eyriksjökull completely). This massive mountain, covering an area of over 30 square miles, stands like an outpost by the large Lángjökull. It is an old volcano, and is

probably responsible for the lava-field which stretches to the south-west, skirting the Strútr, on the southern slope of which Kalmanstúnga is situated. The ridge above the farm is strewn with a stratified ash. The lava, like that of Thingvellir, is mostly ropy. The surface is often covered with a green or brownish glaze of tachylitic nature. Often there are hollow spaces underneath the surface, and then the hoof of the horse striking it produces a peculiar musical sound.

These lava-fields are always very trying to the horses, and often exceedingly dangerous. Their general appearance varies much, but it always reminded me of the sea. Sometimes they are quite flat, with or without small ripples on the surface; sometimes you see beautiful undulations of wave crests and hollows, like an ocean swell; sometimes you find a regular choppy sea, and occasionally the forms of pack-ice left in a mad chaotic struggle, and sticking up when consolidation overtook these destructive streams.

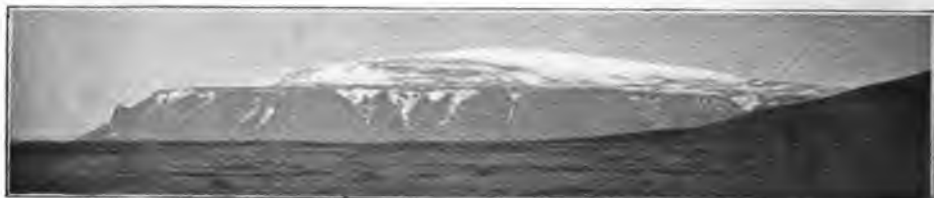


FIG. 4.—VIEW OF EYRÍKSJÖKULL FROM WEST, TAKEN AT A DISTANCE OF 9 MILES.

The lava north of Kalmanstúnga must have been of great viscosity, as shown by the ropy surface and its curves. The large wave mounts are usually cracked, and resemble the broken crust of a pie. The fissures, caused by the cooling of the lava, form one of the greatest obstacles to the progress of the horses; often they are treacherously hidden by a covering of grey moss, of almost the same colour as the lava itself. They show generally a very well-marked columnar structure, perpendicular to the surface of the flow.

A small stone cairn marks the entrance to Surtshellir,* a roundish opening of about 50 feet in diameter, filled very irregularly with big lava blocks, and covered with large masses of snow, reaching deep down into the cave itself. The description of Surtshellir has been given so well by Olafsen and Povelsen, by Henderson and by Preyer and Zirkel, that I shall confine myself to a few remarks concerning the most distant parts. After twice emerging into daylight from exceedingly fatiguing scrambles for more than 4000 feet underground, over big lava blocks piled up in chaotic disorder, we plunged for the third time down on the steep snow incline into the pitch-dark hole before us. Soon the snow

* Surtshellir: *Surtr*, a troll or giant, means "black" = schwarz (German); swarthy, in English; *hellir* = hollow = höhle (German); *κοίλος*, in Greek; *coelum*, in Latin.

ceased, and after a few paces we came on solid ice, flooded with several inches of water, through which we had to wade. The ground was exceedingly slippery; handicapped and laden as we were, we could hardly keep our balance, candles in hand, especially when, after a few feet of rise, the ice-coated ground began to slide downwards. But only a few steps more, and we were rewarded by one of the most enchanting sights it had ever been my good fortune to behold. Out of the floor, uneven, slippery, and more and more slanting, there seemed to rise ahead of us a number of fantastic forms, standing out pale in the uncertain light from the ice floor. On approaching with the candles, we recognized in these pale mushroom-like forms the most gorgeous ice stalagmites, of varying sizes and shapes, scattered all over the slanting floor of the cave, from the densest white to a pale blue of ghost-like transparency. Some were solitary, others formed a cluster; some, in the style of a Gothic spire, were surrounded by a tier of secondary spires, while others, almost mathematically perfect in shape, formed isolated transparent paraboloids.

On the north-western wall of the cave (the main direction of the whole cavern runs from north-north-east to south-south-west) there was a magnificent curtain of long ice-stalactites, forming a colonnade and partitioning off a corridor wide enough to allow us to walk along with a lighted candle. Where stalactites and stalagmites had met, somewhere near the middle of this colonnade, they resembled the face of an organ. (Photographs were taken under almost insuperable difficulties by magnesium flash, but form almost the best of the whole collection.) Add to this the thousandfold sparkling and glittering from those parts of wall and roof which were not draped by graceful icicles, and you will not wonder that we felt completely dazed, as if transported into the midst of a fairy tale of our childhood. (The brilliant sparkling effect, particularly impressive by flash-light, was produced by peculiar forms of ice-crystals which have been described separately in a paper placed before the Royal Society.) With difficulty we tore ourselves away from this enchanted spot. When, at last, we reached the glimmer of daylight, the exit of the cave gave a charming effect. The temperature in the cave and outside on our way back to Kalmanstúnga was $+0.5^{\circ}$ C. (33° Fahr.).

Four weeks later the adverse state of the weather and of the country brought us once more near the caves. On a ride so severe and fatiguing that it stood out as the worst from all our other severe experience, we came from the north in feverish haste to catch our steamer at Reykjavík. So wild was the storm when we reached the Fiskivötn (fish lakes), that no tent could be erected. Before us rose the massive Eyriksjökull, its snowy head covered by heavy clouds, which the mad south-westerly storm tore into long streamers. In lurid tints appeared the tongues of the descending glacier, the storm raging against us, we racing on at full speed; before us, in majestic repose, the enormous mountain. At a

distance of ten miles from the mountain a photograph was taken, while I had to sit on the camera to steady it against the violence of the storm (8 p.m.).

After five hours' further ride, the entrance to Surtshellir was reached, and a descent was made, this time in quest of the coins which had been deposited on a stone block in the remotest recess by Olafsen and Povelsen in 1753, and by Henderson in 1815. I knew of them through the allusion of Preyer and Zirkel, who had failed to find them in 1860.* Fatigued in the extreme, after a nineteen hours' ride, we succeeded at last in finding the tin plate with the coins on a piece of wooden board, on the top of a big block of lava. The water dropping occasionally from the ceiling had cemented some of the coins with a sort of sinter to the plate. Some coins had old seals hardly recognizable, others were more recently placed there. I took two of the oldest coins, both with seals (exhibited). The one is probably from Henderson, to judge from the seal which represented a sitting figure of Christ and some Hebrew lettering; the other is of the year 1668, probably one of the Olafsen coins of 1753. Although I exchanged these coins for their equivalent in modern kroner, I shall not feel satisfied until I have restored them to their old resting-place in Iceland, in the course of a year or two.

And now back to our journey.

From Kalmanstunga we went to Reykholt, famous as the seat of Iceland's greatest son, Snorri Sturluson, who was murdered there in 1241 by his own son-in-law. Well preserved up to this day is the Snorralaug, or Snorris' bath, a circular basin about 12 feet in diameter, 4 feet deep, and lined with stones. Four stone steps lead into the bath, which is filled with warm water from one of the hot springs some 200 yards distant by a primitive stone channel. An overflow keeps the depth about 2½ feet. On the morning of June 30, the temperature of the water was 46.5° C. If the temperature is required lower, the supply is stopped temporarily, and the water allowed to cool to the desired degree. There are several springs close together, about 200 yards east of the bath, which is supplied by the principal spring. This latter boils up in a continuous jet 1 to 2 feet high. The thermometer would not sink beyond 1 foot below the surface, and showed 98.5° C. Close by is a small boiling jet, quite shallow (89° C.), and not very far another spring, with a large and shallow circular mud bowl. It does not rise; the temperature was 98° C. All these springs have a strong smell of sulphuretted hydrogen.

The next day we continued our journey down the Reykholtsdalrt, which is very rich in hot springs, as indicated by its name. The most

* "On we went, hoping to find the coins which Henderson deposited in 1815 on a small stone heap. After a short scramble over sloppy and gently sloping ground, we actually found the stone pyramid, but not the slightest trace could be detected of coins or seals" (Preyer and Zirkel, 'Reise nach Island,' p. 104).

curious of these are the two Geysirs in the river itself. In the midst of the river-bed a rock of siliceous sinter rises about 18 feet long, 6 feet wide, and 5 to 6 feet high; at each end a hot spring spouts. The southernmost is the smaller, both in volume and height; it only springs up to 6 inches. The thermometer descended to a depth of 2 meters, and showed 100·5° C.

The other spring, on the northern end of the sinter block, rises 2 to 3 feet high, but could only be measured 1 foot below the orifice (99° C.), where the cap of the thermometer was caught and had to be left behind.

On turning northwards we had to search for a ford in the Northern Hvítá. Through all our journey the rivers were in a very plethoric condition, while our horses were the opposite; crossing a broad, deep river of opaque whitish water, with the banks constantly changing, was therefore a serious undertaking. Our guides first rode to a flat island in the river; there they drove two of the spare horses into the stream. One of them found a ford, the other had to fight hard against the stream by swimming. The ford having been found, the caravan was divided into three parts; the horses were tied together, the tail of one to the head of the next, in batches of six or seven, and then led by one of the men across the stream. This ensures their following in the same track, an important point when wetting the luggage had to be avoided.

The Icelandic horses are as good natured as they are invaluable. How they can go on carrying the primitive pack boxes on the still more primitive pack-saddle is a mystery to me. They will stand anything, do almost anything, but they will avoid going over a bridge if they possibly can. Once we had to cross a deep cutting near a farm; a few planks covered with soil were placed across. Some of our horses were driven to this bridge, and hesitated until urged on, when two of them at last rushed on to it abreast. The boxes sticking out on both sides clashed together, and the impetus was such that both animals were thrown from the bridge, one on each side, and disappeared below. Strange to say, no lasting injury followed this peculiar display of equine gymnastics, except a few scratches on horses and boxes. Henceforth our horses were allowed to have their own way as far as possible.

North of the Hvítá the basalt is rich in amygdules and zeolites. The basalt of the Grjótháls is smoothed by glaciation, while the pyramidal Baula is split up into very regular columns. We rested at Hvammur. The desolate Holtavörthuheití was veiled from our view by fogs and storm; descending, we saw the first wild swans, a white fox, and ptarmigans. In pouring rain we passed a fine vertical basaltic dyke denuded by a brook which had breached it; the hexagonal ends formed a design of geometrical regularity. Two hours later we scaled with an effort the incline on which stand the farm and "post-office" of Stathir, our destination for that day. For two days the storms kept us prisoners in Stathir. When at last we proceeded we found a good amount of drift-

wood thrown on the shore of the Hrutafjörður. After a visit to the amiable merchant and his wife at Bortheyri, we went north-east, *viá* Melstathir, past the Midhóp, and crossed the remarkable hills near Hnausar, the Vatnsdalsholar (Fig. 5) which I have described in the *Glacialists' Magazine*. In this part we found the only yellow poppies (*Papaver nudicaule*) we saw during our journey. Very few flowers were seen altogether in that year most abundant were the lovely cushions of *Silene acaulis*, from pale mauve to pink and almost crimson; *Dryas octopetala*; *Caltha palustris* of gigantic size; *Geranium montana*; but not a single gentian in blossom.

Turning to south-east, the cone of Reykjanybba rose before us like a volcano in outline. The farm Reykir is situated at its foot on the north side; its north-east flank has a fine example of a glacial "boss," reaching down almost to the level of the long narrow Svinavatn. At Reykir there is a hot spring, mounted on an artificial basin of stone, oval in shape, 10 feet long, 7 feet wide, 1 to 2 feet deep. Temperature



FIG. 5.—GLACIAL DRIFT HILLS NEAR HNAUSAR, CALLED VATNSDALSHOLAR.

53.5° C. At the lake we met for the first time with little flies, not very troublesome, nor very numerous.

The rivers Svartá and Blandá, both swift and deep, had to be crossed; they have the characteristic appearance of an Icelandic river in an upland valley. In the farm of Bolstatharhlith we found one of those beds peculiar to Iceland, which can be made longer or shorter to suit the anatomy of everybody. When not in use they are telescoped together like a table, thus economizing space. The sagacity of Icelandic road-makers is shown by a "road" leading straight over a very fine hemispherical glacial mound near Vithimyri, where it would have been much easier to circumvent it horizontally. When coming to the river Herathsvatn we found fording impossible, and had to take the "ferry." This title is in Iceland applied to a leaky boat that can be rowed across a river by one man while another bales out the water as fast as he can. When the luggage and the travellers have reached the other side, the horses are driven into the stream and have to swim across, no easy task

in the swift current. We nearly lost one of our best riding-horses, which had to be rescued by the timely help of the boat. While we were waiting on the shore for the horses, we saw close to us three seals rising repeatedly out of the river, first going up and then down stream. As soon as the horses had reached the shore they threw themselves on the ground, as usual, and rolled their backs in the sand. What objects of art they looked may be readily imagined when I add that their winter coats, nearly three inches long, had come off in patches only, leaving underneath a short summer coat. From my own experience I never saw the horses "groomed" or "cleaned" in any other way than that just described.

In Silfrastathir a very fine hand quorn for grinding corn attracted my attention; it was, however, too heavy to be brought away. Entering the Æxnadalur, we came to some of the most picturesque mountain scenery in Iceland; a fine valley opens on the south side. Backasel is a typical farm, the interior showing the arrangement of beds, like berths in a ship. To procure more privacy, a cord is put up and a curtain hung in front of the berth which is occupied by two or more people. All the inhabitants of the farm sleep in the same room for the sake of warmth.

At the farm Steinstathir, an ancient wooden hand-mangle was procured; these "trafakafi" have not been in use for the last 200 years. When entering the Eyjafjörður we rode over endless *roches moutonnées*, until we reached Akureyri. Akureyri prides itself more on possessing the biggest trees of the island than on anything else. It is a flourishing settlement of about 500 inhabitants, in the picturesque Eyjafjörður. The trees are a few healthy-looking but small specimens of *Sorbus aucuparia* (rowan tree).

Leaving Akureyri, we crossed the fjord on horseback, the ebb being favourable. It is an experience of its own to ford for more than half an hour that long inlet of the Polar Sea. The Eyjafjartharó forms a very fine alluvial delta, the channels and banks of which are continued below the surface of the water for a certain distance into the fjord. When riding across the fjord the horse has to take these channels and banks alternately, being often only knee-deep in the water, often up to the shoulders. Where the water is shallow, he splashes with legs and knees, and progress, if hardly visible in the vast expanse of the fjord, is at least audible. But as soon as any of the channels are reached, the horse sinks down to the shoulders, the splashing of his legs ceases, not a sound is heard, and the deadly silence has something strangely uncanny about it.

The steep incline of the eastern shore was afterwards scaled—a height of over 2000 feet—and revealed a magnificent view of the delta and the fjord (Fig. 6). On our descent through the Vathlaheithi we found ptarmigans plentiful. Attracted by the rattling noise of the

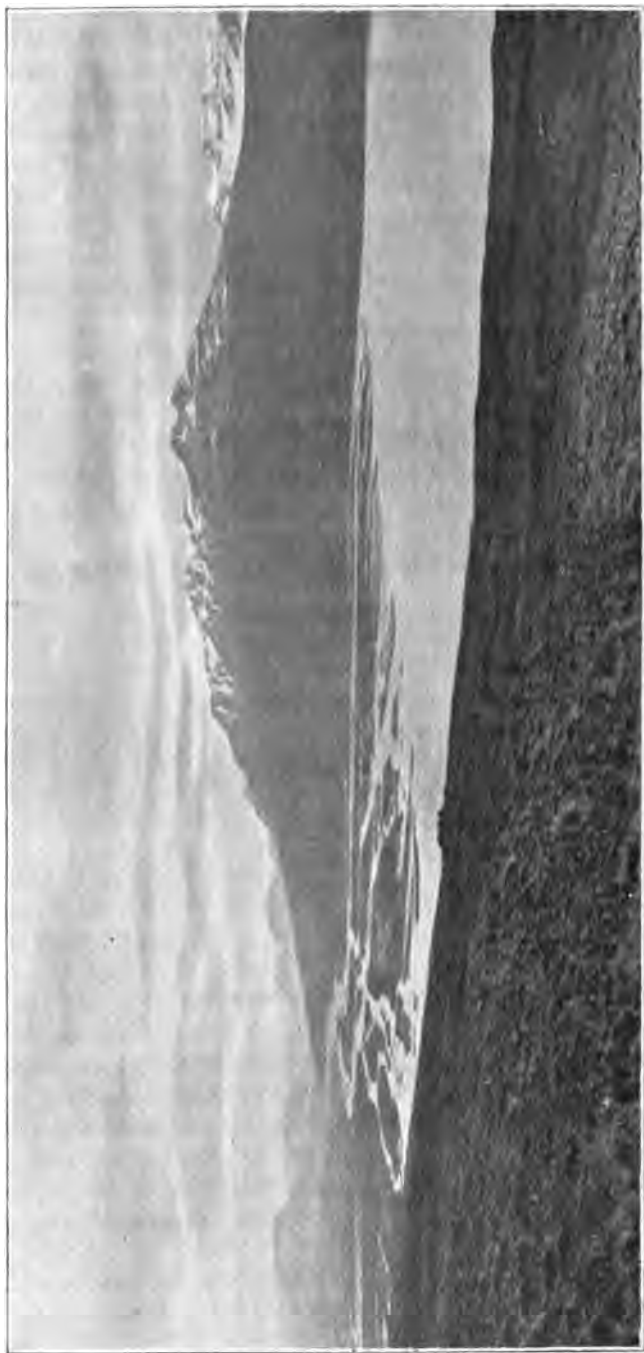




FIG. 6.—VIEW OF EYJAFJORD AND DELTA OF EYJAFJARTHARÁ, TAKEN FROM VATHLAHEITHI, AT AN ALTITUDE OF 1500 FEET.



mother, I repeatedly noticed the young birds almost under the hoofs of our horses. Not able to fly yet, they were caught easily with our hands, but were soon restored to the caresses of their anxious parents.

The river Fnjoská is not broad, but swift and dangerous, owing to the large boulders it carries along. The rate at which some of these streams flow is often astonishing. On our way homewards I was struck by the furious pace at which the swollen Hèrathsvatn raced past Silfrastathir. I measured the velocity in different parts, and found it varying from 3 to 5 meters per second. This was probably exceptional, and due to the great amount of rain during the preceding fortnight.

Beyond Háls we saw a gigantic striated boulder. Evidences of glacial action abound in this part, except where recent lava streams have obliterated them. This has been partly the case at Ljósavatn, although the hill-slope towards the east shows very fine perched rocks standing out against the sky. Half an hour east from Ljósavatn the impressive Gothafoss is formed by the leap which the Skjálfafljót takes into a broad rent in the post-glacial lava. Here the greater number of bridges of the island are crowded into a small area; the roads too are partly very good, almost fit for a wheeled vehicle. At a very poor farm we were consulted medically, and while my companion attended to the patient I took a view of the picturesque exterior of the building.

When riding past the churchyard of Grenjatharstathir we saw three basaltic columns lying on tombs. All three were very perfectly regular six-sided prisms, and were placed in a west-east direction on the grass. One stone had runic inscriptions on the three upper sides—the only runes we saw in Iceland; the second stone showed a much weathered inscription on the uppermost side only, in Latin characters; the third had no recognizable inscription at all. When the wooden handle of my hammer touched one of the columns by accident, a ringing musical sound was produced, varying in height on the different faces of the same column.

Stone I.—Length, 129 cm.; greatest diameter, 19 cm. The three upper surfaces have runes, which we photographed. When struck with the knuckle of the middle finger an almost singing sound is produced. On the largest southern and northern (opposite) faces that note was  as determined with the little tuning-fork which I always carry with me; the upper and the adjoining northern face give a note a third higher, 

Stone II.—Length, 150 cm.; greatest diameter, 21 cm. When struck, the upper and adjoining southern faces emit the note , while the upper northern and the opposite face ring a clear 

The inscription on the upper surface is badly weathered; a photograph would not have shown anything, and a rubbing was therefore taken with



a bit of cloth coloured by some iron-stained amygdules. With great difficulty I deciphered the following:—

“HIER + HVILER + I + DROTTNI + THORGRIMVR + HE . . 'SSON.”

(“Hier hviler i drottni thorgrimur he . . 'sson.”)

(i.e. “Here rests in the Lord Thorgrimur He . . 'sson.”)

Stone III.—Length, 133 cm.; greatest diameter, 19 cm. No inscription.

When struck, the upper northern face emits the note , the upper southern face , while the narrow top (face between the others) gives a note between *c* and *b*, full of interference jerks.

(Mr. S. B. Gould gives on p. 194 of his book, ‘Iceland: its Scenes and Sagas,’ a correct rendering of the runes of *Stone I.*, taken by a “rubbing with a German sausage,” as he amusingly says. For the copying and translation of the inscription on *Stone II.*, however, we can hardly make that sausage responsible; it is thus given: “Hjer hvilir Idrottnei Thurur . . .” “Here sleeps Idrottnei Th——’s daughter.” Idrottnei is not a name for a girl, but it means in Icelandic “in the Lord,” and the inscription shows not “Thurur . . .” but “Thorgrimur He . . 'sson.”)

A few hours north of Grenjatharstathir we see the steam rising in the distance, denoting the spot where the Uxahver or Northern Geysirs carry on a somewhat sluggish existence. There are three springs in all, the largest resembling the Great Geysir. Its circular bowl consists of siliceous sinter, and has a diameter of 30 feet; it does not spout often. As we were riding away we noticed the water rising in the centre for a moment, about 2 feet high only. The second spring is the most active; out of a bowl, 3 meters in diameter, it throws every five to ten minutes a jet of water to a small height, sometimes up to 4 meters, 3½ meters below the surface of the water the thermometer registered a temperature of 103° C. The third spring is comparatively insignificant, only a short distance to the south-east.

A small orchard has been placed close to the springs, and sheltered on the far side by a low turf wall; in the warm damp air potatoes thrive merrily.

The end of that day’s journey brought us to Ásbýrgi, a rift, if not so well known as the Almannagjá, at least equally remarkable. From its parent rock a huge triangular wedge is separated by a perfectly flat depression, half a mile wide, V-shaped, each side of the V about a mile and a half in length. The rock rises perpendicularly to more than 300 feet, and is formed of many layers of a coarse doleritic lava, imitating with its vaulted flows the walls of a mediæval castle, with arches and windows. The rift is well sheltered from storms; we found near the apex of the V quite a respectable little birch forest, with trees of five to six yards in height—the tallest forest trees in the island. A good deal of snow and a dried-up pond at the end took the place of the “lake” which our guide had led us to expect.

Ásbýrgi was our most northern point reached on this journey. A day's ride brought us to the eastern limit, to that finest of all Icelandic and European waterfalls, the Dettifoss. The access to the fall, marked from afar by a white steam-cloud, leads over uneven, barren territory of pre- and post-glacial lava. With one tremendous bound the Jökulsa leaps into the largest of those volcanic rents which in this part of Iceland have a north and south direction. The rift is about 300 feet deep and 500 feet wide, and shows in its perpendicular walls four distinct layers of lava, with exquisite columnar structure. When Gunnlangson drew up his great map of Iceland in 1844, the Dettifoss was not known; on the later maps its position is variously given. When we were there, the white



FIG. 7.—SOME CRATERS OF THE HLJÓTHAKLETTAR GROUP.

cone of Herthubreith, at a distance of about 50 miles, and the mountain Eilífr became visible for a short time, enabling us to take the following compass bearings: Herthubreith, 215° magn.; Eilífr, 297° magn. Allowing 37° for westerly declination, this would give almost exactly the spot on Gunnlangson's map where the dotted boundary-line between the northern and southern Thingeyjarsýsla cuts the Jökulsá.

Of intense interest between Ásbýrgi and the Dettifoss are the Hljóthaklettur (rocks of sound or echo). Thoroddsen * gives the following brief description (Fig. 7):—

“The so-called Hljóthaklettur are a series of steep basaltic peaks

* “Eine Lavawüste im Innern Islands,” *Petermann's Mitth.*, 1885, ix. p. 331.
No. IV.—APRIL, 1894.]

150 to 200 feet high, of the most curious forms. The basalt of these rocks is split up into small columns variously arranged, often in a semi-circle round small openings. The cause of this irregular formation is erosion, which has washed out the palagonite breccia, while basaltic dykes remained; here and there some breccia is still found enclosed in hollows in the rock."

A closer study of some of the photographs of these remarkable rocks shows that this explanation is erroneous, or at least incomplete.



FIG. 8.—VIEW OF HVERFJALL FROM NORTH-WEST.

The rocks have been formed by a rather liquid lava. The columnar structure is certainly the finest I have ever seen, and is found in every one of the rocks where they show an exposure (denuded by erosion). The hollows, however, are so regularly spherical, and in one instance so large—about 100 yards across—that they cannot possibly be explained by the filling up of a space round a nucleus of palagonite



FIG. 9.—INTERIOR OF THE CRATER HVERFJALL, WITH MOUND AND RIDGE IN CENTRAL PLAIN.

breccia. These craters are evidently the same formation for which Dutton * proposed the name of "caldera." They are produced by lava basins which, having been tapped and drained at lower levels, have formed semicircular hollows by the aspiration of the stiffening but still fluid lava. The various sizes of these drainage hollows and channels can be seen in the different photographs taken. The columns are smallest near and perpendicular to the surface of the hollows, proving thereby that cooling began from these hollows, which were probably open spaces and had time to cool before a subsequent filling up with breccia took place. Afterwards the breccia has been weathered out, while the harder

* 'Hawaiian Volcanoes,' p. 105.

basalt has remained. That the basalt has not escaped erosion altogether is shown by various big upright rocks, and also by the circular crater or "caldera," of which the larger half is preserved, while about two-fifths have disappeared. It would be difficult to say how far the breaking down of these hard masses may have been hastened by earthquakes or similar violent shocks.

A few remarks only about the Mývatn. The beautiful crater Hverfjall (Figs. 8 and 9) and the unique phenomenon presented by its interior have been described by me *in extenso* in the November number of the *Glacialists' Magazine*. The steaming sulphur mountains, the mud geysirs, the desert, have been well described by previous travellers. The Hrafutinnuhryggur formed the subject of a special excursion, and enabled us to collect exquisite specimens of Obsidian.

From Mývatn we returned to Akureyri, expected by more than fifty people seeking medical and surgical advice, some of whom had come a long distance. Then followed our hurried ride across the country in order to catch our steamer at Reykjavik. Of the last 66 hours, we spent 44 in the saddle; but we had the satisfaction of arriving at Reykjavik just in time.

APPENDIX.

GEYSIRS. JUNE 20, 1892, 1 P.M.; BAROM. 29·575" ENGL.

1. Great Geysir. Bowl (crater) oval, obliquely elliptical; diameter, west-north-west to east-north-east = 15·5 meters; north to south = 17·5 meters. Temperature at 22 meters depth, 123·5° C.
2. Blesi. Temperature 9 meters below surface, same as near surface = 94° C.; surface level with ground, overflowing.
3. Spring close to Blesi. Surface of water 2 meters below opening; thermometer reaches 6·5 meters, deep in water, and registers 101·5° C.
4. Steaming mud spring close to Blesi. Thermometer enters only 4 inches, and shows 95° C.
5. Stokkr. Surface of water 3 meters below opening; temperature in 10·5 meters of water, 108° C.

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

Sir ARCHIBALD GEIKIE: At this late hour, and after such a pleasing excursion through Iceland, little room is left for comment or criticism. The photographs have given us a vivid picture of Icelandic scenery, and have brought out clearly some of the salient features of Icelandic geology. But I will not enter into any discussion on questions of scientific interest, though Dr. Grossmann has provided us with ample material for it. His pictures of the volcanic regions suggest many points on which we might ask for further information, and his illustrations of the peculiar topography of the island might be made the text for a long discourse. He did not himself enter into scientific problems, and his explanations of some of the superficial features might be open to question. It is remarkable to what an extent all over northern Europe such surface-features have given rise to legends of witches, warlocks, and giants. It would be interesting to know how far the

Icelandic topography has impressed the imagination of the race which has so long inhabited that region.

Sir HENRY HOWORTH: I should like to begin my remarks by emphasizing what has been said in praise, not only of the photographs, but also of the art with which a very great number of picturesque facts have been selected from a large number of observations by Dr. Grossmann. Of this very terribly barren land my old friend Vigfusson used to give a very graphic picture by saying that no man in Iceland was ever known to die in the same house in which he was born. Everything there is in a process of continual destruction by the elements. It is very hard on some of us who love fighting, and who have had a fight already with Dr. Grossmann elsewhere, that it is so late, because we might have had an interesting discussion to-night. One thing is remarkable in all these pictures, namely, the extremely recent-looking surface of this great island. There are reasons for believing that these great outflows of lava and basalt were not there at the beginning of our knowledge of this island. For 150 to 200 years after the island was settled, the volcanic phenomena were unknown altogether, and it was a great surprise to the Icelanders themselves when they began. Since then, and perhaps also in the ages long before then, the island has been overflowed in all directions by these great lava-currents, and the surface has been so dislocated that I am bound to say it is impossible to deduce great laws or important explanations from a visit of only five or six weeks. What our friend has done to-night is to present us with a chain of difficulties—a great chain of questions to be solved. They press upon us all the necessity of having a careful and deliberate examination of the problems of this island, such an exploration as that carried on in our island by the great institution over which Sir Archibald Geikie has presided during his four years' exploration of this country. There is no place where some of the more difficult problems of geology can be studied in the same way as here, where the soil has been removed from a large part of this island, and we can see the naked bones of the land. It seems to me that if we could be transplanted to the moon, we should see there, on a large and exaggerated scale, very much what we see here—large rifts, circular volcanoes, great fields and seas of lava, to be seen nowhere else on the face of the earth except in this island. The questions that arise are of every kind of interest, polemical and otherwise. A great point dividing some of us from the general views of Dr. Grossmann is whether the glaciation of Iceland was by local glaciers on the higher ground, or general glaciation of the whole island. One thing you will all agree with me in—namely, in thanking Dr. Grossmann for the excellent treat he has given us to-night.

Professor JUDD: At this late hour I shall be consulting the general wishes of this audience if I do no more than express in the shortest possible manner the sense of obligation we all feel to the author for taking us to Iceland for a short time, and in such a very pleasant manner. We must all have been struck with the photographs of this wonderful country that have been shown to us, and if we have not heard all we might have wished, yet our eyes have been feasted with such a display of the scenery of this wonderful country, that I think we shall all go home instructed and delighted with what the author of this admirable paper has placed before us, and look forward to the time when we shall be able to read the full descriptions of these scenes, the wild beauty of which we cannot fail to remember.

Dr. GROSSMANN: I will not detain you any longer, especially as a large number of Icelandic exhibits awaits your inspection in the reception-room. The time at my disposal has been very limited for a subject so full of interest as a journey in Iceland, and I could therefore select a few striking features only on which I should have liked to enter into a discussion. It has been my endeavour to lay

before you these facts as impartially as possible by means of photographic views, leaving it principally to you to draw your own conclusions.

As the time is too far advanced for any discussion, it only remains for me to thank you for the very kind reception you have given to my paper and to my illustrations.

CAPT. WHARTON (who occupied the chair): It only remains for me to thank Dr. Grossmann for the very pleasant evening he has given us, transporting us by means of his photographs to Iceland, and enabling us to realize the country in that way better than in any other.

The Map of Iceland.—This map is a reduction of Gunnlaugsson's survey of Iceland.

JOHORE.*

By HARRY LAKE, Engineer in the Service of the Sultan.

JOHORE territory occupies the most southerly portion of the Malay peninsula; it extends from Cape or Tangong Bulus in latitude $1^{\circ} 16' 12''$ north to about $3^{\circ} 1'$ north.

On the north it is bounded by the protected native states of Pahang and the Negri Sembilan, and on the north-west by Malacca. A narrow strait, the "Selat Tebrau" of the Malays, separates the territory from the Island of Singapore. In former times all merchantmen engaged in the China trade passed through this strait, as the present route to the south of Singapore was extremely unsafe owing to the hordes of pirates which infested these seas; even in the Tebrau Straits ships were often attacked and destroyed by Malay piratical phraus. In common with the rest of Malaya, the coast-line is bold and rocky on the east, where it is washed by the China Sea, and low and swampy on the west, where it borders on the Straits of Malacca. The formation is chiefly granitic, traversed in places by veins of quartz and dykes of intrusive masses of diorite, quartz felsite, trachyte, etc. This granite is overlaid by a series of clays and clay shales, with here and there beds of laterite. These clays are non-fossiliferous, and are probably of Paleozoic origin. In the north-east a little sandstone is found, whilst in the extreme north-west there are signs of a limestone formation. On the east coast the clay shales show distinct evidences of metamorphism, in some places, notably near Kuala, Indau merging into a highly stratified clay slate. Amongst these shales and slates are masses and deposits of brown ironstone.

Before proceeding further, it may be interesting to give a short *résumé* of the history of this state. The Sultans of Malacca, before they were driven out of that place by the Portuguese, who were succeeded by the Dutch, may be said to have been the dominant power over the Malay

* Paper read at the Royal Geographical Society, February 12, 1894. Map, p. 356.

peninsula, the Archipelago, and the eastern parts of Sumatra, although each of the states and territories beyond the immediate neighbourhood of Malacca was occupied and governed by its own chiefs under different titles ; independent within their own provinces, but feudatory or tributary to the sovereignty of the Sultan of Malacca. The state of Johore is a case in point. Although the first authentic records date only from the days of the Portuguese conquest, yet we get occasional historical glimpses of the Sultanate of Malacca as far back as the earlier part of the thirteenth century, when the then reigning Sultan, Mahmud Shah, adopted the faith of Islam. In 1511 Sultan Ahmed, being driven out of Malacca by the Portuguese, removed to Muar, then to Johore ; subsequently his successors retreated still further southwards to the island of Rbio, and finally to Lingga. As the sultanic power gradually declined, the most northerly states of the peninsula first, and finally those to the south, one by one naturally grew really independent, became tributary to one another, or formed treaties with the European powers of the time. Thus the hereditary Temenggong, or chief of Johore, virtually became an independent ruler. We find Johore taking an important part in the one hundred and forty years' struggle for Malacca between the Portuguese and the Dutch. At that time the seat of Malay Government was established at Johore Lama, on the Johore river. Up to 1773 the Negri Sembilan or Nine States were feudatory to Johore, but afterwards they petitioned for and obtained a chief of their own from Menangkabau. When, in 1795, the Dutch in their turn were driven out of Malacca, they forcibly took possession of the Carimons and several other islands then under Johore. At the restoration of the Dutch possessions at the peace, they were still allowed to retain these islands ; and when, in 1819, the grandfather of the present Sultan, and the then and last titular Sultan of Johore, ceded Singapore to the British, Johore rule became virtually confined to the mainland. By the treaty of 1855 the British acknowledged the *de facto* administrative right of the Temenggong, and the capital was again removed to Johore Bahru, or New Johore. In 1868 the title of Maharaja was assumed by the present ruler, and this was again changed to that of Sultan by the Treaty of 1885, thus restoring the old Malacca title.

Very little literature exists relative to the geography of Johore. Hervey of Malacca in 1879 made a journey towards the source of the Indau Sembrong, and published an article in the Journal of the Straits Branch of the Asiatic Society. In 1878 the same traveller made a short trip to the Blumut region. Mikluho Maclay in 1875 made an ethnological excursion through portions of Johore ; but, as he was occupied chiefly in observations on the Jakuns, his articles published in the *Asiatic Journal* contribute very little to the geography of the territory. Up to 1890 very little was known of the interior beyond the Sembrong rivers. Dato Luar, chief surveyor of the Johore Government, had

mapped the Muar river, and more or less accurate surveys had been made of the Batu Pahat, the Johore, and the big Sedili river of the Blumut region; of the Upper Indau little or nothing was known. In 1891 the Straits Branch of the Asiatic Society published a fresh edition of their map of the Malay peninsula. As regards Johore, beyond Hervey's survey of the Indau Sembrong, and Dato Luar's work on the Muar Batu Pahat and Johore rivers, it contained little new data of value, and naturally many errors in the position of hills and rivers occurred. Hervey's survey of the Sembrong, considering that it was only time and compass work, was very fairly accurate, except at the source, where it required considerable revision.

Owing to the dense jungle, survey work in Malaya is a most tedious and trying affair. It is impossible to do much traversing with the theodolite, and a systematic triangulation in such a wild country is at present out of the question. I therefore contented myself by fixing a number of prominent peaks and hill-tops by a series of astronomical observations, and then filling in the small tracts of surrounding country by prismatic compass; where the country was moderately open, the plane table was used. By these means the whole of the territory was mapped within two years. This work, while it does not pretend to the accuracy of a regular triangulation, is, I think, sufficiently reliable to serve all practical purposes for some years to come. The heights were in most cases determined by aneroid barometer, and may be regarded as approximate only. Mounts Ophir, Janing, Pulai, and a few others, were, however, determined by a careful series of boiling-point observations.

To those accustomed to read and speak of the huge distances traversed by African explorers, the small area covered by travellers in Malaya will appear very unimportant and trivial. It must seem an easy affair to get across 100 miles of jungle country within the week, but I would like you to consider the drawbacks to rapid and easy locomotion in this country. The interior consists of one dense mass of jungle. Swamps, undulating ground, and mountains alike covered with rankly luxuriant tropical vegetation, so thick and so closely interlaced with thorny creepers and rattans that it becomes almost impossible to move a yard in any direction without previously cutting a path. Even on the smaller rivers the foliage and creepers will stretch entirely across from bank to bank, and a way must be cut for the canoes to pass under; whilst the river-bed is full of snags and fallen timber, which have to be hacked through or moved before a passage can be effected. Although there is no regular rainy season, scarcely a day passes without a downpour, occasionally as much as 25 inches falling in one week. This quickly converts the low-lying ground into a series of almost impassable swamps.

The unexplored country is in most cases trackless and uninhabited;

it therefore becomes impossible to obtain supplies of any kind *en route*. I have found that only the natives of the interior are of any value as carriers and guides, but the far up-country villages are so few and so sparsely inhabited that it is extremely difficult to obtain sufficient carriers for any one expedition. Of these men, however, I cannot speak too highly. Plucky and patient, they will carry their load of from 35 to 40 lbs. day after day across the most difficult and dangerous country; the few rags they possess as clothing drenched night and day; sleeping without shelter in the reeking undergrowth, and living on rather less than a pound and a half of what was often mouldy rice a day, together with a morsel of dry fish and a little tobacco. A few weeks of this work put half your men *hors de combat*, with fever and ulcerated feet and legs; yet they struggle on, and one seldom hears a word of complaint. As supplies of food cannot be depended on *en route*, nearly every available man is employed in carrying that oriental staff of life—rice. Personal outfit is cut down to the smallest possible amount; tents, camp furniture, and European stores must be dispensed with; and the traveller must practically live in the same manner as the natives.

To an ordinary traveller in the interior, the Indau river and the Tenang hills, amongst which it takes its rise, will present the most interesting features. The Indau proper, which is only about 75 miles long, rises between the mountains, Besar and Chabang-tiga, pursues a southerly course, and empties itself into the China Sea in latitude $2^{\circ} 40' 0''$ and longitude $103^{\circ} 36' 10''$. As is usual with nearly all the rivers of the peninsula, the amount of detritus brought down during the rains is enormous, when we consider what a short course these rivers run; the natural result of this is the formation of a bar at the "kwala," or river mouth, which effectually prevents the entrance of ocean-going steamers, except a few of comparatively light tonnage. The Indau is no exception to this rule, and during the north-east mousoon the estuary is completely closed to craft of every description.

For a distance of 30 miles the Indau is a broad tidal stream easily navigable by small steamers; at this distance the junction with the Sembrong river is made, beyond which point the stream narrows rapidly and becomes shallow and sandy. Dykes of felsite, diorite, and granite porphyry, which run in well-defined courses from west to east, have occasioned a most picturesque series of small waterfalls and rapids, which, however, render navigation extremely slow and somewhat dangerous. The banks are high and covered with splendid timber. In the neighbourhood of Mount Janing are two or three small Jakun (*i.e.* aboriginal) settlements; but the upper reaches are trackless and uninhabited, save by the tiger and elephant, the crowds of monkeys, and the brilliantly plumaged birds, among which the hornbill (*Buceros rhinoceros*), the Argus pheasant, called by the Malays "kuau," and the "pergam," or grey pigeon, predominate. During my journey to the source of this river

in 1891, I met with thirty-two of these rapids in the course of 20 miles; this short distance was only accomplished after six days of extremely hard work, or rather less than $3\frac{1}{2}$ miles a day. Many of the canoes were swamped, and others stove in, and the source was eventually reached by wading and scrambling along the bed of the stream.

The canoes, or "jalors," as the natives term them, used on all rivers of the interior, are constructed from a single tree cut longitudinally, hollowed out by fire, and finished with the "bliong," or Malay adze. Some of these canoes will carry twenty to thirty men, but for navigating the rapids they are built very light and small, carrying two or three persons only.

On reaching the source of the Indau, we found ourselves in the midst of an unknown hill-country, the central elevation of which was Gunung Chabang-tiga, or the mount with the three branches. From the summit of this hill, 3100 feet above sea-level, a number of observations for latitude and time were made. On the lower slopes of Chabang-tiga the tapir and rhinoceros are to be found. I managed to shoot one of the former, a full-grown male, and also a fine specimen of the Malayan honey-bear (*Ursus Malayanus*). Notwithstanding the name, this latter is an inoffensive animal, often trapped and tamed by the natives.

Before the survey work in the Tenang hills was complete, we ran short of stores, and I was forced to make a move for the Segamat river. Five days of hard going, during which time we lived on fruits and tapioca root, brought us out at the Jakun village of Penglima Pute, on the Pukin river. Here we got a little rice and Indian corn; but, much to my disgust, I found an aboriginal wedding-feast in progress, and my carriers insisted on remaining two days in order to take part in the festivities, which, as far as I could see, consisted in the people gorging themselves with green corn and sugar obtained from the Cabong palm, thumping tom-toms, and dozing in the intervals. Eventually a start was made, and a tramp of three days brought us to the banks of the Jekati river, where we came across another Jakun village. Here I lost one of my best guides, who was taken from the midst of his sleeping comrades by a tiger. The work in the neighbourhood of the Jekati and Bukit Asoh occupied my party several weeks, during which time I had many opportunities of making observations on the natives of the interior.

From an ethnological point of view, probably the most interesting feature of Johore exists in the survival of these aboriginal inhabitants of the peninsula, whose forefathers roamed the jungle long before the advent of the Malays, who probably were drawn to the peninsula from the islands of the Archipelago. In Johore these aborigines are known as Jakuns, while in Pahang and Selangor they are termed Sakai. The Malays apply various other names to them, such as "Orang benua" (men of the soil), "Orang utan" (forest men), and so on. They are

usually found very thinly scattered in the most inaccessible portions of the jungle.

These semi-wild people are undoubtedly of Negrito origin, but interbreeding with the Malays has in most cases considerably altered and modified the original primitive type, although as a general rule they preserve many of the leading characteristics of the Negrito. Mikluho Maclay, who made an ethnological excursion through portions of the peninsula in 1876, is inclined to think that these aborigines were originally a pure branch of the Melanesian race, but that the Johore Jakuns have now become a mixed Melan-Malay tribe. There seems to be a distinct family relationship between these people and the natives of the Andaman and Philippine Islands. Some authorities are of the opinion that they are of Papuan origin. Wallace, however, while admitting that the Negritos are a distinct race from the Malay, considers those inhabiting the peninsula to be in all probability of Asiatic rather than of Polynesian origin.

The increasing intercourse with the Malays is most strikingly exemplified in the rapid decay of the aboriginal tongue. A few generations ago these aborigines possessed a distinct language, primitive, it is true, but utterly unlike Malay; of late years this has degenerated into a mere dialect, largely composed of Malay words. For the preservation of a number of true Jakun words we are indebted to a superstitious usage largely practised by the jungle Malays and Jakuns, and known as the "Pantang Kapor;" translated liberally, this means the "Observance of the camphor ceremony," of which the following is an explanation.

The camphor tree (*Dryobalanops camphora*) grows abundantly in certain parts of the peninsula, but only occasionally contains camphor crystals. Now, the camphor in question is not at all similar to that obtained from the camphor laurel; it is known in commerce as Borneo camphor, or Borneol, and is in great demand by the Chinese, who use it in embalming their dead, as an incense, and in medicine; being rare, it always commands a high price. As it by no means follows that each camphor tree contains this valuable product—in fact, it being rather the exception than the rule—recourse must be had to the species of witchcraft known as "Pantang Kapor." Therefore, to ensure good luck, the hunters while on their expedition must speak the camphor language, and observe certain practices, in order to propitiate the spirit of the camphor tree, which is known by the Jakun name of Bisan (lit. a woman). Her resting-place is near the trees, and at night when a peculiar noise, much resembling that of a variety of cicada, is heard in the forests, the Bisan is abroad, and camphor will surely be found in the neighbourhood. The language of the camphor spirit consists of a mixture of Jakun and Malay words, with a large proportion of words of Malay origin, but curiously altered or reversed.

The following are a few examples of the Pantang Kapor language:—

A. Words of Malay derivation—

1. Sword = *manchong*, from *Panchang*, to cut or to sever.
2. Tail = *p'nurun*, that which causes to descend; that which hangs down or droops.
3. Chest = *hadap*, the front part.
4. Wrong = *salek*, from *Salah*.
5. A long time = *Awal*, the first, therefore the time that first passed away.
6. Pineapple = *s'jumbol*, the thing with a long tuft of hair or a tassel.
7. Dammar (resin) = *sohoh* = *suloh*, a torch.
8. Sail = *sayap*, a wing.
9. Sand = *p'nabu*, the thing that resembles ashes, from *Abu*, ashes, or *abok*, dust.
10. Shore = *kring*, dry, meaning the dry land.
11. Spark = *bunga p'hangat*, the flower of the heater, or fire.

B. Words of aboriginal origin—

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|---|---|
| <ol style="list-style-type: none"> 1. Rich = <i>kon</i>. 2. Poor = <i>pyeng</i>. 3. To sink = <i>m'pior</i>. | <ol style="list-style-type: none"> 4. Wide or stout = <i>bagin</i>. 5. Open = <i>rayat</i>. 6. The sky = <i>tongkat</i>. |
|---|---|

The Jakuns live in small communities on the banks of jungle streams; those of the Jekati, Palong, and Segamat rivers are the most primitive. They subsist miserably on fruits, tapioca, roots, and small fish and reptiles. They seldom remain many weeks in the same spot, but wander from place to place, living under scanty leaf shelters built on rickety poles at a considerable height from the ground. It is not at all uncommon to find a dozen men, women, and children in company with a tame monkey or two, a few dogs and cats, innumerable fowls, and perhaps a tame hornbill, living in perfect harmony under the same miserable shelter. These aborigines are all very expert fishermen, using chiefly the three-pronged spear or trident; no less skilful are they with the sumpitan or blowpipe, which, with its darts tipped with the deadly Upas or Ipoh poison, constitute their chief weapon. On the Seriting river these sumpitans are manufactured from a very long-jointed, straight variety of bamboo, which is generally carved and traced with many rude devices. The darts consist of thin splinters of wood about a foot long, having a plug of pith at the butt end. The point is as sharp as a needle, and is covered with a black resinous substance; in many cases this is extremely poisonous—so much so, in fact, that monkeys and other small animals die from its effects almost immediately; on man and the larger animals its effect is far less rapid, but quite as deadly. This poison is known to the Malays as Ipoh, and is popularly supposed to be obtained from the Upas tree; but I am inclined to think that in most cases death results from the action of an alkaloid which is either strychnine or else

closely allied to it, which is obtained from quite a different species of tree. The juice of the Upas is very rarely obtainable in Johore. Probably each tribe or even each family of aborigines possesses a different and secret method of preparing the dart poison, which varies within very wide limits in its toxicological effects.

The Jakuns of the Indau and Sembrong rivers are, owing to their intercourse with Malay and Chinese traders, much more civilized than their brothers of the Palong and Jekati; they plant a little rice and Indian corn, wear a certain amount of clothing, and live three or four families together, in thatched bamboo huts. The true Jakun is of short stature; 5 feet 2 inches is a fair average height. They are much darker in colour than the Malays, and as a rule not at all well set up. The hair, which in the pure Negrito curls closely, is here in most cases simply wavy, or even straight. They appear to possess no particular form of worship, but are great believers in the existence of evil spirits. When a man dies he becomes transformed into a spirit that roams the jungle; thus on the grave of a newly buried body they place various kinds of food, a torch, cooking utensils, the sleeping-mat, and weapons of the deceased, for his use and protection in the shadowy land.

Late in September, the Jakati having risen sufficiently to make canoeing practicable, I broke up camp at Bukit Aso, and proceeded down stream to the confluence of the Keratong river. In travelling in canoes one sees far more of the bird and insect life of the country than when actually tramping through the jungle. Birds of every size and colour, from the tiny bronze green sun-bird, and the blue and orange kingfisher, to the big crimson-beaked black hornbill, rise from the trees. Insect-life swarms in myriads; dragon-flies of bronze blue, purple, and vermilion, and butterflies in every shade of yellow, from pale primrose to orange, delicate rose-pink and bright crimson, are in endless variety. Now and then a lizard or snake will glide away in the dense undergrowth, while troops of monkeys chatter and scurry off, crashing through the trees, and taking breakneck leaps from branch to branch in their haste to escape the intruders. On each side is primeval forest, huge trees loaded with creepers drooping in a thousand fantastic shapes, dark green foliage, yellow sand and clear water, overhead a blue sky and blazing sunshine. But let a cloud obscure the sun, and the whole aspect changes; the trees and water look sombre, the birds and butterflies vanish, and one comes down from the clouds and begins to speculate on the chance of getting the camp built without a wetting, and whether Ibrahim the cook will burn the rice as he did yesterday.

We duly reached the little settlement of Keratong after three days' canoeing. Here we found the natives had trapped a fine tiger alive in a pit, and I thus had an opportunity of examining the big cat at close quarters. The Malayan tiger does not seem to attain such a large size as its Indian congener, but is apparently quite as powerfully built and

extremely well marked. One of the headmen showed me a leopard's skin; this animal, the "H'rimau bintang," or starry tiger, as he termed it, is, I believe, exceedingly rare in the peninsula.

From Keratong we made our way overland through dense bamboo jungle to the Palong river at Jeram Badok (the rhinoceros rapids). For miles around this place the country had been overrun by herds of elephants, who had levelled acres of jungle, and broken into and destroyed many of the corn and padi fields of the villagers. However, with the exception of hearing their trumpeting at night, we never came across any further signs of them. At Jeram Badok my Jakun guides brought in many specimens of monkeys, generally shot with the poisoned darts of the sumpitan. Amongst these were two white-handed gibbons or wau-wau's (Malay "Ungka")—this monkey is extremely shy, frequenting the densest forest and keeping in the tops of the highest trees; also a pig-tailed monkey, the "Broh" of the Malays, and several of the black "lotang" variety (*Semnopithecus obscurus*).

The Palong river rises in a big swamp on the northern frontier. The stream is sluggish, and, strange to say, much deeper and broader near the source than at the mouth. Here, as on the Indau, we found numerous diorite dykes. Eventually we reached the source only to find that Tasek Bera, which had been laid down in the existing maps as a big lake, was in reality a huge dismal swamp traversed by a few muddy streams. Our experiences whilst trying to penetrate into this region were anything but pleasant, and when, after three days' hard work, we reached what the Jakuns assured us was the boundary between Johore and Pahang, nobody was more heartily glad to commence the homeward journey than myself. The return was not commenced a day too soon, for the rains set in heavily, and the swamp became hourly more difficult to traverse. However, by pitching away nearly all our stores and kit, we reached the canoes again, made a rapid journey down the Palong to its confluence with the big Muar river, and eventually arrived at Bandar Maharani, where we obtained a steamer to Singapore.

The two Sembrong rivers are, I think, worthy of a short description, from the fact that they both rise in a swamp in the centre of Johore; from thence, one, the Indau Sembrong, flows east to the China Sea, while the other, the Batu Pahut Sembrong, pursues an exactly opposite course, and empties itself into the Straits of Malacca. Hervey, of Malacca, who in 1876 explored a portion of the Indau branch, came to the conclusion that at the source a running stream actually rose and flowed in opposite directions. This, however, is not quite the case, as the two rivers have their common origin in a swamp. Nevertheless, theoretically speaking, the southern portion of Johore is an island. In the course of my work on the Sembrongs in 1892, I was able to cross in small canoes from the east to the west coasts, with the exception of five miles of swamp, which

had to be waded through. A little deepening of the streams of the source, and a cutting through the swamp, would enable canoes to pursue an uninterrupted journey completely across the Peninsula, at a time when the North-East Monsoon closes all ports on the China seaboard. Both these rivers have very little fall to the sea, and in places spread out into big swamps and lagoons, overgrown with *rasau*, a species of *Pandanus*. The Kahang and the Selai are the two chief tributaries of the Indau-Sembrong, the former rising in the Blumut Hills, and the latter in the Tenang Range; the banks of both are very thinly inhabited by Jakuns. The forests at the source of the Kahang are noted for the camphor and "gahru," or eagle-wood (*Lignum aloes*), which they contain. On the Batu-Pahat Sembrong, and its more important tributaries, the Chinese agriculturists have settled in large numbers, planting chiefly pepper and gambier; as this latter product is not commonly known in England, it may be well to describe it.

Gambier is a product obtained from the leaves of a climbing shrub (*Uncaria gambir*). It is largely produced in Johore and the Archipelago by the Chinese. The leaves and twigs of the shrub are boiled in huge cauldrons and well stirred for some hours. The liquor is then strained, concentrated, allowed to cool, and made to set by frequent stirring, when it presents the appearance of a bright yellow clay-like mass, which is cut into cubes, allowed to dry, and in this state exported. The chief use of gambier is as a tanning material, in which it is only second to oak bark. It is also employed as a brown dye, and for strengthening canvas. Its composition is similar to cutch, consisting mainly of catechin.

Each group of plantations possesses what is known as a "kangka," or village. Here resides the "kangchu," or Chinese headman, also the representatives of the various syndicates, or "kongsees" of Chinese speculators. The gambling-house, with the opium store, is also here. Around the central buildings, which are often of a substantial character, are grouped the shops and stores, the eating-houses and innumerable pig-pens,—everything built on the ground, of bamboo and round poles thatched with palm leaf. Scores of such "kangkas" exist on the banks of the Johore, Batu Pahat, Muar, and Sedili rivers. The Chinese are principally Tinchus or Taichus, who come down from the province of Swatow; other clans or provinces are represented in the following order: Hokkiens, Kehs, and Macaos. These coolies are mostly brought from China to Singapore by Chinese labour agents, who defray their preliminary expenses, such as passage, food, clothing, etc. At Singapore they are placed in depôts, until engaged by planters from various parts of the peninsula, when their names are registered in the office of the Chinese Protectorate, the registration fee and the commission of the agent being paid by the engaging planter or trader. New coolies are known as "Singkehs," signifying "new men;" while "Laukehs," or "old men," distinguish those that have been at least three years in Malaya.

Needless to say, these latter command higher wages than the "Singkehs." These Chinese immigrants, naturally indifferent to their ruler, provided their personal independence is secure, generally make very contented and peaceful subjects, and notwithstanding the fact that they are in a very large majority—in the Territory numbering some 200,000, as compared with less than 100,000 Malays—disturbances are of very infrequent occurrence, and of an unimportant character; possibly the efficient police force maintained by the Government has something to do with this.

Johore, unlike the northern portions of the peninsula, is not a mountainous country; the main central ranges of Malaya here break up into small isolated groups of hills, rising as islands from a sea of flat jungle. The most important of these will be the Blumut group, situated almost in the centre of the Territory. In 1890 I made the second ascent of Mount Blumut. The journey is, however, an extremely toilsome one. The low-lying ground at the base is simply a big swamp, and at times we were forced to erect rough platforms in the trees to enable us to pass the night, there being no ground solid enough even to build a fire on. The myriads of leeches in these swamps did not tend to increase our comfort, and in a few days we were covered with ulcerating little sores, from their incessant biting. The following extracts from my journal describe the actual ascent.

On December 26, after eight hours' very hard work, descending one hill, only to find we had to clamber over others, the Jakun guides slowly hacking a path through the dense undergrowth, we arrived just at sunset at the foot of Blumut, and camped on the banks of a small spring of excellent water, probably one of the sources of the Kahang river. Towering above us is Blumut, tier after tier of rock terraces all thickly covered with vegetation, and terminating in one little peak, in shape a truncated cone. It is probable that there is no water much higher than this point. And therein lies the difficulty, for many of my men are helpless with fever; so the stores necessary for a protracted stay on the summit cannot be carried—everything depends on our being able to make the ascent, take the necessary instrumental observations, and descend again to this spot within forty-eight hours, as it will be impossible to take sufficient food and water to last more than half that time.

My next entry is dated December 30. On the morning of the 27th, leaving five sick men in camp and taking a little cooked rice and water with us, together with the necessary survey instruments, we commenced the ascent. Soon our troubles began, as in many places the mountain-side was practically perpendicular, and we were forced to cling to roots and shrubs. Before noon it became a question of abandoning the water and most of the rice, or the instruments. Throwing aside the former, we were enabled at 3 p.m. to reach the summit of Gunong or Mount Bechuak; at least, I presume it was that hill. After getting the small timber cut away, I saw that Blumut still

towered above us, being separated from Bechuak by a steep and narrow ravine.

That night it blew a gale, and the hill-top was enshrouded in driving clouds; entirely without shelter save a few branches, we spent a miserable night, crouched round a small fire, which seemed nothing but smoke. Next morning, after a handful of cold rice apiece, we descended the ravine, clinging to roots and stones. At the bottom we were horribly disappointed to find there was no water. The final ascent of Blumut was commenced at 8 a.m., the vegetation becoming sparser and going more difficult every minute. At last, at noon, the summit was reached. From the top of a pile of granite boulders I got a magnificent view of practically the whole of Johore Territory lying like a huge panorama, one mass of thick dark green jungle, with here and there a patch of bright emerald, marking a clearing of cultivated land; overhead the sun glared down from a cloudless sky, and not a sound broke the stillness of the solitude. To the north-west, Mount Ophir towered upwards with a few fleecy clouds clinging around its summit. Away northwards, beyond the Segamat country, rose the Tenang hills. East of these a stretch of flat land, and then the China Sea, dotted with islands and shining like burnished silver. Following the rugged coast-line southwards, comes the Selat Tebrau or old strait dividing the peninsula from Singapore Island. South-west lay Gunong Pulai, rising from a sea of jungle and having for its background the Straits of Malacca; then miles of mangrove swamp to the Batu-Pahat river, and so along the west coast to Muar and Mount Ophir again.

Four hours were spent on the bare summit, taking observations; and then our thirst, becoming simply insupportable, compelled us to descend the ravine, where we made another fruitless search for water. Evening found us again on the summit of Bechuak, where we spent another wretched night; luckily towards morning a heavy dew fell, enabling us to squeeze a little moisture from the moss which grew abundantly there; it was, however, intensely bitter. On the morning of the 29th the observations were completed, and we managed to make our way back to camp late on the same day. When in sight of water, my men made a rush and literally threw themselves into the shallow stream, where they lay at full length, lapping the water like dogs. On the lower eastern slopes of the Blumut hills rises the Sedili Besar or Big Sedili river. This river is chiefly remarkable for the number of its small tributaries, which form a perfect network, especially toward the north, where numbers of Chinese planters have settled. The Lenggiu rising on the south slopes is a comparatively unimportant stream, which uniting with the Sayong forms the Johore river.

Blumut is a corruption of the Malay word *Berlumut*, meaning mossy; the stunted vegetation on the higher slopes of these hills being so completely covered with moss that it sometimes seems as though one

were walking through a series of little mossy tunnels. The height, determined by aneroid barometers only, is 3100 feet; at night the temperature sinks to about 65° Fahr.

The Jakuns assert that formerly the aboriginal tribes of Johore and the neighbouring states looked on Blumut as the centre of the universe, being in fact the pivot to which the rest of the earth was attached and held together; consequently these hills are firmly believed to be haunted by all sorts of fearful and wonderful spirits, "hantus," "poyangs," "djins," "kramat tigers," and so. The two hills Bechuak and Chimundong lie on either side of Blumut. Respecting the position of these three hills the Jakuns have a legend that Blumut, the husband, possessed two wives, Chimundong, old and ill-favoured, Bechuak, young and pretty. In a fit of jealousy Chimundong cut off Bechuak's hair, who retaliated with a severe kick (the mark of which is still to be seen half-way down the slopes); at this point Blumut interposed his huge bulk between the two, and has been forced to remain there ever since in order to preserve peace.

The province of Muar occupies the north-western portion of Johore territory. It comprises chiefly the tract of land bordering on the Muar river and extending to the frontiers of Malacca and the Negri Sembilan. The chief town, Bandar Maharani, is at the kwala or mouth of the Muar. Ten years ago this was a mere collection of fishers' huts, but under a judicious administration it has grown into a flourishing little place, possessing a daily steamer service to and from Singapore, and a considerable export trade. The Sultan is represented by a Resident. From the town a light railway runs for a short distance to the village of Padang, the centre of a very fertile agricultural district. The banks of the Muar are thickly settled by Chinese gambier and pepper cultivators, as far as Bukit Kepong, a big village 70 miles up stream. Beyond this point the country is sparsely inhabited by Malays, who plant a little padi, but are chiefly employed in collecting jungle produce, such as damar, a resin obtained from various trees, "minyate kayu," or wood oil, gutta-percha, the true gutta, yielded by one tree only, known to the natives as Geteh Taban Merah. Unfortunately, in order to obtain this easily, they fell the tree. Indiarubber or caoutchouc, the dried juice of various climbing plants, is very plentiful. A large trade is carried on in rattans, of which over 30 varieties are exported.

The Muar river is the longest in the territory; it rises in Berembun in the Negri Sembilan and pursues a south-westerly course to the Straits of Malacca. The upper portion from the village of Jembu Lengan to the mouth of the Geme river, forms the boundary between Batin Gemelas district and the protected state of Johol, which is a portion of the Negri Sembilan. The Batin is the hereditary chief, but the supreme jurisdiction over his district is claimed both by the Sultan of Johore and by the British on behalf of Johol. The Batin's country consists of 500

square miles of trackless jungle and swamp, inhabited by wandering families of Jakuns, save along the bank of the Muar where a number of Malays have settled. The chief village is Jembu Lapan, which is near the confluence of the Jempole and Muar rivers. Here the Jempole is separated from the Serting river by a strip of flat swampy land, only 450 yards wide. It is therefore comparatively easy to haul canoes from one river to the other, and as the Serting is a tributary of the Bera, which joins the big Pahang river, travellers are enabled to make a canoe journey from Kwala Muar to Pahang, and thence out to the China Sea.

By far the most fertile portion of the Muar province is the Segamat district, which includes the plain of Tenang, lying at the foot of the Tenang range, and watered by the rivers Segamat, Juase, Pukin, and Tenang. The Chinese have not yet been admitted to this district, which is admirably suited for the cultivation of rice. As the Straits Settlements and Johore are entirely dependent on Siam and French Cochin China for their rice-supply, the cultivation of this cereal on a large scale in Johore is of the highest importance, and I believe there is already a project on foot to open up Segamat for that purpose.

The chief elevation in the territory is that of Mount Ophir, or Gunong Ledang, as it is called by the Malays, in Muar Province. A reference to the map will show its position. It is in the centre of a small group of hills, which at one period probably formed part of one of the main central ranges of the peninsula. From the sea it forms a very prominent landmark, owing to its abrupt rise and sharply defined peak. The height, carefully calculated by a series of observations with the boiling-point thermometer, is 4150 feet. It was long thought to be the highest mountain in the peninsula, but Gunong Tahan, in Northern Pahang, is probably twice that height. It was in endeavouring to reach this last-named mountain that Mr. H. M. Becher, who was exploring under the auspices of this Society, lost his life. The name Mount Ophir was probably given in the seventeenth century by European traders and adventurers, always on the look-out for the gold-bearing Ophir of Biblical fame. Considerable quantities of gold have been obtained in this neighbourhood, but the alluvial deposits are now practically worked out; of late years a little reef-mining has been attempted, with partial success only. The geology of this district appears to be very simple. The mass of hills of which Ophir forms the centre is of granite, containing the biotite variety of mica. In places this granite passes into gneiss; the lower hills and spurs particularly contain much gneiss, here and there traversed by dykes of quartz felsite. The surrounding country is either flat or undulating, consisting entirely of clay shales of various colours and degrees of hardness.

The ascent is a difficult one; but there is now a fairly well-defined path, and within 50 feet of the top is a spring of excellent water. The summit is a rocky platform, sparsely covered with rhododendrons and a

few other shrubs. There has been some talk of opening a bridle-path, and establishing a small sanatorium near the summit, for the use of residents in Singapore, Johore, and Malacca. It is certainly a good idea, as the nights are cool; there is an abundant supply of water, no mosquitos, and a magnificent view. According to local tradition, there is a beautiful enchanted putri, or princess, living on Ophir, attended by a large cat, to see whom is a sure sign of good luck. On attempting, however, to speak to her, the cat changes into a tiger, with disastrous results to the rash interviewer.

The capital of the territory, "Johore Bahru," was founded by the present ruler some 35 years ago; it is now a flourishing little town of about 15,000 inhabitants, the seat of government, and the residence of the Sultan. It is situated on the Selat, or Straits of Tebran, and lies about 15 miles north-west of the town of Singapore, separated from the island of that name by the above-mentioned straits, which are only about one mile wide at this point. Viewed from the Singapore side of the straits, the town presents a very picturesque appearance, built as it is along the shore, with the surrounding small hills dotted over with bungalows and well-laid-out gardens, the artistic palm-thatched native houses mingling with the more substantial stone buildings of the Government. Facing the sea is the Istana Laut, the principal residence of the Sultan, a long two-storied building fitted up with every European comfort and luxury, and looking deliciously fresh and cool in the glaring sunlight. Well-laid-out roads, an esplanade over a mile long, large airy hospitals, waterworks, and wharfs all testify to the enlightened and energetic administration of the present ruler.

Like all other Malayan and Oriental states, the usual autocratic form of government theoretically prevails in Johore. Practically, however, this state, a small but proud remnant of the old and powerful Johore-Malacca kingdom, has, since the accession of the present ruler, enjoyed a form of administration which may almost be described as constitutional. The Sultan is assisted by a council of state, the members of which are composed of chiefs and nobles who are mostly heads of Government departments. The working of the different departments is similar to that of a British Crown colony, it having been the anxious desire of Sultan Abu Bakar to make the form of his government as nearly similar to that of the government of the neighbouring Straits Settlements. The Sultan metes out justice with an impartial hand, being in all cases strongly and intelligently assisted by his judicial officers. All the usual courts of justice may be said to exist in Johore; but over and above these dominate the Council of State as a supreme court of appeal, to which no subject of the Sultan is denied access.

The success of the government of the Sultan is demonstrated by the great and increasing influx of Chinese into the territory; these immigrants, who are chiefly gambier and pepper planters, numbering not

less than 210,000. They are an industrious and law-abiding people, and may be said to be the commercial backbone of the state. Besides the Chinese, Johore receives from time to time immigrants from neighbouring Malay states, Java, and Siam.

The revenue of the state is principally derived from the import duties on opium and spirit, and the export duties on gambier, pepper, and forest produce. I may mention that Government has many other legitimate sources of revenue, which, for reasons best known to the ruler and his advisers, are still untouched, there being, for instance, no other taxes or duties on the population besides those named above.

The population of Johore may be taken roughly at the following figures:—

Malays	...	...	...	...	...	50,000
Javanese Bugis, Siamese and other natives of the Malay Archipelago	...	...	...	...	...	30,000
Chinese	...	...	...	...	...	210,000
Natives of India, Arabs, Eurasians, and Europeans	...	...	...	...	...	10,000
					Total	300,000

Although the mineral resources of the territory are of comparatively small importance, so much tin is annually exported from other parts of the peninsula, that I venture to enter into a brief description of the mining as carried on in Johore. The tin deposits in this state are entirely alluvial, the chief district being the tract of flat land lying on either side of the Johore river, and extending to the slopes of the mountains Pantı and Mentahak. In common with the northern portion of the peninsula the hills and mountains of Johore show absolutely no signs of the existence of tin oxide *in situ*—that is, in distinct veins running through the country rock. Various theories have been put forward to account for this remarkable fact, as it is certainly an anomaly that a country so extremely rich in alluvial tin as the Malay Peninsula should show no trace of the pre-existence of that metal in the form of true veins. Personally I am inclined to agree with the late H. M. Becher that the tin oxide occurs within certain zones of the granite country rock so minutely disseminated as to be almost regarded as an integral constituent of the rock itself. In cases where the deposit is very rich and coarse grained, it probably pre-existed in the form of a series of minute and irregular veins, or a “stockwerke” as it is termed, in the granite.

On the alluvial plain of the Johore river the following is a typical section through the tin-bearing ground:—An overburden of from 10 to 12 feet of soft yellow clay mixed with sand. Below this the stanniferous stratum from 1 foot 6 inches to 2 feet thick, consisting of gravel, very small waterworn grains of cassiterite and quartz fragments, mixed with yellow clay. Underneath this comes a stiff greyish-white clay containing no tin, and of unknown depth. The yield of tin ore varies, within very wide limits, from a few ounces to 50 or 60 lbs. per cubic

yard. The mining is conducted in a somewhat primitive manner by Chinese, who, however, contrive to obtain a profit in places which worked by European methods could not possibly pay.

For the past 20 years the commercial prosperity of Johore has been steadily increasing. The trade is almost entirely with Singapore, which serves as a port and distributing point for the whole of the Malay peninsula. The exports of Johore are principally gambier and pepper; in 1890, 21,577 tons of the former and 9236 tons of the latter were forwarded to Singapore for shipment. The other exports are copra, coffee, tea, areca nuts, tapioca, sago, wood oil, rattans, resins, timber, gutta-percha, indiarubber, tin. The chief import is rice, about 50,000 tons being brought in annually. The minor imports are salt fish, sugar, tobacco, paraffin oil, hardware, and Manchester goods.

Before the reading of the paper, the President said: We have here to-night a surveyor and explorer who will tell us something of his experiences while executing work connected with the delimitation of the northern frontier of Johore. But before calling upon him I cannot refrain from alluding to the untimely death of another explorer, Mr. Becher, in the Malay Peninsula, from whom we had hoped to receive news of an interesting expedition conducted by him to a successful termination. Our Council had given him its countenance and assistance because he was known to be a good observer, and had already done excellent work. He was attempting to reach a mountain in the interior of the Malay Peninsula called Gunong Tahan, three separate attempts having been made to reach it previously without success. He had ascended a river and reached its upper waters, where there were waterfalls and rapids, causing considerable danger. It is pleasant to hear that he took great pains each day to find his latitude and longitude, and it may be said that owing to his zeal in taking observations his life was lost, for when, on September 15, he had to form his camp, he would not do so on the shores of the river owing to the quantities of trees that would have obscured his view. He encamped on a stony islet in the middle of the river, because there he would have a clearer view for his observations of stars as they passed the meridian. He sat up during the night, sextant in hand, when a sudden and rapid freshet carried off the camp. He managed to get into a canoe, but it capsized and he was swept away, and his body has not been recovered. His assistant, Mr. Quin, had a very narrow escape. It may almost be said that Mr. Becher, like old Baffin on the Island of Kishm, died with his sextant in his hand, a martyr to science. Our Council (and I am sure this meeting will join with it) has resolved to send to his father our expressions of regret and sympathy at the loss of so valuable a life. Mr. Lake has also had to pass through many difficulties and dangers in the course of his survey. Fortunately we have him here with us, and I now have to request him to read his paper.

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

The DATO ABDUL RAHMAN, Secretary to H.H. the Sultan of Johore: Before I came in, the President told me that he would only allow me ten minutes. I do not know how much I can say in ten minutes; I can say a great deal, and at the same time very little. I have much pleasure in congratulating my friend Mr. Lake in your presence on the very interesting lecture he has given about my country. He said it is the privilege of a very few to have any knowledge of Johore at all. The majority of you will confess—you will pardon me for saying so—that you knew very little about the country before this evening. Johore, as you

ase, lies between the first and second degree of latitude, just above the equator. I observed Mr. Lake did not say anything about the temperature of the country. I think it would not be out of place for me to say that the average temperature is 80°; that sounds very high. You know most of you would say India has a very high temperature, and so has Johore and Singapore. Although India proper is many degrees higher in latitude than Johore, we say that Johore—and it is the experience of many Europeans—is much cooler than India proper. Johore and Singapore have been called the Paradise of India. I don't think I ought to spoil that definition by telling you any more about the climate.

Another thing Mr. Lake has mentioned—the north-east monsoon. Now, to many of you that is almost Greek. Allow me to explain that the north-east monsoon is a wind that blows incessantly between the months of November and April, and during that time the whole of the Malay Peninsula is in a state of cold; that is to say, it is winter. The other monsoon is the south-west, prevailing between the months of May and October. The north-east monsoon, being the cold season, is supposed to be healthy, and the winds are pretty regular, either north-east, north-north-east, or north-west. The south-west monsoon is not so regular; it may be west, south-west, south-east, and it may change from day to day. Mr. Lake spoke about the aborigines: we are Malays, and here stands before you a fairly fine specimen. The aborigines were the possessors of the soil before we came to the peninsula. It sounds funny that Johore and the other states should not have been inhabited always by the present possessors, but it is so. The aborigines were the proprietors of the soil, and we, the Malays, came there from a place in the Island of Sumatra. There are very few of these aborigines, as you heard, and I may add that the inhabitants of a Jakun or Sakai village number between seven and twenty-five inhabitants. They are simply nomads, and move from place to place, living on tapioca, yam, rice, and forest produce. We have tried to bring them all into closer connection, but have so far failed except with a certain family called Seletar. They are not actually aborigines; I think they are a cross-breed between Malays and the JACOONS. They live, not in the interior, but in boats on the rivers and along the sea-coast. They have no idea of a Supreme Being. Once a number of them were walking along in a street of Johore on a Friday when we were having our service. After it was over we went for them, and asked them if they knew anything about a Supreme Being. They said the Sultan; they did not know any other.

Mr. Lake spoke about the Pantang Kapor language. He translated it as the observance of the camphor ceremony, but it really means the “prohibition of camphor”; it is the using of certain ceremonies and the employment of certain words and expressions while in search of the camphor-tree. The Besan, or the woman, is supposed to be the “Camphor Spirit.” This spirit is supposed to know the ordinary language of the people, either pure Jakun or pure Malay, and in order to approach her it is necessary to use a language unknown to her; thus the camphor language.

With regard to gambier, we are proud of our gambier. Seven or eight years ago we produced most of the gambier used all over the world, but since then other states have begun to grow it, and I suppose in time we shall only contribute a small quantity in comparison. If in the olden days, when you had to depend entirely on oak bark for tanning purposes—for turning your hide into leather, the operation took one week, with gambier the same process can be done in one day. Mr. Lake spoke very little about his map. I think his map, of which we have a reduced copy, may be considered to be the map of the day. You see there are several blanks; for example, the hill country on the east coast is still unexplored. I hope Mr. Lake will be for several years longer available to the Johore Government, and I am quite sure they will entrust him again with the work of finishing the survey he has commenced.

On the map is mentioned the name of a colleague of mine, the Dato Luar, a Malay surveyor, a naturally clever man. If he had had a proper technical education in England he would have made a not discreditable member of this Society. Some years ago he compiled a map which was lithographed and presented to the Government of South Australia after the exhibition at Adelaide. I don't suppose the Society possesses a copy of this map, which was then the map of the time; now Mr. Lake's map has taken its place. Dato Luar has worked hard all his life, and almost taught himself surveying. He has as his friends two Malay engineers, who are respectively the chief engineer of public works and the superintendent of public works, brought up by the engineer of the Straits Settlements, Major McNair. Dato Luar learned surveying from his two friends. He was given charge of the gambier and pepper plantations, and found so much disputing going on between the Chinese planters as to the boundaries of their plantations that he found it necessary to learn something about surveying, and undertook the task of surveying the plantations—I think with great success. You all know the ordinary Gunter's chain. Well, he found so many rivers that often the chain did not do the work required, and he invented a chain simply made of pieces of rattan tied together, which was so taut that he had simply to stand at one end and send a canoe across with the other, and thus obtained the measurement. Before he compiled a map I don't think the Malays had attained to that degree of knowledge; in fact, I have never been aware that a map existed among them, not even like the Chinese, whose first map of the Celestial Empire described the rest of the world as the countries of the barbarians. In 1885 I had the honour of accompanying the Sultan of Johore to have an audience of the Pope at Rome, and much to our astonishment His Holiness knew about Johore, and sent some one to take us to the gallery, where there was actually a map of the Malay Peninsula, but Johore was not marked on it. We looked all over it, and all that was marked was Puntian Besar, because years ago there was a Roman Catholic church there, and I think it exists to this day. I have to thank you very much for the indulgence you have afforded me to-night.

General the Hon. W. FEILDING: The question has been so exhaustively treated by my friends Mr. Lake and the Dato Abdul Rahman, that I can have little to say. Mr. Lake has treated Johore purely from an explorer's point of view. My knowledge extends so far back as twenty years ago, when I was first a guest of the Sultan at Johore Bahru, and ever since then it has been my privilege to keep up a close friendship with him, and to watch with the greatest interest the progress his sultanate has made under his very intelligent government. There is one point of which I can hardly leave you in ignorance, namely, that three years ago, after conference with our own Government, when there was a question of connecting Singapore by railway with the other English settlements in the Malay Peninsula, and those with India, and so joining our great defensive coaling-station with India, His Highness the Sultan of Johore agreed that he should commence the survey of the line proposed through his country, with a view to laying out the railroad, and it was in that way that Mr. Lake, through me, became acquainted with the Sultan and his dominions. He did not go out as a railway engineer, but as a mining engineer and an explorer of the whole country to find out its mineral resources. I cannot leave the subject of his very modest account of his exploration without saying a few words about the nature of his work. You who have attended in this theatre for years have heard a great deal of the arduous nature and toil of exploring work; but, being a bit of an explorer myself, I can fairly say that I do not know any work at all to compare with the heavy labour and great anxiety entailed by exploration in the Malay jungle. You have seen from the photographs to-night what its character is; but that will not tell you the miles of fever-bearing swamp through

which the explorer has to pass, and in which he has to sleep at night. I think it is one of those things of which Englishmen have a right to be proud, when we think how many men we have, of a delicate physique like my friend Mr. Lake, whose pluck and sense of duty have induced him to endure these hardships which have caused him to pass more than two years of his life constantly down with fever, and who is, nevertheless, ready and anxious to go out again to complete his exploration. It is brave fellows of this description which make this Society what it is, the leading Society of that description throughout the world. So long as we have people of that stamp this Society will live. I cannot resume my seat without saying that I feel proud to be connected in any way, however humble, with two such men as have spoken to-night, one the explorer, the other the confidential adviser to the Sultan.

Lieut. KELSALL: I had the pleasure of accompanying Mr. Lake on his last trip across the Johore territory, up the Indau, and down the Sembrong, spending most of my time collecting, chiefly birds and insects, but also botanical specimens for Mr. H. R. Ridley, Director of the Botanical Gardens, Singapore. From what Mr. Lake has told you, you can conceive how difficult it is to move about Malayan jungles; in the state of Johore it is one continuous forest from one sea-coast to the other. In many parts you cannot move a yard without cutting your way through brushwood, and very often it is rattan jungle—long trailers armed with thorns that catch in the clothes and flesh, and hinder in every way. When we come to collecting, these difficulties are more felt. In the first place, the foliage is so very dense it is difficult to see birds and beasts, and when you do see anything it is difficult to get a shot at it, and difficult to find things when they are shot. The fauna of Johore is pretty rich. The greater number of the mammals and birds found in the peninsula are found here, as it offers both lowland and mountainous country. The larger mammals are rarely seen or heard; they are extremely timid, and, although one may frequently come across their tracks, it is very seldom that the animals themselves are actually seen. The elephant, the rhinoceros, the tapir, the bison, and the tiger are the larger ones; and there are several deer—the sambur and the little kijang, and one or two smaller kinds. Birds are pretty plentiful, but it is most tedious work collecting, as they are not only difficult to see, but they do not congregate in great numbers. It is possible to go a whole day and only see a small number. Some of the most noteworthy are the argus pheasant, in the mountainous districts. They are heard every night and morning as soon as one arrives in the hills. The Malays call it *burong kuau*, because of its note, a sort of musical wail, but it is a bird hardly ever seen in its wild state. Specimens are got by trapping, owing to a curious habit it has of making dancing-grounds about a yard and a half square, from which it clears every leaf and twig; the Malays erect an enclosure around this space, and entrap the pheasants by means of snares. The peacock is found, but not so plentifully as further north. Of hornbills there are several; there is the rhinoceros hornbill, and several others. Of kingfishers there are eight or nine species: a little one, very much like the European, is found on the lower parts of the rivers; a larger one seems to live in the thick jungle entirely; then there are barbets, broadbills, and sunbirds. Of monkeys, one species of gibbon is found in Johore, a dark variety that varies a good deal in colouring, but is usually dark brown with light hands; it is very shy, and it is not often one gets a glimpse of it. There is one species, perhaps two, of long-tailed monkeys; they go about in flocks. It has an extraordinary wail, beginning in a low key and ending in a regular shriek. The coconut monkey is trained to climb trees and pick the coconuts, and there is a greenish-grey monkey that inhabits the mango swamps. Butterflies are not very plentiful, and are difficult to obtain save on some open places; in some places in the south of Johore they are plentiful. Everywhere are the cicadas, with their curious cry. Of reptiles

there are a good many, and crocodiles up to 18 or 20 feet in length; on the western coast of the peninsula a large monitor lizard, and a great number of smaller lizards in the jungle—one very handsome species with a fringe down its head, and back brightly coloured, was met with on the Sembrong river. There are a good many snakes, but they are not often met. One or two are very poisonous; one, the hamadyar, is supposed to attack man, but this is a fable. There is a species of cobra, not so deadly as the Indian cobra. There have been very few cases of death from snake-bite in the peninsula. Of the vipers, perhaps one of the most dangerous is of a beautiful colour, black and green—dangerous because it climbs into the bushes and trees and keeps very quiet; one may be within a few inches of it without noticing it.

Mr. W. B. D'ALMEIDA : I have been associated with Johore and Singapore since my boyhood, and know the Sultan, and have a distinct recollection of his father the then Tumungong. I have not been to Johore, though I have coasted along it several times. I am very pleased with the paper I have heard. I look upon it as an inauguration of a new literature on Johore, introduced by Mr. Lake, the Dato Abdul Rahman, and General Feilding. I would make one observation on the Jakuns, whom I saw in Malacca. They were under a Jesuit missionary, who had a mission-house and schools about 15 miles from the town called Maria Pinda, and where he had converted twenty or thirty of them. They were very short people, rather shorter than those described by Mr. Lake, about 4 feet 5 inches. I hope the projected railway will start from Johore and be extended in time to Assam and Calcutta.

Mr. JOHN THOMSON : At this late hour I will only make one or two remarks as briefly as possible. The first is to congratulate Mr. Lake on the very satisfactory result of his exploration of the interior of Johore. I quite agree with General Feilding, and cannot conceive a task more difficult than that of making a survey in a dense Malayan jungle. I have had some experience of the difficulty of penetrating jungles in other parts of the Malay Peninsula. Next, I am surprised at the great progress made since I visited Johore in 1866. At that time there was only a small settlement of native houses bordering the narrow strait that separate the Sultan's territory from Singapore. This is the spot on which the palace and town now stand. The interior was then unknown. I took a photograph of a group of Jakuns, an aboriginal race of the country—a race of the most primitive type, and extremely interesting from an ethnological point of view. Other branches of the same aborigines are found on the mountains in various parts of the peninsula, under different names, all of the Negrito type. The males are short, about 4 feet 8 inches, and females below that average. In the south of Siam I had accounts of similar tribes occupying the mountainous districts above Kamput, a point remote from Johore. The subject of the aborigines is one worthy of fuller investigation. I have to thank Mr. Lake for the pleasure his paper has afforded me.

The PRESIDENT : I am sure the meeting will agree with me, that we have heard a most interesting paper, and that it has been followed by an interesting discussion. There are many points in the paper on which I should have liked to have made some remarks, but at this late hour I must confine myself to asking the meeting to authorize me, which I am sure it will do, unanimously to give its very hearty thanks to Mr. Lake for the paper he has read us.

The Map of Johore.—All the most prominent features in this map have been fixed by astronomical observation. These have been used as fixed points in triangulating the surrounding country, the details

having been filled in with the compass and plain-table. Advantage has been taken of positions previously fixed along the south coast by the Straits Government triangulation of the island of Singapore, and also of the Johore Government Surveys.

RECENT CONTRIBUTIONS TO OCEANOGRAPHY.

By H. N. DICKSON, F.R.S.E.

THE growth of knowledge concerning the depths of the great oceans is necessarily slow and irregular. In the shallower waters near land an expedition combining inquiries into different matters can be carried out with considerable thoroughness, at quite reasonable cost; but in "blue water" the expenditure of time and money involved is usually beyond what can be compassed by those most anxious to carry on the work: scientific research is impossible except to specially organized expeditions, and even these are seldom able to deal fully with more than one class of observations, the others being necessarily left to look after themselves.

Amongst the deep-sea expeditions of recent years, the "Plankton Expedition" of the *Humboldt-Stiftung* must be reckoned of special importance. The work of the s.s. *National* in the Atlantic during the summer and autumn of 1889, is now bearing fruit; and of the five large volumes of results announced, the sections already published include, besides zoological papers, a narrative of the cruise and a report on the meteorological and hydrographical observations, the two last being the work of Dr. Krümmel. The *National* sailed from Kiel on the morning of July 15th, and anchored in the same harbour on 7th November, having traversed a course of 15,000 miles—from the Butt of Lewis to Cape Farewell, Bermuda, Cape Verd Islands, Ascension, Para, Azores, and so home by the English Channel. As the primary object of the expedition was an examination of the Plankton or swimming organisms, the quantitative results of which are graphically exhibited on a map prefixed to the volume, physical investigations could only obtain a secondary place; and the narrative, where not concerned with the description of biological methods and apparatus, deals chiefly with incidents of the voyage and descriptions of the places visited. Of these latter, the accounts given of the Bermudas, of the Cape Verds, of Ascension, of Para and its neighbourhood, and of the Azores, are full of new facts; and the illustrations of persons, places, and things are characteristic to a degree.

In respect of oceanography, however, interest chiefly centres round the description and discussion of the position, form, and extent of the Sargasso Sea. After a review of the earlier accounts given by Theophrastus, Herodotus, and others, touching the existence of drift-weed

beyond the Pillars of Hercules, Dr. Krümmel concludes that the real sargasso was first encountered by Columbus, although the name (*salgazo*) is due to the Portuguese navigator, Oviedo. Various methods of estimating the amount of sargasso weed floating in different parts of the ocean were tried on board the *National*. On the outskirts of the main areas it was possible to obtain results by actually counting the floating bundles, but when these were aggregated by wind and wave into long bands, like stripes of cirrus cloud, it became necessary to make estimations from the amount of area covered and the average density at selected points. By calculating, from the records of sailing ships, the number of times the weed has been encountered in certain five-degree squares, and expressing these as percentages of total voyages across the squares, Dr. Krümmel has been able to draw lines representing the average frequency with which the sargasso occurs in different parts of the Atlantic at each season of the year. The results, reproduced diagrammatically in the following table, were first published in *Petermanns Mitteilungen*, in

	50° W.L.	45°	40°	35°	30°									
50°														
N.L.	0	0.4	0	0.3	0	0.1	0	0.8						
	0.3		0.3		0.2		0.3							
	0	0.6	0.1	1.0	0.1	0.7	0.1	0.1						
45°														
	0.9	3.0	0.5	2.8	0.2	2.2	0.4	1.1						
	1.9		2.5		1.7		1.1							
	1.2	2.4	2.0	4.8	1.8	2.6	1.7	1.2						
40°														
	1.2	4.8	1.3	4.5	2.1	3.1	1.6	0.6						
	4.2		3.8		4.3		1.7							
	4.4	6.5	2.6	6.6	3.0	9.1	2.0	2.4						
35°														
	9.1	8.2	11.1	9.1	5.7	7.4	1.9	2.7						
	9.8		10.5		7.5		3.7							
	11.6	8.7	12.3	9.6	6.7	10.2	4.8	5.6						
30°	The numbers show relative frequency of sargasso in 100 voyages at the following seasons:—													
					9.5	7.8	6.1	2.4						
					9.4		4.4							
	9.1	11.83	5.3	4.0										
25°	<table border="1"> <tr> <td>Spring</td> <td>Summer</td> </tr> <tr> <td colspan="2" style="text-align:center">YEAR</td> </tr> <tr> <td>Winter</td> <td>Autumn</td> </tr> </table>				Spring	Summer	YEAR		Winter	Autumn				
Spring					Summer									
YEAR														
Winter	Autumn													
	8.4	6.0	5.7	2.9										
	5.6		3.0											
	6.1	1.8	2.4	0.8										
20°														

SARGASSO WEED IN THE NORTH ATLANTIC.

1891. They show conclusively that the bundles of weed are derived from the shores of the Gulf of Mexico, and that their concentration is at least partly due to the Gulf Stream bringing up supplies faster than the drift currents are able to carry them away.

Coming next to the purely physical and meteorological work, contained in the third part of the first volume, we have to regret that the limited time at the disposal of the expedition, and the comparatively slow steaming speed of the *National*, almost entirely prevented the taking of special soundings. A number of temperature observations were made at various depths with a reversing thermometer attached to the dredge rope just above the net, but apart from the inherent uncertainty as to the actual depth of the instrument below the surface, this method can scarcely be relied upon, and at best the result may be taken as merely confirming the work of previous expeditions. Zoological work and surface observations do not, however, mutually interfere, and between air and water the staff of the *National* left but little undone. An important series of observations with a standard anemometer affords, when compared with estimations of wind force, so strong a confirmation of the results of the *Gazelle* expedition, that we may accept the following table as a correct valuation of the numbers of Beaufort's scale:—

Force—Beaufort Scale	...	...	2	3	4	5	6	7	8
Wind velocity, miles per hour	...	...	7·6	11·4	15·9	21·0	26·2	31·8	36·2

Observations of the movements of the upper clouds in equatorial latitudes agree with those discussed by Dr. Gerhard Schott, in the paper noticed below, in showing that the motions of the upper atmospheric currents in those parts are by no means so simple as has been supposed. Between the equator and 10° N. lat. the prevailing direction is undoubtedly westwards, and during the summer months this holds good up to 20° N. lat. During winter, however, the most frequent direction in the higher latitude is with the anti-trade from south-west. Krümmel has shown that between 0° and 10° N. shallow depressions are met with at all times of the year, while between 10° and 20° N. they occur chiefly during the south-west monsoon, and as these depressions move almost invariably westward, he regards the deflection of the cirrus clouds as evidence that they are associated with such cyclonic disturbances. It seems necessary, without entering into a discussion of the question, to accentuate the fact that the true cirrus cloud of the high atmosphere is but seldom observed in low latitudes, and that, as Krümmel remarks, most of the cirriform clouds recorded really belong to the intermediate or anti-trade wind layers.

In another paper Dr. Krümmel discusses first the rain-squalls of the horse latitudes, showing that these are associated with local ascending currents; and second the sea-breeze at Para. In the estuary of the Para, as at Cadiz, the Camaroons, and elsewhere, it is noticed that the sea-

breeze attains remarkable strength at the beginning of flood tide, and especially during springs. As the normal sea-breeze moves considerably faster than any tidal current, it is evident that the increase of its speed cannot be due to a dragging action of the water, but rather to the change of pressure gradients caused by the raising up of the air lying on it. The phenomenon can therefore only occur in large estuaries, where the relative alteration with respect to the land is greatest. It is remarkable in this connection that at Campbeltown and other fishing stations near the entrance of the Clyde Sea Area, there is a popular belief that if the barometer falls quickly during flood tide, and the wind does not at the same time correspondingly increase, there will be no change during the succeeding ebb tide, and the storm may be looked for with the first of the second flood. This is recognized as a quite local peculiarity, and the belief is not current in any other part of the west coast of Scotland.

We may take it that for the present the chief aim of the oceanographer is to extend, and at the same time to simplify, the various methods of tracing the movements of bodies of water in the sea by means of physical or chemical peculiarities observable in the water itself; and the second half of the paper before us contains a masterly review of the present state of knowledge with regard to the examination of sea-waters, as well as important additions to the same. In the matter of temperature observations, Negretti and Zambra's reversing thermometer, especially when mounted in the "Scottish" frame, leaves little to be desired for accuracy or simplicity, and the water bottles of Sigsbee or Mill are trustworthy in action with reasonably smooth seas. Troubles may be said to begin with the examination of the samples collected, and where we are only concerned with means of identification, they centre chiefly round the determination of density or salinity. It may be seriously doubted if the very high degree of accuracy demanded by some investigators is really necessary; certainly any theory of circulation involving accuracy in density determinations to the fifth or sixth place of decimals may well be open to question, and in most cases the differences actually observed are much greater; but it must be admitted that we require to know the fourth place of decimals accurately, and ought to have at least some notion of the fifth, corresponding to about 0.10 part by weight of the total salts contained in 1000 parts of ordinary sea-water, or a difference of 0.1 per mille in the salinity. The method of weighing equal volumes of the sample under treatment and of distilled water in a "pycnometer" is certainly the most correct for direct determination of density, but its use involves considerable time and labour, and is, of course, impracticable at sea. Next in importance comes the hydrometer method, but here difficulties are endless. In order to obtain sufficient sensitiveness, and at the same time to include the whole range of densities met with, it is necessary to have either

some means of varying the weight of one hydrometer, as in Buchanan's *Challenger* type, or to employ a series of separate instruments, as in Dr. Küchler's sets of Kiel hydrometers. In either case consistent results within the limit may be obtained, provided the temperature is fairly steady at the time of making the observations; sets of determinations made at about the same temperature with the same hydrometers give satisfactory comparative information, but considerable difficulty arises in ascertaining the absolute values, and it appears that whatever method is adopted for determining the instrumental constants, these should be fully controlled by experiments with waters of known density. The great source of uncertainty in hydrometer determinations is due to the fact that it is difficult to ascertain the temperature accurately, and almost impossible to keep it constant, and it is necessary to introduce corrections which require a knowledge of the change of volume with temperature of not only the hydrometer, but of the water under examination. The variations of specific gravity with temperature in waters of different salinities have been determined by various experimenters, whose results have recently been subjected to a very searching comparison and discussion by Dr. A. Schüick of Hamburg (*Ausland*, 1893, Nos. 40 and 41). Within reasonable limits of temperature and salinity, it seems unlikely that the volume corrections of the water introduce much error, but those of the hydrometer may be another matter. In passing, it seems again a duty to deplore the utter and hopeless confusion in the standards of temperature to which densities are to be referred: different methods undoubtedly adapt themselves best to different standards, and much is got over by the translation into terms of "salinity," but there are limits to the multiplication of results which cannot be compared. Fifteen degrees Centigrade is a convenient working temperature, and dynamical problems demand a recognition of the maximum density point of water—so why not adopt Prof. Pettersson's standard of sea-water at 15° C. referred to distilled water at 4° C.?

Of what may be called indirect methods, that of estimating the total halogen, usually spoken of collectively as chlorine, tends to supersede even the hydrometer in practical work. Amongst its many advantages, the facts that it can be carried out at sea, and that it requires but small quantities of the water samples, are specially in its favour. Given, however, the chlorine in a kilogramme or litre of sea-water, its density and salinity are still somewhat to seek; and here we come upon some of the most important recent work. From an examination of 133 samples, Forchhammer, who may be regarded as *fundator noster* in these matters, concluded that the salinity of any sea-water could be obtained from the chlorine in a kilogramme by simply multiplying the latter quantity by a constant coefficient, i.e. that the chlorine was, in all sea-waters, a constant fraction of the whole salts present. Forchhammer fixed the chlorine coefficient at 1.811, and Ekman, Tornøe, Dittmar, and

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Jacobsen found approximately the same values. Pettersson, however, in revising Ekman's work, found that if the samples were arranged into groups according to their salinity, the chlorine coefficient was smaller with the higher salinities, and conversely. Dr. Krümmel gives an exhaustive review of existing material from this point of view, and shows that the chlorine coefficient increases with diminishing salinity, at first slowly, and then faster and faster, or, in other words, it is found that chlorine forms a smaller proportion of the total salts the fresher the water. This would indicate that the dilution of sea-water by rivers is accompanied by the addition of a fairly constant proportion of salts, amongst which chlorides occupy but a secondary place; but it may be doubted if this constancy can be sufficiently trusted to allow of the universal application of the new chlorine coefficients. So far, the greater number of determinations have been made with brackish waters from the Baltic, and it would be interesting to see if the same values hold good for estuarine waters generally. The recent analyses of bottom waters by Murray and Irvine (*Trans. R. S. E.* xxxvii. p. 481) certainly show that there are other influences at work tending to alter the ratio of the chlorine to other salts in sea-water, and great caution must be exercised in making any assumptions of a general nature.

In computing *density* from chlorine, we meet the familiar "Dittmar's D," but here in the new form of an equation of the second degree. The advantage of dealing with litres of sea-water instead of kilogrammes is undoubted where volumetric methods are concerned, but this seems to be more than neutralized by the fact that "Chlorine per litre" involves a standard temperature, about which differences of opinion have of course arisen, as well as by the quadratic equation required in any calculation. From the various values for the coefficients in this expression, Dr. Krümmel revises the values of the factor for computing the salinity direct from the density, using different sets of data, and obtains a number practically the same as that of Karsten generally used. It may be noted that the uncertainty in this value is greater than that affecting density determinations of even comparatively modest pretensions.

With the aid of the surface observations made during the cruise of the *National*, Dr. Krümmel has revalued the older data of the surface salinity of the North Atlantic, and a new map is appended to his paper, which he observes resembles Buchanan's *Challenger* chart more closely than it does that published by the Deutsche Seewarte. The most striking feature of the map is the manner in which it shows that the densest surface water is found where evaporation goes on most actively, not where the insolation is strongest.

Among new methods of determining density indirectly, Dr. Krümmel's modification of Abbe's differential refractometer, first tried on board the *National*, promises excellent results. The chief difficulty with this instrument lies in correcting the optical comparison of salt water with

fresh for temperature; a difficulty which, it would seem, might be got over by using salt water of known density as a standard instead of fresh. Practical workers in this field will be glad to know that Dr. Krümmel is developing further improvements in what we may expect to be an invaluable instrument for sea work.

Practically a new departure is made in the application of Forel's "Xanthometer" scale to the observation of the colour of the surface of the sea. Combining the observations of the *National* with those made by Dr. Schott in the voyage already referred to, a chart of the North Atlantic has been prepared, in which the surface is coloured according to the percentage of yellow in the corresponding colours of the scale. Comparing these, which obviously allow of more rigorous treatment than the usual purely descriptive colour observations, with the observations of transparency, Dr. Krümmel concludes that the more transparent the water the purer the blue colour of its surface, and the less transparent, the more the colour tends to green. Dense warm water would seem to be bluer and more transparent, other things being equal, than water not so warm or so dense; but the conditions are so complicated by the number and nature of the solid particles in suspension, that it is extremely difficult to establish any general relations.

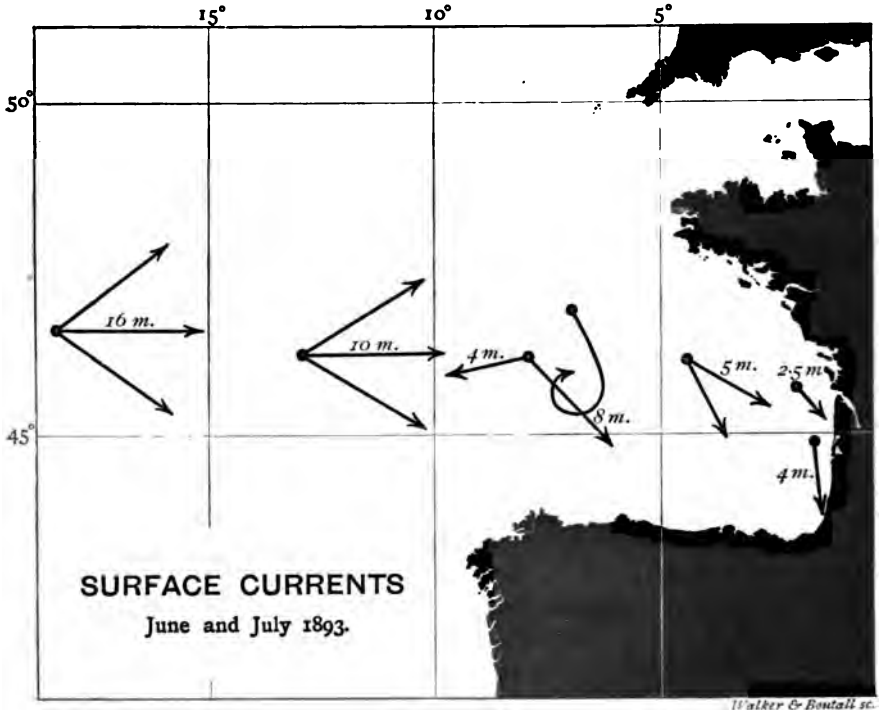
In *Ergänzungsheft* No. 109 of *Petermanns Mitteilungen* Dr. Gerhard Schott gives an interesting, if somewhat diffuse, account of a voyage made by him in 1891 and 1892 to the East Indies and Japan. Dr. Schott's observations were also unfortunately confined to "between wind and water," and in the first half of his paper, which deals exclusively with hydrography, the work is of a similar scope to that of Dr. Krümmel. The chart showing the salinity of the surface waters of the South Atlantic fits in excellently with that of the North Atlantic noticed above, and that of the China Sea and the region between the Indian and Pacific Oceans affords new information of considerable importance. Dr. Schott's observations of surface currents in the higher southern latitudes are of extreme interest, and although some of his conclusions certainly require the support of observations at greater depths, they give further indications of drift currents from a great Antarctic anticyclone.

In the second part of his paper, Dr. Schott describes his meteorological observations, and gives an account of the working of Assmann's aspiration psychrometer on board ship. Some remarkable observations were made on the effects of tropical rains on the sea and air: it was found that even heavy continuous rain altered the temperature and salinity of the surface water but little, while the change of air-temperature was considerable. In a section devoted to the temperature relations of the air and surface water, Dr. Schott confirms the general conclusion that the water is on the whole slightly warmer than the air lying upon it. It would appear, however, that there are important exceptions to

this rule, which Dr. Schott omits to notice. If, for example, we compare the air-temperatures for the North Atlantic in the *Challenger* Report on Atmospheric Circulation with the surface-temperature charts for the same area published by the British Meteorological Office, we find that the air is in many cases somewhat warmer than the sea, answering to the general condition that the usual state of things is reversed where the water is welling up or is part of a cold current. Toynebee, from 25,000 observations, concluded that in the North Atlantic the sea was on the whole warmer than the air in autumn, colder in summer, and that the temperatures were equal in spring.

Considering the numerous difficulties which arise in the course of identifying samples of sea-water from their chemical or physical peculiarities, and the pitfalls which beset any attempt to draw definite conclusions from such identifications, there is much to be said in favour of the old methods of mapping surface currents from the drift of floating objects, whether these be specially prepared floats, as in the investigations of H.S.H. the Prince of Monaco, or derelict ships as tracked by the Hydrographic Office of the United States. The most important recent application of this method is an extension of the Prince of Monaco's "Bottle-chart," by M. Hautreux, vice-president of the Society of Commercial Geography of Bordeaux, who publishes two short papers in the Society's *Bulletin* (Nos. 14-15 and 22, 1893). It has long been suspected that the accepted views concerning a steady northerly current, usually known as Rennell's, moving along the French coast in the Bay of Biscay, were erroneous; and, as M. Hautreux shows, recent research has brought forward no evidence of its existence. Bottles thrown overboard from the Prince of Monaco's yacht while following a course close to the meridian of 18° W. long. drifted invariably southwards of east, and were for the most part found on the Landes coast. To settle the matter, a first series of bottles, numbering thirty-five in all, were supplied to the fishing authorities at Arcachon and to the steamers of the Messageries Maritimes sailing from Bordeaux. These were put overboard at distances of 10 to 100 miles from land during June and July, and twenty-one were recovered, all on the Landes coast. Taking account of wind and tide, M. Hautreux found that the rate of motion diminished as the land was approached, varying from 5 to 6 miles per day 100 miles out to 1 mile and under close inshore, and that the motion was more southerly near the head of the gulf; also that the greatest number of bottles came ashore at spring tides. We reproduce a chart showing the general results. Continuing the investigation during August, September, and October, it was found that with the more variable winds the movements of the bottles were extremely erratic. Only about one-fifth of those put into the sea were recovered, and, although some were found to the north of their starting-point, their course had evidently been slow and tortuous. M. Hautreux' investigation has quite disposed of the northerly

Rennell current, and shown that instead of an active division of the drift current from the Gulf Stream in the Bay of Biscay, the water simply loses its proper motion as it approaches the part of the coast bordered by sand-dunes, and follows the prevailing winds, just as it does, for example, on the east coast of Scotland. We may take M. Hautreux' paper as another striking illustration of the variability of surface drift cur-



rents, and of the danger incurred by navigators in trusting implicitly to current charts. One of the leading results of recent oceanographical research is to show that surface drift currents vary in direction and speed almost as widely as do the winds which cause them, and that in different years and different seasons the same parts of the sea may contain water derived from widely different sources.

COUNT SZÉCHENYI'S TRAVELS IN EASTERN ASIA.*

By BARON F. VON RICHTHOFEN.

THE long-expected account of the scientific results of Count Széchenyi's expedition in Eastern Asia in 1877-8 has at last appeared in a form worthy of the workmanship. Three years ago the work was published in the Hungarian language, but its contents remained closed to nations who had a very real interest in the subject-matter. The importance of the expedition has long been known; it is one of the most brilliant undertakings of the last twenty years. Not only did it strike a path through great stretches of country hitherto scarcely trodden, but it had a quite special value in the fact that its purpose was purely scientific, and that among its members were men of scientific competency. Although the expedition did not reach Tibet, the object it originally had in view, this does not detract from its success. For the lines of route which it actually followed were quite as important, from a scientific point of view, as the approaches to the mystical Lama city.

We are told, in words of the deepest sadness, of the gloom which had come over the life of the Count Széchenyi, and which induced him to start on his great undertaking. The early death of his wife, endeared to him by her beauty and by her graces of intellect and thought, plunged him into profound grief. He sought relief in study, and then he formed the plan of a journey into the inner Asiatic "region of silence and solitude." But the journey was not to be one merely of adventure; the writer recalls with pleasure several conversations with the Count, when the latter gave earnest expression to the desire that his expedition might be a means of contributing something great towards the scientific knowledge of the globe. He was successful in engaging companions of tried ability. In the first place, desiring to find out the districts originally inhabited by the Magyar race, he required the help of some one familiar with the languages of Eastern Asia. An able scholar was found in Herr Gabriel Bálint, but unfortunately he was taken ill on the arrival of the expedition at Shanghai, and had to return. Lieut. G. Kreitner, who had been actively engaged at the Military Geographical Institute (Vienna), and was thoroughly versed in all the technique of cartography, undertook the topographical and general geographical work, while Herr Ludwig v. Lóczy went as geologist. The expenses of the expedition, as well as those in connection with the publication of its results afterwards, were borne entirely by Count Széchenyi. The plan was designed on a noble scale, and so it was carried out. The

* 'Die wissenschaftlichen Ergebnisse der Reise des Grafen Béla Széchenyi in Ostasien 1877-1880.' Erster Band. Die Beobachtungen während der Reise mit 175 Figuren, 10 Tafeln und einer geologischen Uebersichtskarte. Nach dem in Jahre 1890 erschienen ungarischen Originale. Wien. Ed. Hölzel, 1893. With Atlas.

Count's own charming personality and his high rank as a Hungarian magnate won him at once success in Peking. Letters of protection and passports were obtained for him, escorts of 4 to 16 men supplied, and often in the far West a grand reception was in readiness for the much-honoured expedition. As no money was spared in its conduct, everything went on without friction or difficulty, except for one slight delay at the end among the Kachins.

The expedition started from Trieste in December, 1877. Some time was passed on the way in India, Java, Hongkong, Shanghai, and Japan; so that it was the 8th of December, 1878, before the expedition actually started from Shanghai and began its special work. They reached Hsi-ngan-fu in the end of January, 1879, Lan-chou-fu on the 20th of February, Su-chau on the 21st of March, where they remained for a month. Then they went on to Tun-hwang-hsien, the most westerly point attained. A stop at Hsi-ning-fu from the 24th of June to the 10th of August was made use of to visit the Koko Nor and the famous convents of the neighbourhood. Then they crossed the Tsinling Mountains by a road hitherto unknown southwards from Tsing-chau, and reached the capital of Se-chwan. On the 11th of October the journey was continued from Ta-tsien-lu to Batang by a route frequently traversed in recent time. From Batang to Ta-li-fu their route diverged in part from that taken by other travellers; but they followed the usual road once more from Ta-li-fu to Bhamo. They arrived at Bhamo on February 18, 1880.

Although new ground was struck for short distances only, there was a decided lack of exact observations for nearly the whole of this route. The journeys made by the present writer in China coincided, too, only in very slight degree with those of the expedition. Plenty of opportunity was therefore offered for new and important research.

Herr Kreitner having published in 1881 a vivid account* of the experiences of the expedition and his own personal impressions of land and people, the authors were enabled, in writing the later great work, to confine themselves to the real subject-matter, which is therefore treated more exclusively than is customary in the reports even of scientific travels. Each of the three members of the expedition has written a separate report following the same line of travel. Yet the three reports do not materially overlap, for each bears clearly the impress of the author's individuality and special domain.

The first part, from the pen of Count Széchenyi himself, is called introductory, and occupies 253 pages. It gives the diplomatic and historical account of the course of the expedition. Only in this part is the complete journey described, from the departure from Trieste to the return. The intercourse with the officials, and the documentary matter

* Kreitner, 'Im fernen Osten,' Wien: 1881.

associated with this, give a distinct character to the account. We are told of the constant hindrances which came in the way of their plan to reach Lassa. Again and again they took it up anew and were prevented. But, looking away from these pages, we read with especial interest the account of the Count's negotiations with the two noble worthies, and really men of no small consequence, Li-hung-chang and Tso-tsung-tang, as well as with the Tsungli Yamen. And we follow with pleasure the attractively written sections on Hsi-ning-fu and the convents of the neighbourhood, the stay at Ching-tu-fu and 'a-tsien-lu, and on the Kachin race, as well as on the hunting expeditions, the observations of animals, and many other subjects. The author has conscientiously avoided everything which belonged to the department of his companions. His criticism of the Mandarins and the people is on the whole favourable, but there are a good many restrictions (*e.g.* p. xxxii. footnote, p. xlvi., and several other places). The summary of the impressions made by the Chinese people on such an experienced traveller is of great value. In the opinion of the writer, the author has formed too low an opinion of the value of the missions (p. lxiv. footnote).

The second part of the work is Herr Kreitner's report. First we get the astronomical determinations of position, 20 lines of longitude and 25 of latitude. The instruments are described and the observations given in full. Comparing these with earlier determinations, it is seen that, with regard to longitude, the figures of the Jesuits, with the exception of their probably less exact measurements in western Kansu, do not differ more from Kreitner's than those made by travellers during the last decade. In the north Kreitner's lines of longitude run from 0 to 17.7 minutes farther east than the lines fixed by the Jesuits, while in Yunnan they are from 7 to 13 minutes farther west; the differences between Kreitner's lines and those of Prjevalski, however, amount to more than a degree. The lines of latitude agree well with those of the Jesuits, within a small figure. The next subject relates to Kreitner's height-measurements. As the siphon barometer got broken in the very beginning of the journey, three aneroids were used, whose correction-tables are given. For comparative points only very distant stations are available at the present time, namely, Shanghai, Rangoon, and Calcutta; hence it is not surprising that the results of different observers vary considerably. Comparing 104 measurements of Gill and Baber with Kreitner's, we find differences up to 165 feet for 39 places, from 165 to 330 feet for 28, from 330 to 660 feet for 30, and of more than 660 feet for 7 places. Still greater are the differences compared with Sosnowski's measurements in Kansu; according to Kreitner, there are 5 places on an average about 790 feet lower, 2 places on an average 570 feet higher, than Sosnowski measured. Thus we see that the measurements of height in western China cannot claim great exactitude; where several are given, however, those of Kreitner merit special consideration. At all events,

his 374 aneroid determinations, and also the numerous trigonometrical measurements of the heights of mountains, give a most important basis for the knowledge of the relative difference in levels. We gather, from the annexed statement of the routes made, that in 269 days of march, 4450 miles were travelled, or $16\frac{1}{2}$ miles on an average per day.

The topographical description of the journey, by Kreitner, furnishes a large amount of new and valuable material, but is apt to be used as a mine of wealth beyond its true value by those who may wish to gather information on special topics relating to the geography of China. Throughout one recognizes the cartographer and military staff-officer, who prefers above all to deal with given lines and positive figures. Each district through which the journey leads is treated at first generally; an effort is made to describe briefly the map of the district such as it is considered to be, and without going into critical details. The Chinese maps are accepted with as much faith as if they were military maps of a European state, and river-basins described in all the minutiae of their complete development. It reminds one of Ptolemy when the lines of latitude and longitude are given for every little spring of a tributary, however uncertain in its position. In the same bold style, the main roads, bridle-paths, and footpaths, and even the mountains, are described in a few short and pointed sentences. With regard to the mountains, the manner in which they are represented does in several cases not agree with the correct map of the country. The description of the eastern slope of the Tibetan Highlands (pp. 214-217), for instance, does not correspond with the natural relations, as they clearly result from Lóczy's report.

Any separate district having thus been traced in its general outlines, the road which the expedition took through it is then described in detail. And here Herr Kreitner deserves high credit. He proves himself to be a many-sided observer with a thoroughly practical eye. The forms of the ground, the depths of the water, breadth of rivers, the bridges, fields, peculiarities of the inhabitants, the products, and much else, finds full consideration. The writing is completely technical; without unnecessary words, the facts are crowded one after another in a dry sequence. Figures (for the number of the houses, the population of towns, the breadth of valleys, etc.) are constantly given with an accuracy of detail which makes one sometimes doubt of their complete trustworthiness. Here and there some passage of more general interest is interspersed; *e.g.* on the number of inhabitants in China (pp. 226-232), on the road for traffic between Ta-t sien-lu and Lhasa (pp. 258-264), and between Ngan-hsi-fan and Hami (pp. 207-212), on the races of the Kachin and the Shan (pp. 293-297). The question of a railway for each part traversed is also discussed, and in conclusion a great railway plan drawn out for the whole of China (pp. 236-239), even the cost of which is calculated. As the originator of the plan is personally familiar with

a small portion only of the ground included in the projected railway system, the plan is naturally in part chimerical. A railway, for instance, following the Yang-tse-kiang from Ichang-fu to Chung-king-fu would be thoroughly impracticable. On the other hand, it has escaped the author's observation how easily he might have effected a union of the lower Han Valley with Honan-fu, and thus with his North-China Railway.

The most important portion of the whole work is its third part, written by Lóczy, and containing the geological observations. It is also the largest, for it consists of 540 quarto pages. Valuable as the contributions to topography are, they could only in individual cases bring any essentially important new matter. In the case of geological investigation, almost the whole journey offered new ground. There is scarcely another geologist in recent time to whose lot such a wonderfully grand and beautiful area of research has fallen, and Lóczy has proved himself to be the right man for it. Even a rapid glance at the work will suffice to show the hand of an active and keen explorer, capable to grasp clearly the main features and careful in his observations. Very little work had been done here before. At the time of Lóczy's journey, the only available geological work, excepting Pumpelly's, which relates to other parts of the empire, was that of the present writer, published at Shanghai. It contains detailed information on some regions in the middle provinces, Kiangsi and Kiangsu, which Lóczy traversed during the Count's stay in Japan, also on the Lower Han and the interior of the province of Se-chwan. For the written account, the second volume of the writer's work on China, relating to Northern China, could already be used along with the atlas-sheets belonging to it. Although Lóczy himself repeatedly mentions that he based his identifications of the age of the older formations for the most part upon this work, they have been carried out in many cases independently, by means of Lóczy's own collections of fossils (especially from Devonian, Carboniferous, Permian, Triassic and Jurassic rocks). An important addition to our knowledge consists in the discovery of very thick and widely distributed lake deposits in the north-west, which are proved to be of Pliocene age by the mammalian remains in them. They afford evidence that Tibet possessed in Pliocene time a wealth of extensive lake basins. The writer agrees completely with the view that most of the deposits which he called Lake Loess in Northern China belong to this formation.

High importance is given to the representation of the geographical structure and the tectonic facts, and it is made comparatively easy to understand the ideas of the author by reason of numerous drawings of sections in the text and several plates of sections. We now have before our eyes for the first time the structure of districts which heretofore had been far beyond the horizon of geological knowledge, such as the Nan-shan, the neighbourhood of Koko Nor, or that remarkable highland

region crossed by the road from Ta-t sien-lu to Batang. It might have been expected that the magnificent mountain region which forms the south-eastern part of the great Tibetan highlands would offer an interest equalled by few other parts of the continents. For there the direction of strike followed by the mountains of China (S.W.—N.E.) meets that of further India (N.N.W.—S.S.E. and N.—S.) and of the Kuenlun (W.N.W.—E.S.E.). It is true the problem has not yet been solved, and it forms still one of the grandest tasks for structural geology; but Herr v. Lóczy has certainly succeeded in making important contributions to its solution.

We might refer to many other points of interest and importance if space did allow. It must suffice in this short notice to mention one more of the great merits of the author. He made himself familiar with the literature on the whole south-west of China, more particularly on Yunnan and parts of further India. Its critical examination led him to draw a most interesting delineation of the structure of this part of Asia. Taking a still bolder flight, he undertook to combine all that is known of the geology of China in a "General Map accompanying the Travels of Count Béla Széchenyi," drawn to scale 1 : 5,000,000. To the explanation of this map are devoted the two concluding chapters of the whole work, which treat (pp. 785–821) on the geological history of the inner Asiatic highlands and their tectonic features. While it is delightful to read a representation from such broad aspects, there can be little doubt that many views are not based on sufficiently ascertained facts, and must meet with opposition in the future. The geological map, where it rests on the observations of others, could scarcely keep free from errors. At the same time, these are weaknesses which could not be avoided in the present meagre state of our knowledge. They are far more than outbalanced by the high value of the astonishing number of facts and actual observations which Ludwig v. Lóczy has recorded in this masterpiece of geological work.

The atlas accompanying the work offers, in a series of 15 sheets (scale 1 : 1,000,000) connected by conical projection, a representation of the route of travel and the country adjoining it up to the distance of from 10 to 25 miles on either side. A trained draughtsman had it for his sole business to prepare the geographical maps, an advantage seldom enjoyed by an expedition. The Military Geographical Institute in Vienna undertook the printing, and the originator of the expedition has devoted large sums of money to the execution of this part of the work. We are therefore justified in expecting a brilliant result; and indeed, as regards technical workmanship, Kreitner's maps are far ahead of all others existing hitherto of those regions. Great care has evidently been devoted to the topographical delineation. It appears, however, that the surveys have not been of equal exactness in every part. The writer had an opportunity of testing the accuracy of the river-drawings

only in two places on the basis of his own surveys, namely, in the course of the Han, between Hankow and Hsiang-yang-fu, and on the Kia-ling-kiang, near Kwang-yuen-hsien, and he must express his regret that in either case Kreitner's delineation does not bear minute criticism. In spite of this, there is a very marked advance in the drawing of the river-systems compared with Chinese representations. The Chinese map has been used, naturally enough, for the indication of the courses of rivers beyond the districts actually surveyed. But it cannot be approved that the river-courses taken from this source of information should have been drawn with the same firm lines as those based on careful surveys by excellent travellers, such as Gill or Baber. In the drawing of the mountains, a distinction has been made between the observed and the doubtful, and in this respect the maps are in advance of those of the writer. The orographical technique is admirable; but there prevails a tendency to represent all mountain scenery on a certain elegant pattern which is captivating to the eye, but does not suffice for the accurate expression of the very varied character of the inequalities of the soil. To take one example—the great scenic contrast remains unexpressed between the table-land of the inner basin of Se-chwan and its wild mountain surroundings. And if the orographic drawing be compared with the coloured geological picture, it is at once evident that the two have been prepared by different hands. The harmony between the inner structure and the surface relief appeals to us only in extreme cases of contrast, such as mountainous and flat country. Apart from those failings, the whole series of topographical maps forms undoubtedly a great help to our knowledge of the surface of China. The fifteen sheets of geologically coloured maps are throughout a new contribution to science. What has been said of Herr Lóczy's text applies equally to them, and not too much praise can be bestowed upon his conscientious work.

It is much to be regretted that the spelling of the geographical names on the maps and in the text has not been carefully carried out according to a particular system. This is no doubt owing to the early departure of Herr Bálint. As a Chinese scholar accompanied the expedition, he ought to have been directed to put down the names of all the places along the course of their route in Chinese characters, and it would have been a simple matter afterwards to transcribe the names according to some uniform system. But Herr Kreitner wrote the names according to their sound, and thus the very basis of correctness is wanting, namely, a fixed standard of transcription. The precise system used is of little consequence; the main thing is that the same written sign and the same sound shall be represented every time by the same syllable. As this has not been done, the use of the work is rendered difficult. Improvements have already been introduced in the text. Herr v. Lóczy gives himself considerable trouble in this direction. He has, moreover,

declared his intention of publishing at the conclusion of the work a comparative list of place-names, which will put things right with the geographical nomenclature.*

While the reviewer dared not neglect to mention some of the failings of the work, he fully appreciates its far greater excellences. He can realize how much it has gained for science, and with all the more enjoyment as it forms an immediate connection with his own observations. More than many others, he has reason to be grateful to the noble-minded originator of the expedition, and to those who devoted their powers to it, for what they have done to enrich our scientific knowledge of Eastern Asia. Inner Asia has been in recent times traversed in many directions. We admire the spirit of enterprise, the energy and perseverance of the travellers. Many among them have materially increased the knowledge of the forms of the surface, of the animal world, and of the inhabitants; but if one might venture to weigh the value of the individual expeditions against one another according to the total amount of scientific work done, there could be scarcely a doubt that a place in the highest rank is due to the expedition of Count Béla Széchenyi.

THE PAMPAS.

By P. KROPOTKIN.

IN a paper, recently contributed to *Petermanns Mittheilungen* (vol. xxix. 1893, 10, 11), Prof. Bodenbender gives some data relative to the pampas in the east of Córdoba, which, apart from their direct interest, throw some light on the very difficult and much-debated question as to the origin of pampas, steppes, and prairies generally. This question has lately been discussed a good deal, especially since Nehring came forward with his theory of a post-glacial steppe period in Middle-Germany.†

The same question has not ceased to occupy Russian explorers since the times of Ruprecht and Chaslavsky; and the works of Beketoff, Kuznetsoff, and Krasnoff, among botanists; Barbot-de-Marny and the staff of the Geological Survey, among geologists; and Prof. Dokuchaeff, among the explorers of the soils of Russia, have thrown upon it a good deal of new light. Without attempting, however, to sum up in this notice the just-mentioned researches, it is worth while to mention one point, at least, in which Bodenbender's researches meet those of the Russian explorers.

In a previous work,‡ Prof. Bodenbender has shown that the structure of the pampa deposits at the foot-hills of the Cordillera, where they are seen alternating with other deposits in the valleys, may give a clue to

* 'Verhandl. des X. Deutschen Geographentages zu Stuttgart,' 1893, p. 207.

† Nehring, *Ueber Tundren und Steppen der Jetzt- und Vor-Zeit*. Berlin, 1890.

‡ *Bulletin de la Academia Nacional*, t. xii.; also *Petermanns Mitt.*, 1891.

the origin of the former. He has proved, moreover, that the surface of the sandstones and conglomerates, upon which the pampa deposits rest, is not so even as might have been supposed on looking at the immense flat surfaces which now stretch before the eye in the prairies. Depressions and river-channels, quite different from the present ones, have been discovered, hollowed in the underlying rocks, and it appears that the rivers of our own time follow them only in their upper courses, while the lower parts of the old valleys have been entirely silted up by the deposits of the rivers themselves. Accordingly, the thickness of the pampa deposits varies greatly, attaining as much as 170 to 200 feet, and perhaps even 260 feet (about Córdoba), without, however, increasing further east. It is also worthy of note that the same clayey and sandy deposits, characteristic of the pampas, penetrate into the valleys of the Cordilleras, and cover such high plateaus as the Pampa de San Luis (5280 feet) and the Pampa de Pocho (3300 feet).

The materials of which the pampa deposits are composed are considered by Bodenbender as of glacial origin. True, that no polished and striated rocks have yet been discovered, either in the Argentine Cordilleras or in the main chain in the latitude of Córdoba; but the region has never been carefully explored for this purpose, while on the other side, Prof. Moreno has described undoubtedly morainic deposits on the borders of the Mendoza Cordillera, and Bodenbender himself has found the same at the foot of the Cebro del Plata. He therefore considers it highly probable that parts of the Argentine territory have been glaciated; and that the Loess and the thick layers of the pampa formation have been derived from the old moraines. The finest sand and mud, of which the latter is composed, have been deposited, partly by the agency of the wind and partly by the rivers during their inundations.

All the present river beds are of a relatively modern origin, and one may see still how they have originated from successions of lagunes, or elongated lakes. The present gradient of the Argentine rivers is certainly small, but is greater than it had been supposed to be. Thus, on the first two miles after its issuing from the mountains, the Rio Primo has a fall of 0.015, which decreases to 0.0025 above Córdoba, and to about 0.0014 in its lower course. Similar figures have been found for the Rio Secundo, Tertio, and Quarto. It is evident, moreover, that in previous times, before the rivers had silted up their lower courses, their gradients must have been still steeper, and this is confirmed by the larger size of the shingle in the older gravels.

At the present time the whole of the surface of the plains is dotted with countless elongated depressions and channels, which are known under the names of *arroyos* (streams), *canaverales*, and *cañadas*.* Those

* It is known that the steppes of South Russia are also dotted with similar depressions, which play such an important part in the life of the steppe as reservoirs of moisture.

depressions are so slight that they can easily be overlooked—with no slight inconvenience if this happens in railway building—but they are mere remnants of much larger depressions which existed in times past, and have been filled up since, partly with dust transported by wind, and partly with the loam deposited over their grassy surfaces by inundations. This levelling process—so characteristic of the South Russian steppes as well—is continually going on nowadays, so that even the slightest depressions of the surface gradually disappear. Even now, inundations play an important part in that process, and one may easily guess the part they have played in times past, when the channels of the rivers were less deeply cut into the plains than they are now. Thus, in 1888, the inundation in the southern part of the Rio Quarto district extended for nearly five hundred miles south of the Arroyo S. Catalina, so that Rio Quarto and Rio Quinto nearly joined together, to form one common basin; and the inundation of 1891 also was on the same grand scale.

Prof. Bodenbender's remarks concerning the part taken by rivers in the formation of beds of Loess and similar "Steppe formations," fully confirm the conclusions arrived at by the Russian explorers. It is known that both in Europe and North America the Loess appears as an outer fringe around formations, the glacial origin of which is no longer a matter of doubt for most geologists. In North Germany, such a fringe stretches west to east at the northern foot of the Harz, the Thüringerwald, the Erzgebirge, and the Riesengebirge, and it is precisely from this belt that a post-glacial vegetation bearing a Steppe character has been described by Nehring.* In the steppes of South Russia the Loess occupies a broad belt between the morainic deposits of Middle Russia and the Black Sea. In Turkistan, as is so well seen on the geological map of Prof. Mushketoff, a Loess belt fringes the outskirts of the highlands and follows the foot of the chains of the Tian Shan system; while in China the Loess belt follows the foot of the south-eastern slope of the Central Asian plateau, and the same formation reappears again on the north-western slope of the plateau in Siberia.

Altogether an intimate connection between the Loess and glacial deposits is thus fully established, and the most accredited opinion among geologists is, that this sandy loam must have originated from the finest particles of mud and dust contained in the glacial beds, and carried away either by the agency of wind or by that of water. Richthofen's hypothesis, according to which wind has been the chief agency in accumulating beds of Loess, has much to be said in its favour, and it has found by this time many adherents, especially in western Europe; but several Russian geologists, who have had splendid opportunities for exploring the Loess where it comes in contact with the

* See the map of Dr. Ernst H. L. Krause, in *Globus*, 1894, No. 1, 'Die Steppenfrage.'

glacial deposits and penetrates in the shape of islands into their midst (as is the case in the depression of Nizhni Novgorod), or appears interstratified with them, are more inclined to favour the fluviatile origin of the Loess and similar steppe formations. The ice-cap which covered Russia, almost as far south as Kiev and Kharkov, and crept still further south into the basin of the Don, must have given origin to numberless streamlets, heavily laden with mud, which must have spread that mud over the tundra-like and, later on, grassy plains of South Russia, both at the time of the greatest glaciation and while the ice-cap was thawing and retreating. The rivers of the time had not yet dug out their channels; they were then, as many of them are still, what Peschel used to describe as "young" rivers, flowing in yet unsettled channels, and periodically inundating immense areas. Such inundations, when they have been spreading over surfaces covered with a thick grass vegetation, undoubtedly must have given origin to an unstratified formation of sandy clay, very similar to what we see now as Loess. This view, as just seen, would thus find a further confirmation in Bodenbender's observations. It may also be added that a formation, almost quite similar to the Loess, is formed under our very eyes in the middle parts of the Amur, where, after having issued from the Little Khingan, it flows through wide prairies to join the Sungari. The soil of the prairies on the banks of the two rivers, in the just-mentioned parts of their courses, as well as the soil of the countless islands which are continually formed and destroyed by the great inundations taking place during the period of the great summer rains, are (if we take into account the difference of the formations supplying the mud) very similar to the Loess, and the inundations evidently do not prevent a flora and a fauna, which bear a great resemblance to the flora and the fauna of the steppes, thriving upon these prairies.

At any rate, whatever use the geologist may make of Bodenbender's observations, they are very interesting in themselves, as they complete our knowledge of the geography of the pampas.

DR. CVJIĆ ON THE PHENOMENA OF LIMESTONE REGIONS.

UNDER the general designation *Karst-phenomena*, physical geographers in Germany include a variety of land-surface features, all characteristic of limestone regions, which, when the features in question are present, are known as "Karst-regions." To bring together in one comprehensive view the main facts relating to these is the object of a monograph by Dr. Jovan Cvijić, which forms one of the *Geographische Abhandlungen* edited by Professor A. Penck, of Vienna. The author has himself studied the subject in the *Karst* regions of East Servia and the shores of the Adriatic

in Istria, Montenegro, etc., from which, therefore, the bulk of the illustrations are taken.

The chief features of such limestone regions are those known as *karren*, *dolinen*, blind valleys, and *poljen*. The *karren*, or surfaces composed of blocks of limestone separated by narrow fissures, are dealt with very briefly, much having already been written about them. The writer's conclusions are that they occur in regions composed of pure limestone, and where the surface is least protected from chemical erosion by water. The *dolinen* (called by English writers swallow-holes, sink-holes, or cockpits) are rounded hollows varying from 30 to over 3000 feet in diameter, and from 6 to 330 in depth, great numbers often occurring in a limited space. They may be either dish, funnel, or well-shaped, according to the varying proportion between depth and diameter, though other forms also are found. Some have bare floors, but they are more often covered with the product of decomposition of the limestone (called *terra rossa*), which is of importance as affording almost the only soil fit for cultivation in some districts. Besides the simple basins, the *dolinen* also occur in the form of chimneys, communicating below either with blind cavities, or with underground river-courses or systems of fissures, the first being known in France as *avens*, and the second in Jamaica as *light-holes*. The last to be mentioned are those occurring in alluvial soil, which are caused by a sinking of the latter into clefts in the rock beneath.

The old idea (not, however, held by many English geologists), that these hollows are originated by a falling in of the roofs of underground cavities, is thought improbable by the writer (except in isolated cases), although it has found favour with some recent investigators. His reasons are—(1) the supposed instances have always been hollows in alluvial soil, and not in the rock itself; (2) the greater number of *dolinen* have no connection with such cavities; (3) where they do lead to caverns, there is nothing to prove that they were originated by a falling in of the roof, the connecting passage being often extremely narrow; (4) the presence of cones of *débris* in the caverns (which has been thought to support the view in question) may be easily explained otherwise. The true explanation, Cvijić holds, is that which attributes the *dolinen* to the erosive power of the water which sinks down into cracks and fissures of the rock.

The writer next deals with the streams and valleys of *Karst* regions, which differ in many ways from those of other countries. While as a rule the heights of a country are isolated and the valleys connected, in limestone districts the reverse is the case, owing to the frequency of "blind valleys," shut in at the lower as well as the upper end, the water of the streams sinking into clefts in the porous soil. Another type of depression shut in all sides is that of the *poljen* (a Croatian term), which are broad hollows with steep sides, and fairly

level bottoms without definite slope. They may be either dry, periodically inundated, or occupied by lakes, the second class being far the most numerous. The water of inundation is often derived from springs on their floor. The *poljen* occur at low levels, and therefore receive an enormous supply of "ground water," especially at the times of the autumn or winter rains, which the underground outlet cannot carry it off fast enough. The most important point in reference to the structure of the *poljen* is that their axis is usually parallel to the strike of the strata in which they lie.

Dr. Cvijić concludes the treatise with a sketch of the distribution of *Karst* phenomena in the different geological formations.

NORTHERN GREECE.

By DR. A. PHILIPPSON.*

NORTHERN Greece, *i.e.* the land north of the Ambracian and Malian Gulfs, or the provinces of Epirus and Thessaly, forms, in its general characteristics, a connecting link with the districts of the Western Balkan peninsula, which bound it on the north. The difference between the latter and Hellas is very marked, in spite of the slight distance and the agreement in geological structure. The western front of the Balkan peninsula is occupied by a rugged mountain range—Albania. A great number of parallel chains here run in a north-north-west and south-south-east direction parallel to the coast. They are the Dinaric rocky chain, which is continued into Hellas with the same direction of strike and the same rocks. But, whereas in the latter it has been shattered and opened out by the sinking of larger or smaller sections of the range during the Tertiary epoch, in Albania no such shattering has taken place; the range is a continuous mass, difficult of access, and the coasts are uniform and unbroken, no gulf nor wide bay opening a way into the interior. Albania is on this account completely continental, and its inhabitants have never stood in so close a relation to the sea as the Greeks. An extreme climate—sharp frost and deep snow in winter, burning heat in summer—oppresses this inhospitable land, in which a population, robust and energetic, but indisposed to all regular political organization and higher culture, has been settled from the earliest times. Further to the east, in Upper Macedonia, we find, it is true, fertile basins occupying depressions in the range, but they are rarer, and on that account larger, than in Hellas, and intercommunication is impeded by high ranges. There is wanting here, moreover, the diversity, and above all the genial climate, of Hellas. Only the products of Central Europe thrive in the basins of Upper Macedonia, exposed as they are to severe winter cold. What a contrast between these barbarous, trackless, and gloomy lands in the north, and the sunny and diversified fertile lands of Hellas in the south! The coasts of Northern Greece stretch uniformly, and are separated from the interior by mountains. In the south-east alone does the Gulf of Volo penetrate into the interior, and here only do we find a large seafaring population.

Epirus is, like Albania, filled with parallel chains with a north-north-west and

* Paper read at the Berlin Geographical Society, January 6, 1894.

south-south-east direction, between which are extensive and fertile longitudinal valleys, which are wanting in Albania. The special characteristic of the climate is the happy mixture of northern and southern peculiarities. On the coast a Mediterranean climate and vegetation prevail. In the interior the winters are still fairly cold—the Lake of Janina (1575 feet) often freezes—but yet milder than in Albania, and the summers are not so dry as in Southern Greece, owing to the frequency of thunderstorms. The rivers of Epirus are, therefore, far more considerable than in other parts of Greece. In the east, towards Thessaly, the mountains crowd ever closer together up to the wild and inaccessible Pindus, hitherto as good as unknown. Eastward of this extends the wide plain of Thessaly, walled round with mountains—in the east, Olympus, Ossa, and Pelion; in the north, the low Kambulic mountains; in the south, Othrys. The climatic conditions are not so favourable here as in Epirus. The severe winter cold banishes hence the characteristic plants of the Mediterranean climate, and the summers are quite as burning hot as in Hellas. The exploration of Greece has, until quite recently, been carried on almost exclusively in the interest of history and archæology. Now, because in this respect Northern Greece is of slight importance, our knowledge of these regions has remained in a very backward state compared with that of Hellas. In the beginning of this century, when the bloodthirsty tyrant Ali Pasha ruled the country with an iron hand, Epirus was visited by quite a number of travellers; but the English archæologist Leake alone substantially promoted the knowledge of the topography of Epirus, while nothing was done for the physical geography. No systematic investigations at all, even with regard to archæology, have been undertaken hitherto in Epirus. The site of the ancient Dodona has been revisited only within the last decade and a half, whilst as to the Pindus range it is even worse. Here only the new Græco-Turkish boundary-line has been surveyed, but nothing but the *line*, the observations scarcely extending a few miles to the right and left of the boundary. Moreover, only one pass over the Pindus, the Zygos or Lakmon pass, has been frequently crossed by travellers. The northern and southern bounding ranges of Thessaly, too, are almost completely unknown. Olympus, Ossa, and Pelion alone have been investigated in respect of geology and botany. It is, therefore, no wonder that the existing maps are extremely inaccurate, seeing that the greater part rests on report only. Even the larger river-courses are laid down very incorrectly, the numerous names of places occur in wrong positions, and the direction of the mountain-chains is not, especially in the case of Pindus, correct even in its outlines. Thus, on the Upper Aspropotamus, several hitherto quite unknown peaks, of over 6500 feet, were found in places where, until now, a broad basin of this river-valley was laid down.

On account of the disturbances from brigands, an escort of soldiers, who must be kept together in quarters, is indispensable for a journey in Northern Greece. But it is of more use still in dangerous neighbourhoods to enter into relations with influential "Friends" of the brigands, and to gain the good-fellowship of the latter, for they even put themselves at the head of the soldiers, and escort the traveller in absolute safety through the districts under their sway, and recommend him in turn to their confederates. In this way Dr. Philippon was able to traverse over 1200 miles, almost constantly on wild mountain paths, without any serious incident.

From Lamia he crossed, with a strong escort, various ridges of the Othrys range, which divides the plain of the Spercheios from the basin of Thessaly, a low, featureless range of serpentine, slate, and limestone. It is almost entirely uninhabited, covered with extensive forests of oak, which harbour abundance of game. The few villages are notorious for their leaning towards brigandage, for from 1829 to 1881 the Græco-Turkish boundary ran over this range. Travelling here was very difficult

owing to the quite unusual quantity of snow, and the bad weather which prevailed throughout all Greece in the spring of 1893. Othrys is joined on the west by a broad slate range, which forms the skirts of the Pindus proper. The deeply cut valleys are a hindrance to progress, in spite of the gentle slopes of the crests. The valley of the Megdova, which forms the boundary with the limestone chains of the Pindus, is one of the finest examples of a hollow of erosion in the world. Repeated heavy snowstorms made it impossible on the 15th of April to penetrate the Pindus range from Karditsa, an animated little town of the Thessalian plain, and therefore an advance was first made hence to Trikala and Kalabaka, on the borders of Macedonia. Two important facts were discovered here. It was found that the Kambulic Hills, which had been usually drawn as a chain stretching east and west, consist of ridges of crystalline schist running south-south-east, and thus belong to the system of Olympus. The range is covered with forest along the course of streams, and the Greek and Turkish boundary posts are the only human habitations. In the second place, it came to light that north of Kalabaka there is a broad gap in the range, filled with gentle hills of horizontal Oligocene marls and sands. It is the country of Chassia, forming an easy gate of entrance to Thessaly. Although the land is not unfruitful, the population is the poorest of all Greece. In spite of the severe winter, they live exclusively in grass-covered huts, which are worse and smaller than those of African savages. This is a result of the excessively grievous conditions of land-tenure, which prevail in all Thessaly with the exception of the higher mountains. The land belongs to great landlords, to whom the cultivators have to pay a great part of their produce, and who perhaps never visit their property, but allow the peasants to be relentlessly plundered by bailiffs. The peasants are therefore sunk into the most extreme poverty, idleness, and apathy; and so Thessaly, highly blessed as it is by nature, which might be the granary of Greece, is an open sore of the land, and the acquisition of this province—the cause which has brought this about—is that which above all has brought Greece to the verge of bankruptcy.

The Zygos pass, which, with its height of only 4900 feet above the sea, as a rule presents difficulties only in the depth of winter, was in 1893 barred to baggage animals, even at the end of April, by the masses of snow. It forms the one line of communication between Thessaly and Epirus, because here only a single crest has to be crossed, the Thessalian Peneios to the east, and the Artimos to the west, passing through all the other chains.

Janina, a dirty, irregular town of 20,000 inhabitants, lies on the large but shallow lake of that name. It has lost much of its commercial importance since the cession of Arta and Thessaly to Greece.

The geological structure of Western Epirus is fairly simple. Long, bare limestone ranges traverse the land in a south-south-east direction, between which the rivers have cut broad longitudinal valleys. In these dwells an energetic, agricultural population, in numerous thriving townships. The extreme north-western part of Epirus, with the river-plains of the Upper Kalamas of Argyro-Kastro and Delvino, is the best peopled and the most fruitful part of the land, and Epirus is far from being so bad as it is painted. It is true it is an excitable race which dwells here, and they are always ready to exchange the plough and shepherd's staff for the musket and *yatagan*. From Janina the traveller proceeded southwards to Arta by the excellent road (omitted on all maps) which connects Janina with its port, Salohora, on the Ambracian Gulf, and along which almost the whole trade of Epirus passes. Here it was absolutely impossible to obtain information about routes and supplies in the Pindus range, for no communication with Thessaly exists at this point across the mountains. The Pindus is an extremely wild and trackless range, although its

height does not exceed 7500 feet. It consists almost entirely of white stratified limestones, which are abruptly folded together in the most pronounced fashion. The rivers have washed out for themselves excessively steep and deep "valleys of erosion" in the folds, which are pressed together so as to form a single mountain mass. The Aspropotamos and all its tributaries run all of them in narrow ravines, which often reach a depth of over 3000 feet, there being never any level bottoms, which might serve the purposes of cultivation and traffic. It is these deep ravines which make the land so extremely impassable, since the mountain crests are not at all exceptionally difficult. As evidences of a former higher civilization, and a more active traffic, one still finds old-fashioned high-arched stone bridges in great numbers. Without them the fording of the rivers is not without danger, since they are continuously filled with felled fir-trunks in rapid descent; for in the mountains, otherwise so impassable, these copious and swift rivers afford the possibility of floating down the felled timber with ease to the sea, whence they are brought to market across the gulf to Patras. This easy transit occasions a heedless plunder of the forests by speculators from Patras and Trikala, who for small sums procure a permit from the government, and with their armed trains of woodcutters take up their abode in the woods, often against the opposition of the inhabitants. In a short time the splendid primeval fir woods, which a few years back clothed the whole of the Pindus, will have disappeared. Then the few cultivable spots in the valleys will be ruined by the flood-waters, and the population, so far as it does not emigrate, will give itself up to brigandage more than ever. Its chief means of support is the rearing of sheep and goats, and the adventurous forays which are made even into the heart of Epirus and Macedonia. From this source many of the people are comparatively well off. They live in large and stately stone houses, in the enjoyment of complete freedom under their chiefs, but entirely without requirements, maize-cakes being as a rule their only food. The supply of the traveller and of his escort of thirteen soldiers involved, therefore, the greatest difficulties.

A quite different race inhabits the northern part of the range, from the district of Aspropotamos to far within the Turkish territory. It is that of the Zinzars, a scattered Wallachian tribe. Here, in the bleakest mountain wilds, one finds large villages and towns, sometimes with over 5000 inhabitants (*e.g.* Metsovo and Syraku), with fine town houses adorned with artistic panelling and elegant European furniture, but without any fields to speak of, or visible means of subsistence. In winter these places are mostly quite deserted, but are filled in summer with a bustling population, many in European dress, and of good manners. A part of these Wallachians are shepherds, who in winter repair with their flocks to the Thessalian plains; others, however, are merchants and innkeepers, who wander away to all parts of the Mediterranean, from Marseilles and Tunis to Syria and the Caucasus. They always know how to make money quickly, and as soon as they consider they have enough, they return for the summer to their mountain home.

Having returned to Arta, Dr. Philippson proceeded to the southern part of the Pindus, which displays the same wild character, and then went by Karpenisi to the coast of the Gulf of Corinth, through the Oxya range adorned with fine beech woods, past the important chain of the Vardussia, for the exploration of which no time was left. The chief result of the journey is the discovery that the Pindus does *not* consist of two large chains which include a broad longitudinal valley of the Aspropotamos, but of a system of several chains crowded together, crossed in a diagonal direction by the Aspros in narrow ravines.

THE KIZIL IRMAK—THE ANCIENT HALYS.*

By LIEUT. MARCKER.

A SURVEY of the lower Kizil Irmak, the ancient Halys, was carried out in the autumn of 1893 by Lieut. Märcker, in company with Herrn von Pritwitz, von Flottwell, and Kannenberg. Of the 280 miles of the course of this stream below the latitude of Angora, only the section from Karghy to Daruchai had been previously laid down with accuracy, while the sections from Osmanjik to Haji Hamza and Duragan to Cheltek were based on the rough route-surveys of Chihachef and Ainsworth, and over 200 miles of the river's course were completely unknown. From Angora the travellers proceeded *viâ* Hassanoghlu to the junction of the Elmadaghchai with the Kizil Irmak over a gently undulating high plain, completely bare of trees. The cultivation of corn is being rapidly developed in this part of Anatolia, in consequence of the making of the railway: the tithes of the Vilayet of Angora brought in 20,000 Turkish pounds more in 1893 than in 1892, in spite of a moderate harvest. At Kalejik the travellers separated and began their surveys in two separate parties, intending to meet again about once a week, in order to connect their route-surveys. North of Kalejik the stream has cut itself a deep perpendicular-sided gorge six miles long, through dark volcanic rocks. Progress in this was possible only along a narrow goat-path. Here, and in eight other places, the travellers discovered rock-tombs, which are ascribed to Paphlagonian rulers, and of which only five groups were previously known. These burial-grounds are always in a prominent and commanding situation, which might be supposed to give the departed a wide view over the country. With the exception of one near Akjalan, which occurs high up in the mountains, they lie in the immediate neighbourhood of the river. In most cases the tombs are cut into an isolated rock, which thus plays the part of a monument. The height of the tomb above the alluvial soil is usually from 16 to 50 feet. They have all an antechamber, often with pillars, whence a low broad passage leads to the tomb proper, which contains one to four compartments. A closer examination of the numerous mountain valleys which debouch on the Kizil Irmak from the Kizdagh between Changri and Iskilib would probably disclose still more tombs of this kind.

Below Hamsale the stream flows through a plain two or three miles wide, which is little cultivated, since the soil contains salt. Below Tozluburun the stream is again hemmed in by a narrow pass, that of Ibik Boghaz. Downwards from this the country assumes a different character: the mountains, hitherto completely bare, acquire a slight covering of oak brushwood and stunted pine woods. At Karaveran the heights bore stately trees, and in the river-valley as far as Osmanjik, the vine was much grown for the preparation of raisins. Northwards from Karaveran the way is at first difficult, afterwards it passes by the hour over a series of long low uniform undulations. In Osmanjik a fine old stone bridge of fifteen arches, built by Bajezid II., leads across the stream. A causeway well suited to purposes of Turkish rule leads from Osmanjik to Haji Hamza along the left bank of the stream, and thence up the valley of the Devrezchai. Its only weak points are its thirteen bridges, now in a state of decay. Haji Hamza, a small town of two hundred houses, is surrounded by a wall dating from the earlier middle ages; its gardens are overflowing with abundance of the finest fruit. An hour's march below the town is the mouth of the large tributary, the Devrezchai. Its valley, from $1\frac{1}{4}$ to 2 miles wide, shut in on the north and south by perpendicular

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walls of yellowish-red rock, grows rice, cotton, and vines. Below the village of Daruchai, further progress along the stream was stopped by a gorge $7\frac{1}{2}$ miles in length, the traveller again reaching its banks only in the neighbourhood of the Cherkess village of Alchakh, since the stream makes a wide bend to the north. At Cheltek a good wooden bridge 340 paces long leads across the stream, and below it the river enters a gorge nearly two miles long, which Lieut. von Flottwell traversed by swimming. The section from Cheltek to Bafra, in which the stream crosses the coast range, is in parts very difficult, and had been previously unmapped. Idir is the southern limit of the cultivation of tobacco, which then takes the place of the vine. Here all the Greek villages lay on the heights, the Turkish in the valley, recalling the time of the persecution of the Christians; on the west coast the positions are reversed. The Greek peasants between Samsun and Sinope speak Turkish exclusively, and even among the rich Greek tobacco merchants there are only a few, of the older generation, who are acquainted with Greek. It is only within the last few years that the government has allowed the establishment of Greek schools. At the village of Assar the stream forces its way for the last time through an imposing gorge of rock, where three fine rock-tombs and extensive fortifications are to be seen. Beyond Cheltek the influence of the Black Sea makes itself felt in the form of fogs and increased cloudiness. Bafra, a town of 1900 houses, of which 400 are Greek and 200 Armenian, exports yearly about 7,700,000 pounds of tobacco. It is a rich town, and the Greek quarter contains a number of fine villas. North of Bafra the stream enters the lowland proper. In the environs of the town large meadows, separated by hedges of myrtle bushes, wild roses, and blackberries, extend, sprinkled over with fine oaks and walnut-trees, and enlivened by large herds of horses and cattle, as well as by thousands of wild swans, storks, etc. Further north the fields disappear, and their place is taken by a park-like country with thickets of dwarf oaks, which still further on changes into a broad swampy level with sedge and reeds, grazed over by huge herds of buffaloes. Close beside the stream an impenetrable forest belt of one to two hundred yards in width, resembling the African gallery forests, makes it impossible to follow its course to the mouth. In summer the stream is not navigable below the mouth of the Elmadaghchai even for small boats or rafts, on account of the many rapids. When the water is highest, large boats with corn are said at times to reach Bafra from Kaisarieh. A passage upwards seems impossible on account of the steep slope of the bed, and because towing-paths do not exist along the banks. It is thus not suited to afford a means of communication between the high plains of Central Asia Minor, with their wealth of corn and cattle, and the wood and tobacco producing north coast. In its lower course it actually forms an effectual barrier to intercourse between the districts lying east and west of it.

Between the mouth of the Elmadaghchai and the sea there are five bridges, one an hour's march above Kalejik (of stone), the others at Osmanjik (of stone), below Karghy (of wood), at Cheltek (wood), and at Bafra (wood). The last is destroyed almost every spring by the flood water, and is thus perpetually "in course of construction." There are, besides, six ferries within this stretch of 280 miles. The width of the streams varies in the height of summer between 55 and 330 yards, and the velocity is nowhere under $6\frac{1}{2}$ feet per second, or $4\frac{1}{2}$ miles per hour. The whole district is fairly safe to travel in, the greatest danger arising from the savage shepherds' dogs, which fiercely attack all strangers, and against which only a good riding-whip avails. From Bafra the travellers proceeded through the thickly peopled, well-wooded coast range *viâ* Alacham to Sinope, and thence back to Angora by Duragan, the Kizdagh, Iskilib, and Changri.

THE MONTHLY RECORD.

THE SOCIETY.

The Oxford Geographical Studentship.—The electors appointed by the Royal Geographical Society and the University of Oxford have elected to the annual geographical studentship, instituted jointly by the two bodies, Mr. Charles Raymond Beazley, M.A., of Merton College, Oxford. Mr. Beazley has given special attention to the exploration of the African coast by the Portuguese, initiated by Prince Henry the Navigator, and, with the approval of the Council, he will probably endeavour to carry out investigations on either the east or the west coast of Africa, with a view to throwing further light on the narratives of Portuguese enterprise.

The Society's Prizes to English Training College Students.—The Royal Geographical Society's prizes for proficiency in geography, in the late examination of students in English Training Colleges, have been awarded by the Government examiners as follows:—Male Students (prizes of £5 each): W. B. Alexander, Peterborough Training College; H. Copping, York Training College; E. Lupton, Culham Training College. (Book prizes): C. Gould, Battersea Training College; H. Milnes, Borough Road Training College; W. Pope, Chelsea, Whitehouse Training College; A. Purkington, Homerton Training College. Female Students (prizes of £5 each): A. M. Barnes, Tottenham Training College; D. Capamagian, Stockwell Training College; M. M. Lee, Derby Training College. (Book prizes): J. G. Beckett, Stockwell Training College; E. H. Bowyer, Stockwell Training College; A. J. Stone, Tottenham Training College; A. E. Thompson, Tottenham Training College. In order to adapt these awards to the new arrangements made by the Education Department, there will in future be twenty prizes of £2 each, and twenty certificates without any money award, in each case ten to males and ten to females. The total sum awarded remains the same.

EUROPE.

Origin of the name Vienna.—The origin of the word Vienna, in German Wien, has of late given rise to much discussion. Müllenhoff and Miklosich tried to prove that the names Vindobona, Vindomana, and Vidobomina are the original Celtic forms, and that the word Veduni, of Slav or German origin, is an intermediate link. But Dr. T. R. von Grienberger has recently shown (*Mitth. Geogr. Ges. Wien*, 1893, vol. xxxvi. p. 657) that this is impossible, inasmuch as Viudobona and Veduni, or Wedonb, have no connection with each other. He regards the Celtic Vindobona as a composite name—a view which we find supported by Professor Egli in his great work, 'Nomina Geographica,' he being inclined to regard the word Wien as coming from the composite Celtic place-name Vindobna = White Castle (*vindos* = white, *obna* = castle).

The Area of France.—The Geographical Service of the French army has recently concluded an elaborate remeasurement of the superficial area of France, which was described at a recent meeting of the Paris Geographical Society by General Derrécaigaix. The late General Perrier had instituted a measurement on the sheets of the 1:80,000 map by means of planimeters, one year being occupied in measuring the total area, one year in measuring the departments, and a third year in estimating the area of the arrondissements. At General Perrier's death there only remained an estimate of probable errors to complete the work, but when this was gone into it was found that the unequal shrinkage of the paper and certain defects in the planimeters employed seriously vitiated the results. Accordingly, General Derrécaigaix and Colonel de la Noë resolved on a complete remeasurement with improved instruments on the copper-plates instead of the printed sheets of the 1:80,000 map. This has now been completed, with the curious result that France has been found to be more than 3000 square miles larger than was previously supposed. The area between successive parallels and meridians of 10' was calculated on the assumption of the surface being that of Clarke's ellipsoid. For the greater part of the country, 7341 squares, the area was thus calculated without appreciable error, the planimeter being only used for measuring those parts where the 10' squares were crossed by a sea or land frontier. In the latter case the French portion of the square was first measured, then the oceanic or foreign portion, and finally the entire square. From these successive determinations the probable error was found. The total error in estimating the entire area was less than 124 acres. On the other hand, the physical change of area through coast erosion has to be taken into account; this amounts to a loss of about 75 acres per annum. The area of the whole country from this measurement is 536,891 square kilometres, or 207,301 square miles, which is 3022 square miles more than the less exact measurement of 1883 showed. In 1883 the total area of France was believed to be 130,678,543 acres; the new measurement gives 132,612,076, or 1,933,533 acres more. Amongst other interesting results of the adoption of the new figures is the reduction of the average density of population of France, as estimated at the last census, from 187·8 to 184·9 per square mile.

ASIA.

Survey of Aden.—Since October, 1891, survey operations have been in progress around Aden, the area undergoing mapping being roughly a semicircle with a radius of about 70 miles, described with Aden as a centre, and extending from the coast to the borders of Turkish Arabia. Orders were issued about two years ago for the survey of the peninsula of Aden on the same scale (8 inches to the mile), but financial considerations prevented this from being carried out at the time, though it was set on foot later. The Bombay military authorities have now applied for a survey of the cantonments of Aden on the scale of 24 inches to a mile, and this will probably be put in hand as well. It is much to be hoped that these operations will not be wound up and Captain Wahab's party disbanded without a serious effort being made to survey the protectorate of Berbera and the adjacent towns on the African coast, which are to all intents and purposes dependencies of Aden. The careful determination of some fixed points along this coast, and the extension across the straits of Bab-el-Mandeb of the Aden triangulation, would serve as a valuable point of departure for fresh geographical operations in the Galla and Somali lands.

M. Potanin.—The Russian traveller, G. N. Potanin, has returned to Moscow from his fourth journey to China. The illness, and ultimately the death of his wife, who accompanied him in his previous journeys, as well as in this last, compelled the

indefatigable traveller to stay chiefly in Torsando, and to return to Russia much sooner than he expected. He, nevertheless, has brought back most valuable collections of plants and animals, as well as very rich materials relating to the folklore of the inhabitants of the countries he visited.

Coal in Siberia.—It appears, from the geological explorations which have been made in connection with the Siberian railway, that there are several places in the southern parts of the Government of Yeniseisk where brown coal of a pretty good quality may be extracted. The most promising beds are those of Kushun, situated within ten miles from the projected railway station, Esaulova. They contain about 1,000,000 tons of lignite that may be worked; next come those of Antropova, on the Chulin river, and Kubekova, on the Yenisei, 13 miles from Krasnoyarsk.

The Shilka River.—It has been proved by the explorations in connection with the Siberian railway that the Shilka river, which has hitherto been considered as accessible to steamers only as far as Sryetensk, can be easily navigated for another 105 miles, as far as the village of Mitrofanovskaya. The steamer *Kiakhta*, five feet draught, reached this village in 1893, the level of water in the river being not above the average.

A New Map of China.—The Russian *chargé d'affaires* in Korea, M. K. I. Weber, has presented to the Russian Geographical Society the first four sheets of his new map of China, printed at St. Petersburg in two different editions, Russian and English. The author, who has been five years in the diplomatic service in China, Japan, and Korea, and knows the Chinese language well, has spent twenty-seven years upon the compilation of this map. He has collected all possible materials for this purpose, and has submitted them to severe scientific criticism; and, taking advantage of all the recent explorations made by Europeans in China, as well as of all the best Chinese researches, he has compiled the map on a scale of 32 versts (20 $\frac{2}{3}$ miles) to the inch. One of the best modern maps of China—according to the *Izvestia* of the Russian Geographical Society—has hitherto been the map of Matusovsky, published in 1888, on the scale of 125 versts (75 miles) to the inch, in his excellent work, 'Geographical Review of the Chinese Empire' (*Geographicheskoye Obozreniye Kitoiskoi Imperii*). This map is a very conscientious work, containing a good deal of new material, worked out by M. Matusovsky, and all the inscriptions of Chinese names on it have been verified by specialists. M. Weber's map is a further step in advance, both by its much larger scale, and by the richness of materials of which the author has availed himself. The first four sheets, which are now published, cover the north-eastern part of the Chinese Empire. The remainder of the map is in preparation.

Botanical Exploration in Sikkim.—A botanical trip, made in 1892 by Mr. G. A. Gammie, assistant in the Government Cinchona plantations at Mungpu, is described in the *Kew Bulletin* (1893, p. 297). The special object was to collect the plants of the temperate and alpine regions, this being the least-known section of the flora, and although Mr. Gammie followed more or less in the footsteps of Sir Joseph Hooker, his journey to some extent supplements the work of the latter. The Singalelah range, stretching southwards from Kinchinjunga, was first visited. This had been crossed by Hooker, whose routes also led parallel to it for considerable distances; but Mr. Gammie was able to follow its crest by means of paths used by shepherds, who pasture their flocks along it in summer. The journey being made in the wet season, constant fog and rain were encountered, and this weather characterized the subsequent journeys also. Characteristic of this range, probably owing to the coolness and moisture induced by the nearness to Kinchinjunga, was the luxuriant growth of rhododendrons, herbaceous plants being comparatively scarce.

The next trip was to the Lachung valley, leading to the Donkia pass. The beginning of this forms a decided boundary between tropical and temperate vegetation. Conifers grow here in great variety. An excursion to the Tankra mountain gave an introduction to the Alpine flora, which is marked by species of *Saussurea*, etc., growing in dense hemispherical tufts. The Donkia pass was reached, but not crossed for political reasons. Herds of yaks, going to or returning from Tibet by this route, were seen daily; the salt, barley, and blankets of the latter being exchanged for planks, bamboos, rice, etc. A side valley unvisited by Hooker was explored, leading to a pass over the range which bounds Sikkim on the east, and, finally, an excursion was made to the Chola range, east of Tumlung. A collection of 238 packets of seeds, gathered by Mr. Gammie, has been received at Kew.

Changes of Level of Armenian Lakes.—Dr. R. Sieger, of Vienna, finds (*Globus*, 1894, vol. lxxv. pp. 73–75), by a comparison of the existing data, that the levels of the Armenian lakes Van and Urmia show periodic changes coinciding with the periods of climatic variations which Professor Brückner has shown to exist on the globe. In the course of the present century the levels of these lakes reached, according to Dr. Sieger, their periodic maxima in the years 1810, 1840–50, and 1876–80. Of Lake Van, it is further shown that on the whole, its level was lower in the first than in the second half of the present century.

AFRICA.

M. Dècle's Journey in Central Africa.—The latest letters received from this traveller (*vid. supra*, p. 60), announce his arrival at the south end of the Victoria Nyanza, after a detention by fever at Tabora, where, he says, the Germans have made praiseworthy progress in the pacification of the country (*Comptes Rendus*, Paris Geog. Soc., 1893, p. 441; and 1894, p. 14). He speaks in high terms of the friendliness of the natives and the healthiness of the country traversed. His route was different from those previously followed, lying to the west of those of Stanley and others, and in the southern half east of that of Speke. It does not seem, however, to diverge greatly from that of Junker in 1836 (*Pet. Mitteil.*, 1891, map 13). He reports, from his own observations and from inquiries, that a system of streams, starting from 4° S. lat., unite to form a river named Ikwundo, which is the same that enters Smith Sound as the Isanga, and that the latitude above mentioned is, therefore, the southern limit of the Nile basin. Speke, he says, must have crossed this stream when dry, and so failed to notice it. It may be remarked, however, that the latter does mention a river (the Mningira) as draining into the creek of the Nyanza from some of the districts on his route ("Travels," etc., i. p. 90), but the fact that Junker's map does not mark such a stream seems to show that it cannot in any case be very considerable. The latter traversed the district late in August, Speke in July and August, and Dècle apparently early in September. The French traveller says that the quantities of game seen in the district of Lohumbo surpassed anything he had seen in Africa. A similar abundance is accounted for by Speke by their congregating in the neighbourhood of water.

M. Foureaux's Journey in the Sahara.—News has been received in Paris from this traveller, dated December 5, 1893 (*Comptes Rendus*, Paris Geog. Soc., 1894, p. 12). He had then made a rapid survey of the route from El Golea (South Algeria) to Insala, crossing the plateau of Tademaït from north to south. He speaks with enthusiasm of the wild beauty of this region, with its steep slopes and fine gorges. The plateau terminates in an abrupt cliff, the southern slopes falling steeply to the region of sand-dunes, while to the north they are long and gradual. Owing to this, the wadis which flow to the north have courses of considerable

length, while those to the south are soon lost in the sands. It is a curious fact that the gum-acacias, with which the country to the south is dotted, do not occur at all to the north. M. Foureau was, at the time of writing, about to start for the Tuareg countries.

AMERICA.

Mean Elevation of the United States.—In a pamphlet extracted from the Thirteenth Annual Report of the Director of the United States Geological Survey, Mr. Henry Gannett discusses the average elevation of the United States. The Geological Survey has compiled all available statistics of determinations of height from surveys, railway sections, etc., and utilized them to produce a map of the United States on the scale of 1:2,500,000, or about 40 miles to an inch, on which contour-lines are drawn at altitudes of 100, 500, 1000, 1500, 2000, and each thousand feet up to 12,000. The material was of varied value. Many parts can be looked on as correct, being reduced from large-scale surveys; the larger portion may be considered very nearly correct, being compiled from numerous intersecting railway levels. The portions which can only be considered as hypothetical are Northern Maine, the Adirondack region of New York, Central Idaho, the Cascade range, and the Coast range of Washington, Oregon, and Northern California. This map was used for the measurement of the areas included within each successive contour-line, from which the mean height has been deduced on the assumption that the area between any two consecutive contours had the average elevation midway between those contours, or, in cases where the mean range of elevation was very slight, an average was taken of all determinations of altitude. Tables are given of the areas in each state between successive contour-lines, and also of the average height deduced for each state. From these tables it appears that scarcely any part of Delaware, Louisiana, Florida, or Rhode Island exceeds 500 feet in height, the average altitude of these low-lying states being respectively 60, 100, 100, and 200 feet. On the other hand, no part of Wyoming lies so low as 4000 feet; the whole of Colorado is above 3000 feet; and Nevada, New Mexico, and Utah are all entirely above the 2000-foot line. Colorado is on the average the loftiest state, 6800 feet; but it is closely approached by Wyoming with 6700 feet, and Utah with 6100. Eight other states exceed the average for the whole country, which is 2500 feet. These are—New Mexico, 5700; Nevada, 5500; Idaho, 5000; Arizona, 4100; Montana, 3400; Oregon, 3300; California, 2900; and Nebraska, 2600. Thirty-two states have a mean elevation less than 1300 feet. The paper is accompanied by a reduction of the map from which the calculation was made, the elevations on which are shown in shades of brown represented by magnificent colour-printing, and producing an admirable sense of vertical relief.

Early Voyages on the North-Western Coast of America.—Professor George Davidson contributes to the *National Geographic Magazine* a paper read at the Chicago Conference, on the identification of coast features recorded in the narratives of Ulloa, 1539; Cabrillo and Ferrello, 1542-43; Drake, 1579; and Vizcaino, 1602-3. He finds that the inaccuracies of the earliest discoverers were due to their crude instruments, ignorance of coast currents, errors of judgment in estimating distances, and failure to seize salient features. After pointing out the uncertainty of the observations of latitude taken by early discoverers, who rarely stated it closer than half a degree, except to add that it was "more" or "scant;" and having proved that the average error increased as the latitude increased, Professor Davidson went on to describe the main features of the discoveries of Cabrillo and Ferrello in 1542. The vessels sailed in company from Cape San Lucas on July 6, and, after skirting the coast for three months in favourable weather, arrived at the eastern

entrance to the Santa Barbara channel on October 10. Professor Davidson has been able, by his unequalled personal knowledge of the whole west coast of America, from Mexico to Canada, to locate every anchorage of the explorers, and all the salient points described by them. When, on November 11, the vessels were under the shadow of the Sierra Santa Lucia, a south-eastern gale separated them for four days. Ferrello was driven northwards, where he notes the chief landmark—"a point which forms a cape, and it is covered with trees, and it is in forty degrees." This they called Cabo de Pinos, and it is to be identified with the high wooded spur overhanging Fort Ross Cove, in lat. $38^{\circ} 31'$. From this point they returned southwards, "passing by a great gulf, formed by a change in the direction of the shore," which they named La Bahia de los Pinos. The change in the direction of the coast here mentioned, is point Rezes, and the great gulf is that of the Farallones. Ferrello describes the coast to the south as "very bold. There are mountains which rise to the sky, and the sea beats upon them; they are covered with snow to the summit." They named them Sierra Nevada, and one which projected into the sea they called Cabo de Nieve, placing it in $38^{\circ} 40'$. This snowy cape must be the massive western spur of the mountains on the peninsula of San Francisco; Mount Bache lies east of the cape, in lat. $37^{\circ} 6\frac{1}{2}'$, and reaches an elevation of 3825 feet. The vessels returned to San Miguel, and remained there until January, when Cabrillo died, after which Ferrello spent some time beating about among the Santa Barbara islands. In February they again coasted northwards, until they reached a point where the coast turns towards the north-west; this was Point Arena, in lat. $38^{\circ} 57'$. Drake's voyage was not considered, its critical treatment being deferred for a subsequent paper.

Gold Mining in British Guiana.—The proportions which this industry is assuming may be judged from the following figures, which have been supplied by the officer in charge of the district: In 1892, 131,425 ounces of gold were exported, and the output for 1893 was 142,000 ounces. All the gold, so far, has been obtained by alluvial washing, but mining has now been started on quartz reefs in the North-west District, on the Barima, and also on the Demerara rivers. About half of the output for 1893 was obtained from No. 2 District, which comprises the Potaro river, Conawaruk, and other tributaries of the Essequibo river, and gives employment to over 3000 men. The Government has sanctioned a railway to connect the Demerara and Essequibo rivers, so as to avoid the rapids on the Essequibo, and make the journey from Georgetown to Potaro and Conawaruk a quicker and less dangerous one, and this work has already been commenced.

AUSTRALASIA.

The Elder Exploring Expedition in Australia.—The earlier results of this expedition were noticed at the time (*Proceedings*, 1892, p. 48), and the large-scale maps embodying the surveys have since been commented on (*Journal*, vol. i. p. 552). The final report and full journal of the expedition enable us to add some details respecting the later work done by it. The temporary abandonment of exploration having been necessitated by the failure to find a water-supply at Queen Victoria spring after the southern unknown tract of desert had been crossed from north to south, Mr. Lindsay determined to proceed northwards along the outskirts of settlement in Western Australia, and make another start into the interior from the neighbourhood of the Upper Murchison. Having repaired to the coast to communicate with the authorities at Adelaide, he was unexpectedly summoned thither to consult with them, the result being the decision to abandon the expedition. Meanwhile the long-continued drought broke up, and conditions for exploration

became exceptionally favourable. Mr. Wells, who had been left in charge during the leader's absence, was able to do some valuable work east and south-east of the Kimberley range, travelling 834 miles, and discovering a large extent of pastoral country, equal in value to that now occupied on the Murchison (the valleys consisting of "rich chocolate loam covered with rich stock mulga, acacias, saltbush, and grass"), as well as some auriferous tracts, which should add a stimulus to the settlement of the former. Few natives were met with during the whole expedition. Mr. Lindsay considers that, had the enterprise been persevered in, the remaining exploration of Western Australia might have been easily completed.

The Chillagoe Caves, Queensland.—Mr. Thistlethwayte recently read a paper before the Queensland Branch of the Royal Geographical Society of Australasia, describing a visit he made in the early part of last year to the Chillagoe limestone caves. These caves are distant about 90 miles from Mareeba, the present terminus of the Cairns railway. The first two visited are named with singular inappropriateness Herculaneum and Pompeii, and are distant about one mile in an easterly direction from the crossing of the Zillmanton track over Chillagoe Creek. The Royal Arch cave is about two and a half miles in a south-westerly direction from Chillagoe station. These caves appear to have been formed by the continuous removal of limestone in solution by water, the water finding its way through joints and fissures in the rock, and enlarging these into chambers of various dimensions, and into connecting passages. The caves are in many cases richly ornamented by stalactites and stalagmites of all sizes. In no case do the floors of the caves themselves appear to sink below the general level of the country outside. As a rule, they were perfectly dry, only a small pool of the clearest water being occasionally met with.

POLAR REGIONS.

New American Arctic Expedition.—Mr. Robert Stein, whose proposed exploration of Ellesmereland was referred to in the January number (*Geographical Journal*, p. 62), sends some details of a new scheme for Arctic exploration, put forward by Mr. Walter Wellman, a journalist of Washington. Mr. Wellman has already started for Europe, in order to consult the Arctic authorities in England before proceeding on his journey *via* Norway to Spitzbergen. He proposes to land on Dane's Island, at the north-west corner of Spitzbergen, as early in the season as possible. Several attempts have been made by seal-hunters and others to settle on this island, and a house has been built, in which Mr. Wellman intends to store sufficient provisions to serve sixteen men for a year, in case it should be necessary to winter there. He hopes, however, to achieve the object of his journey in a single season, and to return to Norway in October. He will leave two men to guard the *dépôt*, and with the others will push north in aluminium boats of a new design constructed in Baltimore, and so light that each weigh only 400 lbs. Runners are provided, by the addition of which the boats may at once be converted into sledges should ice intervene. By making an early start, Mr. Wellman hopes to avoid the strong southerly drift of the ice which Parry experienced in 1827, when he reached 82° 45' by sledging over the floe. The greater lightness of the aluminium sledges is expected to make it possible to exceed Parry's farthest, and possibly to reach the pole in one season, or, failing that, to ascertain the character of the region north of Spitzbergen, and discover any islands that may exist. The funds for the new expedition amount to £4000. It is intended to leave the provisions at Dane's Island if they are not required by the party, and, at Mr. Stein's request, an effort may be made to establish a permanent station there. The importance of this rests on the facilities a series of circumpolar stations would give to fresh explorations

by providing alternative lines of return to the explorers, and so obviating the necessity of retreating exactly along the line of advance.

Antarctic Whaling Cruises.—In our last issue (p. 239) we referred to the three Norwegian whalers, *Jason*, *Castor*, and *Hertha*, stating that they had returned to the Falkland Islands. Letters received on the 1st of March extend and confirm the telegraphic communication. The Norwegian sealers arrived at Port Stanley on the 12th of January, from the south. Enormous numbers of seals were seen, but, owing to the broken condition of the ice, it was impossible to secure a catch. Only one sperm whale and about 330 seals' skins were obtained. After discharging their cargoes into the store-ship *Orion*, the vessels took in coals and stores at Port Stanley and sailed again, in the expectation of getting a full ship. The *Orion* will remain until they return again, probably some time in March. She will then take all their cargoes and proceed to Norway, leaving the sealers to winter at the Falkland Islands. These vessels have very considerably extended our topographical knowledge of the Antarctic regions. Dr. John Murray has received a letter from M. Christensen, Norway, which says: "I can now inform you that a letter has arrived from Captain Larsen, of the *Jason*, dated 29th of December, in which he states he has passed along Grahamsland on the east side down to lat. $68^{\circ} 10'$ S. and long. 60° W. So I think he now has a good supply of fossils if you wish some more. One of our other ships has been to 69° S. and further west. Captain Larsen will send me by next mail his day-book, where some more information may perhaps be got, if it is of interest to you. There has hardly been any ice in the Antarctic this year; and he writes that he has discovered some land and islands. As there was so little ice, he could not find seals where he got them last year. The ships have now gone south again, looking for seal and whale." Thus it appears that these vessels have reached a higher latitude in these longitudes by four degrees than any of their predecessors, and their observations will fill an absolute blank on the south polar maps. The latitude attained is the highest ever reached by a steamer in the southern hemisphere.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Sea-Temperature round Scotland.—The *Annual Report* of the Fishery Board for Scotland for last year contains a long report, by Dr. H. R. Mill and Mr. A. J. Herbertson, on the results of physical observations carried on at selected points along the coast. Four stations on the east coast and four on the west are compared for the three complete years, 1890, 1891, 1892, temperature observations having been taken daily, forenoon and afternoon (9 a.m. and 3 p.m.). On the east coast the stations were peculiarly well fitted for observing sea-temperatures unaffected by the proximity of land, two of them being on lightships—the North Carroff Five Ness, and the Abertay at the mouth of the Tay estuary; and the others lighthouses built on rocks rising abruptly from comparatively deep water—the Oxcar in the Firth of Forth, and the Bell Rock off Arbroath. On the west coast the observations were made from boats in the shallow water of Loch Ryan and West Loch Tarbert, and from the pier-heads at Brodick in Arran and at Ardrishail. In the forenoon the water was about a degree and a half warmer on the west coast than on the east, on the average for the whole three years; and in the afternoon the contrast was accentuated, as on the west coast the average afternoon temperature was three-quarters of a degree, and on the east coast only half a degree above that of the forenoon. For the three years considered the mean annual water temperature on the east coast was in the forenoon 45.5, 47.5, and 47.7 respectively, and on the west coast 47.5, 48.8, and 49.3. Thus each year was somewhat warmer than the preceding. The average temperature of the water was usually reached in May while rising, and in November while falling. August or September was the month of

warmest water, and February or March that of coldest. The range of temperature between the warmest and coldest months was about 15.5° F. for both coasts, but the range between warmest and coldest days was about 20° for the east coast and 24° for the west. This comparison would be more exact if the western stations had been on the open Atlantic, and so fully comparable with the Bell Rock and lightship observations in the North Sea. The result would probably be to show that the Atlantic water is both warmer all the year round, and changes less between summer and winter than the water of the North Sea. The report gives the results of specific gravity observations at selected stations, but places less reliance upon these than on temperature work. There are also some interesting observations on the transparency of the water on the east coast. In the Firth of Forth the water is clearest along the middle line, but less opaque along the north shore than the south. The opacity is mainly due to mud, in part derived from the river Forth, but partly also from side tributaries and from dust. The muddiness of the water along the southern margin of the Firth about North Berwick and Dunbar is probably to be ascribed to the prevailing south-westerly wind sweeping the earth from the cultivated fields over the edge of the cliffs which line the coast. These results are of considerable interest in physical geography, and may become important in elucidating the movements of fish if the fishery statistics were compiled in accordance with the suggestions derived from the physical work.

GENERAL.

Death of Von Middendorff.—Alexander Theodor Von Middendorff, the well-known explorer of Siberia, died on January 28, at his estate in Livonia. He was born on August 20, 1815, at St. Petersburg, and received his education, first at a St. Petersburg gymnasium, and later on at the university of Dorpat. At the age of twenty-two he obtained the degree of M.D., and went to the universities of Berlin, Vienna, Erlangen, and Breslau, to continue his education. On his return to Russia he was appointed professor at the Kieff University, and had the chance of joining the same year Karl Baer's expedition to Lapland. This journey, under the guidance of the great physical geographer, determined his further career. In the year 1843 he was sent by the Academy of Sciences to explore Northern Siberia, and his first reports upon observations of the temperature of the Earth at various depths in the Sherguin shaft, at Yakutsk, won for him a European reputation. For many years in succession Middendorff continued to work out the many and varied results of his Siberian expedition—geographical, botanical, zoological, and anthropological—which were published in both German and Russian. Besides his life-work devoted to Siberia, Middendorff was for twelve years secretary to the Academy, and published various works, either chiefly zoological, as his papers on the 'Hares,' on the 'Mammoths of Siberia,' on the 'Natural History of the Brown Bear,' on the 'Remains of Labyrinthodonts,' on the 'Problems of Hippology,' etc.; or geographical, as his excellent monograph on the 'Baraba,' and on the 'Northern Branches of the Gulf Stream,' which he wrote after his excursion to the Arctic Sea. He devoted the last years of his life chiefly to agriculture, for which purpose he undertook a special journey to Turkistan, in order to study the intensive agriculture of the Uzbegs.

The Work and the Awards of the Russian Geographical Society.—At the Annual Meeting of this Society, which was held on February 7, reports were read on the expeditions of MM. Roborovsky and Kozlof in Central Asia, M. Obrucheff on the north-eastern border of Tibet, in the Nan-Shan mountains, M. Berezovsky in the north-west part of the Chinese province of Se-chuan, and of M. Potanin on the western border of the same province, where it fringes Tibet.

Work within Russia proper was limited to the expeditions of MM. Istomin and Lyapunoff for the collection of popular songs, and to ethnographical explorations in Western Russia, Novgorod, and Pakov. The measurements of the force of gravity in the neighbourhood of Moscow, as well as of magnetic elements in the neighbourhood of Byelgorod (the seat of the well-known anomaly), have been continued, and the former have been brought into connection with similar measurements by French geodesists. Most valuable geographical explorations have been made by two members of the Society, Baron Toll and Lieutenant Shileiko, in Northern Siberia, on the shores of the Arctic Sea, and in the New Siberia Islands. More than 4600 square versts have been mapped, and the positions of thirty-eight points have been determined from astronomical observations. The great Constantine medal has been awarded this year to Prof. A. N. Veselovsky, for his researches on the domain of Russian literature; the Count Lutke medal has been awarded in V. E. Fuss, for work in mathematical geography. Two large gold medals have been awarded to A. I. Sobolevsky, for researches into the ethnography of White Russia, and to the statisticians who have investigated the conditions of the peasantry in the governments of Irkutsk and Yeniseisk. The chief works published by the Society during the year have been, besides many numbers of the memoirs (*Zapiski*), the two large quarto volumes, 'The Tangut and Tibetan Borders of China and Central Mongolia,' by G. Potanin, one volume of Additions to Ritter's 'Asia,' and 'The Songs of the Russian People, collected in Archangelsk and Olonets.'

French Geographical Congress at Lyons.—The fifteenth annual congress of French Geographical Societies will be held in Lyons in August of the present year, under the presidency of Dr. Hamy. An international exhibition, to be held in the town, will devote special attention to exhibits from French colonies. The Lyons Geographical Society is preparing a special volume dealing with the geography of the surrounding district, the compilations of the various sections being undertaken by specialists.

Rylands on Ptolemy.*—In this sumptuously printed volume the author undertakes an "elucidation" of Ptolemy, whose geography has engaged his leisure hours for many years past. Having given a very readable outline of the rise and progress of cartography prior to the time of Ptolemy, Mr. Rylands seriously sets himself the task of determining Ptolemy's errors. These he traces to four causes: firstly, errors in the itinerary distances; secondly, errors in the accepted results of astronomical observations; thirdly, errors of scale, Ptolemy having assumed a degree to measure 500 stades instead of 600; and, lastly, errors due to the projection upon which Ptolemy is supposed to have plotted his map. As to the first and second sources of error the author frankly admits that no "general principle of rectification can be applied to them." The third source of error has been dealt with before, often in too sweeping a spirit, we conceive, as it disappears altogether wherever Ptolemy was able to make use of trustworthy observations for latitude. The fourth source, that due to an erroneous projection, is now dealt with for the first time, but in no sense can we look upon the author's arguments as conclusive. By combining the errors due to a wrong scale and a faulty projection, the author arrives at the conclusion that a degree on Ptolemy's maps is equivalent to 46 geographical miles. In separate chapters the author deals with the Ptolemaic geography of Great Britain, identifying the Belisama with the Mersey, thus agreeing with Dr. C. Müller, whilst

* 'The Geography of Ptolemy,' elucidated by Tho. Glazebrook Rylands, F.R.S., Dublin: Ponsonby and Weldrick, 1873. Size 12½ × 10 in., pp. xx. and 97; 24 plates. Presented by the Author.

differing from most of the earlier commentators, who identified that river with the Ribble. The curious distortion of Northern Scotland he explains by suggesting that Duncansby Head was laid down by Ptolemy in accordance with a longitude obtained by observing an eclipse of the moon. In an appendix the author points out and corrects a corrupt passage in Book vii., c. 6, of Ptolemy's Geography, which deals with the problem of describing the earth within the armillary sphere.

CORRESPONDENCE.

The Height of Peak Godwin Austen, of the Karakoram Himalayas.

THIS peak was first brought to notice, as of very remarkable altitude, in the year 1858, by the operations of the Great Trigonometrical Survey of India. No name having been discovered for it, it was provisionally designated K_2 —or No. 2 of the Karakoram range—and it is still very generally known by that designation. But in preparing the final results of the survey for publication, the symbolic numbering of the unnamed peaks of the Karakoram range was altered, to produce continuity of numbering from left to right; and thus, in Synoptical Volume No. 7 of the Survey—which gives the details of the Kashmir triangulation, and was published in 1879—the peak is entered as Karakoram No. 13. Thus K_2 has ceased to be an appropriate name for the peak, and it may well be known in future by the designation Godwin Austen, which was assigned to it some years ago at a meeting of the Royal Geographical Society, in recognition of Colonel Godwin Austen's geographical services in its neighbourhood, and which, though objected to by some persons, has been accepted by various English and German geographers; it is adopted in the excellent Atlas of India which has recently been published by Messrs. W. and A. K. Johnston, and which, for lowness of price and elaboration of detail, is a very remarkable production.

The height first given by the survey to this peak was 28,278 feet, making it the second highest peak in the world whose height had been accurately determined, and about 100 feet higher than the celebrated mountain of Kinchenjunga, which stands at the meeting-point of the borders of Nepaul, Tibet and Sikkim. The final height is given in the Synoptical Volume as 28,250 feet.

In the *Alpine Journal* for last November, Mr. W. M. Conway gives a table of altitudes determined by him in his Karakoram Mountain Expedition, in which he maintains the height of this peak to be only 27,750 feet, as ascertained by himself from a combination of trigonometrical and barometrical observations in the vicinity, with barometrical observations taken simultaneously at two places, Leh and Gilgit, about 150 miles off. In the *Alpine Journal* for February he maintains the accuracy of his determination.

Now, the Synoptical Volume gives the finally concluded height of the peak, and the information that it was determined by observations from nine of the principal stations of the Kashmir triangulation, and the average discrepancy per mile in the lengths of the common sides of the triangles fixing the peak; but it does not give the nine independent determinations of height, as this could not have been done generally throughout the volume without swelling it to inordinate dimensions. Still it is a pity that this was not done for a peak of such importance, which was fixed with special care, by observations from an unusually large number of stations.

In order to place geographers in possession of the exact facts of the case, I have obtained the separate values from India, and give them in the following table.

Height determinations of K₂.

Year and station of observation.	Distance in miles.	Height in feet above sea-level.	Mean heights of groups.
1856. Harámúkh	137	28,294	} 28,274
1857. Kanúri-Nár.....	114	28,218	
„ Bárwái.....	88	28,259	
„ Thalanka.....	75	28,323	
1858. Marshála.....	59	28,240	} 28,252
„ Kastor	66	28,261	
„ Thurigo.....	62	28,254	
1859. Shangruti.....	79	28,247	} 28,233
„ Biáchúthúsa	99	28,219	
Mean height.....			28,253
Adopted final value.....			28,250

There can be little doubt that the finally adopted value may be accepted as true within a few feet. It is obviously far more reliable than a result which was obtained from a few days' barometric observations near the peak, combined with corresponding observations taken concurrently at fixed points 150 miles off. The trustworthiness of a height so deduced depends on the barometric variations, occurring at the time of the observations, being of identical magnitude and direction relatively to the mean yearly values, at all the observing stations. This is always assumed to be the case, and when the assumption is true, accurate results are obtained; but it certainly is not always, and probably not very often, true, and it cannot have been in the present instance.

J. T. WALKER,
Late Surveyor-General of India.

OBITUARY.

Sir Harry Verney, Bart.

THE death of the Right Honourable Sir H. E. Verney on February 12, removed from the Society one of the original Fellows whose name appears on the first list, issued in August, 1830. Now only one remains out of the 460 who joined the Society on its formation sixty-four years ago. Sir Harry was born in December, 1801, and had thus attained the exceptional age of ninety-two years. He was the eldest son of General Sir Harry Calvert, G.C.B., and succeeded to the baronetcy in 1826, assuming the name of Verney in the following year on his succession to the estates of the Irish Earldom of Verney.

He was educated at Harrow and at Downing College, Cambridge, but, leaving the University at a very early age, he entered the army in 1819, and, after being an officer in the 7th Fusiliers and the Grenadier Guards, he retired as a major in 1827. He became a member of Parliament in 1832, and took part in the abolition of slavery, the promotion of railways in England, and many other hotly contested reforms. For over fifty years he sat in nearly every parliament, and in 1885, when he retired from public service in the House of Commons, he was made a Privy Councillor.

As a cultured country gentleman, Sir Harry was at the front in all works,

religious and social. He assisted in the formation of the Royal Agricultural Society in 1838, and lived to be its oldest member, always taking a keen interest in the improvement of agriculture, and fully aware that, despite the present overwhelming importance of mineral and industrial production, the nation must ultimately depend once more on the cultivation of the land.

Although neither an explorer nor a scientific geographer, Sir Harry Verney travelled much, and accumulated a rich collection of interesting curios, which he offered to make over for public use if a local museum were established in Buckinghamshire. He rendered assistance to the Royal Geographical Society both by the part he took in discussions at the evening meetings, and by his long service on the Council, where he occupied a seat for twelve years, during two of which he was a Vice-President.

He was twice married, his second wife being a sister of Miss Florence Nightingale, and herself distinguished as a writer on various subjects, and as editor of the 'Verney Papers.' He was a good landlord, a steady friend, and a genial member of society. His vitality was wonderful, and his health unbroken; within a week of his death he took his usual exercise on horseback, and kept in touch with all the interests of rural life.

At its meeting on February 26, the Council passed a resolution of regret at the death of Sir Harry Verney, and of sympathy with his family.

General Saunders Abbott.

By MAJOR BROADFOOT, R.E.

MAJOR-GENERAL SAUNDERS ALEXIUS ABBOTT, who died at Brighton on February 7, aged eighty-two, was fifth son of Henry Alexius Abbott of Calcutta and Blackheath. He had been a Fellow of the Society since 1876. His three soldier brothers each achieved distinction: the late Major-General Augustus received the Order of the Bath for the defence of Jalálábád; the late Major-General Sir Frederick, Kt., c.b., served in Burma, Afghanistan, and the first Sikh war, and was for many years Governor of Addiscombe; and General James, c.b., of Khiva fame, held charge of the Hazára district with such success that its head-quarters, Abbottabad, was named after him.

Saunders Abbott was appointed ensign in 1828, from Addiscombe, where he was a contemporary of the first Lord Napier of Magdála, Sir Robert Montgomery, Sir Henry Durand, and Eldred Pottinger. In 1836 he was appointed to the revenue survey under Henry Lawrence, and some five years' good work in this department may be considered as his contribution to Geographical information. Next we find him on Lord Ellenborough's staff, and present at Ferozpur on the historic occasion of the return of our armies from Afghanistan in December, 1842. Soon afterwards he was appointed an Assistant Agent on the north-west frontier, and, with the rest of Major George Broadfoot's assistants, collected supplies for Sir Hugh Gough's army when war became imminent. When the Sikhs crossed the Sutlej, Abbott was sent to the hills to bring reinforcements, a matter of vital importance; he performed this duty so promptly as to secure the thanks of Sir Henry Hardinge, then Governor-General. Three days later (December 21, 1845) he was on Hardinge's staff, which suffered so severely on the hard-fought field of Ferozshah. Our advance was made under a storm of grape and matchlock fire, and Abbott's horse fell with two shots through the neck, whilst he himself, immediately on rising, was struck down by three bullets. He thought he was killed, and was surprised to find he could obey when Broadfoot (who was riding between Abbott and Sir H. Hardinge) calmly desired him to get up and come on. With wounds undressed, he continued on the

field that eventful night and during the successful attack next morning, making himself useful on several occasions. After the battle he shared a tent with Sir Herbert Edwardes and Sir Frederick Haines (now Field-Marshal), both of whom were on Gough's staff, and were wounded.

When the war was over, Abbott was employed in a civil capacity in the Punjab and in Oudh, in both of which provinces his work was satisfactory. He left India in 1863, but returned in 1868 for four years, as agent for the Sind, Punjab, and Delhi Railway Company. Since 1873 he found useful employment at home. He took great interest in the meetings of this Society; but as he got older he had by degrees to give up work. He married Harriot, daughter of Dr. J. Johnstone, in 1839; and General and Mrs. Abbott's hospitality has for many years been widely extended. For some time the General has had bad health, and he has depended on his wife's never-failing devotion.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1893-94.

Sixth Ordinary Meeting, February 12, 1894.—CLEMENTS R. MARKHAM, Esq., C.B., etc., President, in the Chair.

PRESENTATIONS.—*Lord Belhaven and Stenton.*

ELECTIONS.—*Sir Percy Anderson, K.C.B., K.C.M.G., Assistant Under-Secretary for Foreign Affairs; Chas. Arthur Albert Barnes, Assistant Colonial Surveyor to the Gold Coast Colony; William Henry Brittain, President, Sheffield Chamber of Commerce; George Branchett Chace; William Stanley Desborough; John Edwin Hall, B.A.; Charles Heape; Captain Henry Charles Howard (King's Royal Rifle Corps); George Ormsby; H. J. Pearson; D. G. S. Robertson, C.S.I.; Capt. F. E. G. Skey, R.E.; Herbert Warrington Smyth; Rear-Admiral Frederick K. Van der Muelen; John Weston.*

The late Sir Harry Verney.

The PRESIDENT said: This afternoon we received the sad intelligence of the death of Sir Harry Verney. He had lived a very honourable and useful life, and was full of years, so that we could not have expected to see him here again, but there are many of us who will regret that his kindly face and genial words will be seen and heard no more among us. He was many years member of our Council, and a very constant attendant at our meetings, and I may add that he was the last but one surviving of the original fellows of this Society.

The Paper read was:—

“Johore.” By Harry Lake.

Seventh Ordinary Meeting, February 26, 1894.—CLEMENTS R. MARKHAM, Esq., C.B., F.R.S., President, in the Chair.

ELECTIONS.—*Captain Arthur Campbell; Rev. William A. Colledge; Edward Foa; Lieut. Fredk. Wm. Green, R.A.; John Robert Harrington; Algernon Grundy Hartley, M.A.; Frank Harris; E. C. F. James; Alexander Knox; Eric Heygate-Lambert; James Rennell Rodd; John Bennett Stanford; Gerald Henry William; Edwin William Winton.*

The Paper read was:—

“Exploration of the Upper Mekong, Siam.” By Herbert Warrington Smyth.

Special Meeting, March 5, 1894.—CLEMENTS R. MARKHAM, ESQ., C.B., F.R.S.,
President, in the Chair.

In commemoration of the Fifth Centenary of the birth of Prince Henry the Navigator, the Father of modern Discovery and modern Geography.

His Royal Highness the Duke of York and His Excellency the Portuguese Minister were present.

The President opened the proceedings by a short address on the career of Prince Henry, and the following gentlemen took part in the discussion: Sir George D. Taubman Goldie; Captain W. J. L. Wharton, R.N.; Charles Raymond Beazley, Esq.; H. Yule Oldham, Esq.; and the Portuguese Minister.

Eighth Ordinary Meeting, March 12, 1894.—The Hon. G. C. BRODRICK,
Vice-President, in the Chair.

ELECTIONS.—C. H. Cowling, B.A., H.M. Inspector of Schools; H. H. P. Deasy, Lieut. 16th Queen's Lancers; Rev. Charles Harris, M.A.; Sir Charles Hunter, Bart.; The Very Rev. Arthur John Maclean, Dean of Argyll; Robert McAuslan; John Ashmead Pruen, M.A.

The Paper read was:—

“Montenegro and its Border Lands.” By W. H. Cozens-Hardy.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

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

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

A. = Academy, Academie, Akademie.	Mag. = Magazine.
Ann. = Annals, Annales, Annalen.	P. = Proceedings.
B. = Bulletin, Bollettino, Boletim.	R. = Royal.
Com. = Commerce, Commercial.	Rev. = Review, Revue, Revista.
C. R. = Comptes Rendus.	S. = Society, Société, Selskab.
Erdk. = Erdkunde.	Sitzb. = Sitzungsbericht.
G. = Geography, Geographie, Geografia.	T. = Transactions.
Ges. = Gesellschaft.	V. = Verein.
I. = Institute, Institution.	Verh. = Verhandlungen.
J. = Journal.	W. = Wissenschaft, and compounds.
M. = Mitteilungen.	Z. = Zeitschrift.

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.

EUROPE.

Austria-Hungary. Csánki.

Körösmegye a XV-ik Században. Székfoglaló Ertekezés. Csánki Dező. Budapest, 1893. Size 9½ × 6, pp. 154. *Map.*

This is a paper by Dr. Szánki on the geography of the district between the rivers Drave and Save, illustrated by a map. It forms the final part of the fifteenth volume of the publication of the Magyar Academy.

Austria—Tyrol. *Z. Ges. Erdk. Berlin*, 28 (1893): 367–392. Schjernerjng.

Der Zeller See im Pinzgau. Von Dr. W. Schjernerjng in Aachen.

This paper, which is accompanied by a contoured map of the Lake of Zell, will be noticed in the Monthly Record.

British Empire. *J. R. Colonial I.* 25 (1894): 283–303. Chesney.

The British Empire. By General Sir George Chesney. With discussion. Suggestions for a form of Imperial federation.

- British Fisheries.** *Scottish G. Mag.* 10 (1894): 69-81. **Calderwood.**
British Sea Fisheries and Fishing Areas, in view of recent national advance. By W. L. Calderwood. *Map.*
- British Islands—Gazetteer.** **Cassell.**
Cassell's Gazetteer of Great Britain and Ireland. Being a complete Topographical Dictionary of the United Kingdom. Parts 1-6. London, Cassell & Co. Size 10½ × 7½. Price of each Part, 7d. Presented by the Publishers.
- These are the first parts of what promises to be a useful work of reference regarding the British Isles. In addition to an alphabetical list of the Counties, Parliamentary Divisions, Baronies, Parishes, Townships, etc., the present work will describe the physical features of the country, such as mountains and hills (with their altitude), rivers (with their fisheries), waterfalls, bays, capes, lakes, islands, rocks, and shoals; while the antiquities are also to receive considerable attention. Each part contains a map, besides a number of illustrations. A special map of the British Isles is presented with Part 1.
- British Islands—Rainfall.** *J. S. Arts* 42 (1894): 298-309. **Symons.**
Rainfall Records in the British Isles. By G. J. Symons. With discussion.
- Danube.** *M. G. Ges. Wien. Beilage zu Heft 8, Band 36* (1893). **Trabert.**
Die Cubischen Niederschlagsmengen im Donaugebiete. Von Dr. W. Trabert.
A contribution to Dr. von Lorenz-Liburnau's *Donau-Studien.*
- France—Brittany.** *Annales G.* 3 (1893-94): 42-63. **Gallouédec.**
Etudes sur la Basse-Bretagne II. La Cornouailles Intérieure. Par L. Gallouédec.
A complete geographical study, illustrated by sketch-maps of the peninsula of Cornouailles in Brittany, physical features receiving most attention.
- France—Cette.** *B. S. Languedocienne G.* 16 (1893): 147-171. **Malavialle.**
Coup-d'œil sur l'Histoire de la Ville et du Port de Cette par M. L. Malavialle.
- France—Liron.** *B. S. Languedocienne G.* 16 (1893): 172-175. **Twight.**
La Rivière souterraine du Liron. Par M. E. Twight.
Short account of the exploration of the underground river of the grotto of Liron, on the slope of the Saint-Loup mountain, near Montpellier, with a view and plan.
- France—The Causses.** **Martel and Gaupillat.**
A miscellaneous collection of pamphlets consisting of reprints of papers already published, dealing with M.M. Martel and Gaupillat's underground explorations, chiefly among the Causses of Southern France. Presented by M. E. A. Martel.
- Greece.** *Nouv. Archives des Missions Scientifiques* 2 (1892): 323-376. **Hauvette.**
Rapport sur une Mission Scientifique en Grèce (Septembre-Octobre, 1891)
Marathon—Salamine—Platées. Par M. Amédée Hauvette.
Visits to the three famous battle-fields are described, with plans and views. M. Hauvette, having resided in Athens for many years, and travelled largely in Greece and Asia Minor, is able to give a good comparative description of the places he studied.
- Ireland and the Armada.** *P. R. Irish A.* 3 (1893): 175-217. **O'Reilly.**
Remarks on Certain Passages in Captain Cuellar's Narrative of his Adventures in Ireland after the Wreck of the Spanish Armada in 1588-89, followed by a literal translation of that Narrative. By Professor J. P. O'Reilly.
The notes are mainly concerned with the identification of the places mentioned in the Narrative, the translation of which is very well done.
- Messina Strait.** *Globus* 65 (1894): 176-178. **Schott.**
Die Meeresströmungen in der Strasse von Messina von Dr. Gerhard Schott. Hamburg.
This account of the tidal currents through the Strait of Messina will be noticed in the Monthly Record.

- Montenegro.** *Petermanns M. 40* (1894): 34-41. **Hassert.**
Die Landschaftsformen von Montenegro. Von Dr. Kurt Hassert. *With Geological Map.*

An important paper, the main features of which will be summarized in the Monthly Record.

- Montenegro.** **Rovinsky.**
Chernogoriya v yeya proshlom i nastoyaschem. Geographie—Istorie—Etnographie—Arkhéologie—Looremennoe Polozhenie. [Montenegro, its past and present.] Sostavil P. Rovinsky. St. Petersburg, 1898. Size $9\frac{1}{2} \times 6$, pp. 881. *With a Map.*

Forms vol. 45 of Collections of the Department of the Russian Language and Literature of the Imperial Academy of Sciences.

- Russia—Earthquakes.** **Mushketof and Orlof.**
Katalog Zemlotriasenii Rossiiskoi Imperii. [Catalogue of earthquakes in the Russian Empire.] J. Mushketof and A. Orlof. St. Petersburg, 1893. Size $10 \times 6\frac{1}{2}$, pp. 582. *With Diagrams, Illustrations, and Map.*

This work, which forms vol. xxvi. of the Zapiski of the Russian Geographical Society, includes notices of earthquakes in all parts of the world.

- Switzerland.**
Statistisches Jahrbuch der Schweiz. . . . Annuaire Statistique de la Suisse. Publié par le Bureau de Statistique du Département Fédéral de l'Intérieur. Troisième Année, 1893. Bern, 1893. Size $9\frac{1}{2} \times 6\frac{1}{2}$, pp. xvi. and 450. *Maps, etc.*

ASIA.

- Afghanistan.** *J.S. Arts 42* (1894): 260-274. **Gray.**
Experiences at the Court of Afghanistan. By John A. Gray.

The author, as surgeon to the Amir, had exceptional opportunities of acquiring knowledge of the people of Kabul and its surroundings.

- Borneo.** *Petermanns M. 40* (1894): 27-33. **Schneiders.**
Die Südostabteilung von Borneo. Von Bergingenieur Gottfried Schneiders in Aachen.

An orographical map of south-eastern Borneo accompanies this memoir. The geographical observations made will be referred to in the Monthly Record.

- Central Asia.** **Potantin.**
Tangutsko-Tibetskaya okraina Kitaya i tsentralnaya Mongoliya. Puteshestvie G. M. Potanina, 1884-1886. [The Tanguto-Tibetan borderland of China and Central Mongolia. Journey of G. N. Potanin, 1884-1886.] St. Petersburg, 1893. Vols. 1 and 2. Size $12\frac{1}{2} \times 9$, pp. 568 and 436. *With List of Proper Names, 3 Maps, and 42 Plates.*

- Dardistan.** **Leitner.**
Dardistan in 1866, 1886, and 1893: being an Account of the History, Religions, Customs, Legends, Fables, and Songs of Gilgit, Chilas, Kandia (Gabrial), Yasin, Chitral, Hunza, Nagyr and other parts of the Hindu Kush, as also a Supplement to the Second Edition of the 'Hunza and Nagyr Handbook,' and an epitome of Part III. of the Author's 'The Languages and Races of Dardistan.' By G. W. Leitner. Woking, Oriental University Institute. Size $10 \times 6\frac{1}{2}$. *Map and Illustrations. Presented by the Author.*

- India—Chin Tribes.** **Reid.**
Chin-Lushai Land. Including a description of the various expeditions in the Chin-Lushai Hills, and the final annexation of the country. By Surg.-Lieut.-Colonel A. S. Reid. *With Maps and Illustrations.* Calcutta, Thacker, Spink & Co., 1893. Size $9 \times 5\frac{1}{2}$, pp. xii. and 236. *Presented by the Author.*

A timely description of the Chin-Lushai country in the form of a history of the various military expeditions, with descriptions from personal observation of the characteristics and customs of the people.

- India—Folklore.** *P. R. Irish* **1. 3** (1893): 151-169. **Ball.**
On the Volcans and Hot Springs of India, and the Folklore connected therewith. By V. Ball, C.B., LL.D.
This paper bears on the scientific interpretation by travellers of "native report," and in the course of it Professor Ball strongly urges the importance of an elementary training in physical science for all travellers, so that they may be able to describe with some degree of precision any natural feature to which their attention may be directed.
- Indian Ports.** **Hill and Roberts.**
Tide-Tables for the Indian Ports for the Year 1894 (also January, 1895). Part I. Western Ports (Aden to Pámban Pass). Part II. Eastern and Burma Ports (Negapatam to Port Blair). By Lieut.-Colonel J. Hill, R.E., and E. Roberts, F.R.A.S., etc. Size $6\frac{1}{2} \times 4\frac{1}{2}$, pp. 1011. *Presented by the India Office.*
- India—Railways.** **Sargeant.**
Administration Report on the Railways in India for 1892-93. By Lieut.-Colonel R. A. Sargeant, R.E. London, Eyre & Spottiswoode, 1893. Size $13 \times 8\frac{1}{2}$, pp. 244. *Diagram and Maps.* Price 5s. 3d.
Special notice will be taken of this report.
- India—Telegraphs.** *J.S. Arts* **42** (1894): 217-233. **Walker.**
Telegraphic Communication between England and India: its present condition and future development. By E. O. Walker.
The paper is illustrated by a sketch map of the main telegraph lines of Asia and Europe.
- Indo-China.** **Orleans.**
Around Tonkin and Siam. By Prince Henri d'Orleans. Translated by C. B. Pitman. London, Chapman & Hall, 1894. Size $9\frac{1}{2} \times 6\frac{1}{2}$, pp. xii. and 426. *Map and Illustrations.* Price 14s. *Presented by the Publishers.*
A notice of the French edition of this work appeared in the *Journal* for March, p. 251.
- Irawadi Country.** **Gray.**
Diary of a journey to the Bor Khamti country, and sources of the Irrawaddy, made by Mr. J. Errol Gray, season 1892-93, from Assam. Size $13\frac{1}{2} \times 9$, pp. 78. *Presented by the Secretary of State for India.*
This important journey was noticed in the *Journal* for March, p. 221.
- Korea.** **Cavendish and Goold-Adams.**
Korea and the Sacred White Mountain, being a brief account of a journey in Korea in 1891 by Captain A. E. J. Cavendish, together with an account of an ascent of the White Mountain. By Captain H. E. Goold-Adams. *With 40 Illustrations and two specially prepared Maps.* London, George Philip & Son, 1894. Size $9 \times 6\frac{1}{2}$, pp. 224. Price 25s. *Presented by the Publishers.*
The most original feature in this little book is the series of fine reproductions of native sketches of Korean life, many of them in colours. The journey itself was of short duration, but through very interesting country, and is well described.
- Persia.** **Browne.**
A Year amongst the Persians. Impressions as to the life, character, and thought of the people of Persia, received during twelve months' residence in that country in the years 1887-8. By Edward G. Browne, M.A., M.B. London, A. and C. Black, 1893. Size $9\frac{1}{2} \times 6$, pp. x. and 594. Price 21s. *Presented by the Publisher.*
Mr. Browne, the lecturer on Persian in the University of Cambridge, visited Persia in order to study the intellectual and religious life of the people, with whose mental attitude he shows complete sympathy. Nevertheless many of the brief geographical descriptions are remarkable word-pictures, and the book as a whole gives a view of modern Persia from a standpoint very rarely occupied by an outsider. The quick intuition and poetical character of the people come out characteristically in an anecdote, describing how a Persian who had never before seen a map, expressed regret that Mr. Browne had not a microscope also, so that they could see not only the position of Yezl, but the events which were happening in its streets.

- Siberia—Khingán.** Putiata.
 Expeditia v Khingán, 1891. Opisanie puti sledovanie. [Expedition to Khingán in 1891; a description of the route taken.] D. V. Putiata. St. Petersburg, 1893. Size $8\frac{1}{2} \times 6$, pp. 74. *Maps and Plans.*
- Siberia.** *Globus* 64 (1893): 319–326, 343–349. Leder.
 Reise von Irkutsk nach Urga in der Mongolei. Von Hans Leder.
 Account of a journey made in 1891, with views of Kiakhta, and other places of interest.
- Sikkim.** Gammie.
 Report on a Botanical Tour in Sikkim. By G. A. Gammie. [Vol. I. No. 2 of Records of the Botanical Survey of India.] Calcutta, 1894. Size $10 \times 6\frac{1}{2}$, pp. 24. *Presented by the Government of India.*
 Will be noticed in the Monthly Record.
- Trans-Caspian Region.** [Tarnovski.]
 Obzor Zakaspiiskoi oblasti za 1891 god. [Review of the Trans-Caspian region for 1891.] (Lieut. G. Tarnovski.) Askhabad, 1893. Size $9 \times 6\frac{1}{2}$, pp. 392 and Appendices. *Presented by the Author.*
 The Appendices contain a list of inhabited places and *auls*, or native villages, in the Trans-Caspian region.
- Turkish Arabia.** Cowper.
 Through Turkish Arabia. A journey from the Mediterranean to Bombay by the Euphrates and Tigris Valleys and the Persian Gulf. By H. Swainson Cowper. London, W. H. Allen & Co., 1894. Size $9\frac{1}{2} \times 6$, pp. xx. and 490. *Price 18s. Illustrations. Presented by the Publishers.*
 An account of a journey by a little-known route, which, although making no pretence to scientific accuracy or literary style, will be found interesting by the general reader, and is sure to be useful to later travellers through the same country.
- AFRICA.**
- Algeria and Morocco.** *B.S.G. Paris* 14 (1893): 185–222. Duveyrier.
 De Telemans à Melilla en 1886. Par Henri Duveyrier. *With map of route.*
 This tardily-published memoir was read to the Paris Geographical Society in 1887. The route was at first westward, then due north to Chabat-el-Lahab, and thence along the coast to Melilla, a small plan of which is given.
- Congo State.** *B.S.R. Belge G.* 17 (1893): 543–564. Francqui.
 Le Bassin Supérieur du Congo, par M. le Lieutenant L. Francqui.
 Lieutenant Francqui's account of the geographical results of his Katanga expedition.
- Dahomey.** *Jahresb. G. Ges. Bern*, 11 (1893): 149–164. Barth.
 Land und Leute in Dahomey. Vortrag von Herrn Barth.
 Record of a visit to Dahomey in 1891.
- French West Africa.** *B.S.G. Paris* 14 (1893): 223–237. Gaillard.
 Explorations de la haute Sangha et du haut Oubangui (1891). Par Gaston Gaillard, Administrateur colonial au Congo français.
 A short account of the French expedition to the Upper Sangha Basin, in 1891.
- Katanga.** *B.S.R.G. Anvers* 18 (1893): 36–46. Cornet.
 Le Sol du Katanga au point de vue agricole. Par M. le Dr. Cornet.
- Matabilland.** *J.R. Colonial I.* 25: (1893–94): 50–96. Colquhoun.
 Matabeleland. By Archibald R. Colquhoun.
- Morocco.** *B.S.G. Madrid* 33, p. 321, 34, pp. 95 and 280, 35, p. 75. Pezzi.
 Los Presidios Menores de Africa y la Influencia Española en El Rif, por D. Rafael Pezzi.
 A very long treatise on Spanish influence on the north coast of Africa, with historical references, and the text of various agreements with the Emperor of Morocco concerning Ceuta, Melilla, &c.
- Morocco—The Rif.** *Deutsche Rundschau G.* 16 (1894): 193–198. Rohlf.
 Der Rif. Von Dr. Gerhard Rohlf.

Nile. *B.S. Khéliviale G. 4* (1894): 5-43. **Ventre.**
Hydrologie du bassin du Nil. Essai sur la prévision des Crues du fleuve par Ventre-Bey.

Portuguese West Africa. *B. American G.S. 25* (1893): 512-541. **Chatelain.**
Bantu Notes and Vocabularies. By Heli Chatelain, late U.S. Commercial Agent at Loanda, West Africa. No. 1. The Language of the Bashi-lange and Ba-luba.

The paper includes a grammatical sketch of the Bashi-lange language by Dr. W. R. Summers, a medical missionary, who after being a printer, conjurer, circus agent, and captain in the Salvation Army, studied medicine in New York, and for two years before his death had been an enthusiastic student of the language of the people amongst whom he laboured.

Togo-land. *M. Forsch. Deutschen Schutzgebiet. 6* (1893): 103-254. **Kling and Büttner.**
Ergebnisse der Forschungsreisen im Hinterlande von Togo 1890 bis 1892 von Hauptmann E. Kling und Dr. R. Büttner. . . .

The description of Captain Kling's journey contains all the particulars of points determined in latitude, longitude, and altitude. In addition there are lengthy discussions by Dr. Büttner and other specialists on the fauna and flora of the regions traversed, a large number of excellent illustrations and a series of maps, the whole forming a valuable and attractive treatise on the geographical conditions of the Togo hinterland.

Tunis. *Nouv. Archives des Missions Scientifiques 2* (1892): 377-561. **Saladin.**
Rapport . . . sur la Mission accomplie en Tunisie en Octobre-Novembre 1885. Par M. H. Saladin.

A richly illustrated account of ancient architectural features of Tunis dating back to Roman times.

Unyoro. *P.R.S. Edinburgh 19* (1891-92): 136-192. **Felkin.**
Notes on the Wanyoro Tribe of Central Africa. By Robert W. Felkin, M.D. *With a Plate.*

A brief summary of the geography of Unyoro is given, and a very full account of the character, customs, and language of the people.

NORTH AMERICA.

Canada. **Haultain.**
A Country Walk in Canada. By Arnold Haultain. *From Blackwood's Magazine for January, 1894.*

Newfoundland Banks. *American J. Science 47* (1894): 123-129. **Upham.**
The Fishing Banks between Cape Cod and Newfoundland. By Warren Upham.

The paper concludes thus: "The Fishing Banks are thus to be accounted, like the fjords of all our northern coasts, the submerged continuation of the Hudson River Channel, and the similar very deep submarine valleys off the shore of California, near Cape Mendocino, to which I have previously called attention, as evidence of a great epeirogenic uplift of the northern part of this continent preceding and producing the Ice-age."

Pacific Coast. *National G. Mag. 5* (1894): 235-256. **Davidson.**
Early Voyages along the North-western Coast of America. By George Davidson. (Also a separate copy presented by the Author.)

A paper read to the Conference of American and European Geographers held at Chicago in 1893. A notice of it will appear in the Monthly Record.

United States—Alaska. *National G. Mag. 5* (1894): 173-179. **Scidmore.**
Recent Explorations in Alaska. By Eliza Ruhamah Scidmore.

United States—Chicago. **Mayr.**
Wien—Chicago. Eine Urlaubsreise, Rudolf Mayr. Wien, 1894. Size 10½ × 7, pp. 144. *Maps and Illustrations.*

Popular account of the visit of an Austrian tourist to the World's Fair.

United States—Maryland.**Williams and Clark.**

Outline of the Geology and Physical Features of Maryland, with a geological map of the State and 16 plates. By George H. Williams, Professor of Inorganic Geology in Johns Hopkins University, and William B. Clark, Associate Professor of Organic Geology in Johns Hopkins University. Baltimore, 1893. Size 10 × 8, pp. viii. and 68. *Presented by the Johns Hopkins University.*

Contains a chapter on the configuration and climate of the State as well as the geological description, and views of typical scenery.

United States—New York.*American J. Science* 47 (1894): 105-113.**Lincoln.**

The amount of glacial erosion in the Finger-lake regions of New York. By D. F. Lincoln, M.D., Geneva, N.Y.

A contribution to the theory of lake-formation, especially with regard to the part played by glaciation.

United States—Texas.*P. A. Natural Sciences, Philadelphia* (1893): 313-347.**Tarr.**

Notes on the Physical Geography of Texas. By Ralph S. Tarr.

Mr. Tarr writes partly from observation and partly from the study of published works, a list of which is appended to the paper. He traces the evolution of the surface features of the State, showing how the geological succession and the period of successive uplifts determined the present configuration and drainage system. The absence of lakes, especially, is explained by the absence of structural features, which might produce them in all except the geologically oldest part of the region, where prolonged river-action has long since drained any that may have been formed. Climatic conditions are considered in relation to configuration.

United States—Washington.**Wickersham.**

Is it Mount Tacoma or Rainier? By Hon. James Wickersham. Tacoma, 1893. Second edition. Size 9 × 6, pp. 34. *Map. Presented by the Author.*

Mr. Wickersham, in this edition of his pamphlet, adds further opinions in favour of reverting to the native name *Tacoma* for the great snow-summit of the state of Washington.

AUSTRALASIA.**Australia.***J.R. Colonial I.* 25 (1894): 225-232.**Shaw.**

The Australian Outlook. By Miss Flora L. Shaw. With discussion.

Miss Shaw is well known as an authority on colonial matters, from her series of letters to the *Times* from South Africa and Australia, which have been republished in book form and noticed in this Journal. The present paper is an attempt to forecast the prospects of Australia from a survey of its present resources and condition.

Fiji.*Scottish G. Mag.* 10 (1894): 120-140.**Thomson.**

The Land of Viti. By J. P. Thomson.

Hawaii.*B.S.R. Belge G.* 17 (1893): 405-436, 565-584.**Du Fief.**

Les Iles Hawai. Par J. Du Fief.

A general description of the Sandwich Islands.

Kerguelen Island.*Ann. Hydrographiques* (1893): 246-269**Lientard.**

Mission aux Iles de Kerguelen, Saint-Paul et Amsterdam. Rapport de M. le Capitaine de frégate Lientard, commandant l'Aviso-transport l'Eure.

New Guinea, German.

Nachrichten über Kaiser Wilhelms-Land und den Bismarck-Archipel. Herausgegeben von der New Guinea Compagnie zu Berlin. Berlin, Ashe & Co., 1893. Size 10 × 7, pp. 68. *Maps. Price 3 marks.*

The official reports of German New Guinea for 1893.

POLAR REGIONS.

Antarctic Research. *Ann. Hydrographie* 21 (1893): 449-467. **Neumayer.**

Die neuesten Fortschritte der Bestrebungen zu Gunsten einer wissenschaftlichen Erforschung der antarktischen Region. Von Dr. Neumayer.

Dr. Neumayer brings together a short account of recent attempts to revive Antarctic exploration, and dwells on the importance of work being done in that direction, incorporating in his article the preliminary reports of Messrs. Bruce and Donald, and a report of Dr. Murray's R.G.S. paper.

Arctic Tides. *T. R. Irish A.* 30 (1893): 325-346. **Haughton.**

On the Tides of the Arctic Seas. Part VIII. On the Tides of Lady Franklin Sound. By Rev. Samuel Haughton, M.D.

The continuation of Dr. Haughton's exhaustive discussion of the tides of the Arctic Seas deals with the hourly observations made on H.M.S. *Discovery* from September 16th, 1875, to March 28th, 1876, while frozen in the ice of Lady Franklin Bay (latitude 81° 45' N.). The observations are discussed by Fourier's Theorem, in order to show the mean tide-level, the diurnal tide, the semi-diurnal tide, and the tertio-diurnal tide. This paper is published separately, price 2s., through Messrs. Williams & Norgate.

Greenland. *National G. Mag.* 5 (1894): 197-234. **Curtis.**

Recent Disclosures concerning pre-Columbian Voyages to America in the Archives of the Vatican. By William Elleroy Curtis.

The Vatican Library was searched in 1892 for any evidence as to the Norse voyages to Vinland being known in Rome before 1492. No such evidence was found, but there were many interesting records of early missions to Greenland, some of which are given in the article and referred to in the Monthly Record.

Greenland. *G. Tidsskrift* 12 (1893-94): 149-157. **Garde.**

Dansk Expedition til Sydvestgrønland i Sommeren 1893. Af V. Garde.

Lieutenant Garde gives an account of his work last summer, with a sketch-map showing his journey on the inland ice from a point midway between Ivigtut and Julianhaab, his greatest elevation, about 75 miles from the coast, being 6840 feet.

Greenland. *G. Tidsskrift* 12 (1893-94): 158-160. **Knudsen.**

Under Østkysten af Grønland 1893. Ved Kaptajn Ragnvald Knudsen.

Captain Knudsen of the Norwegian sealer *H-kla* succeeded in breaking through the ice-barrier and reaching the east coast of Greenland in 68° 22' N., the new coast seen being indicated on a sketch-map, which shows a considerable divergence from the provisional coast-line of Greenland in Stieler's *Handatlas*.

Greenland—Eskimo. **Nansen.**

Eskimo Life. By Fridtjof Nansen. Translated by William Archer. London, Longmans and Co., 1893. Size 9 × 6, pp. xvi. and 350. *Illustrations.* Price 16s. Presented by the Publishers.

This is a translation, modified in places, from the original Norwegian edition which was issued in 1891, and noted in the *Journal*, vol. i., 1893, p. 282. The volume gives a good insight into the general condition of the Eskimo, their habits and mode of life.

Greenland—Umanak Fjord. *Verh. Ges. Erdk. Berlin* 20 (1893): 438-454. **Drygalski.**

Herr Dr. Erich von Drygalski: Bericht über den Verlauf und die vorläufigen Ergebnisse der Grönland Expedition der Gesellschaft für Erdkunde. *Map.*

The preliminary results of the Greenland expedition as here set forth were summarised in the *Journal* for January, p. 47.

Greenland—Umanak Fjord. *Verh. Ges. Erdk. Berlin* 20 (1893): 454-469. **Vanhöffen.**

Herr Dr. E. Vanhöffen; Frühlingsleben in Nord-Grönland.

Dr. Vanhöffen was the naturalist on the Berlin Geographical Society's Greenland expedition, and he here describes the fauna and flora, both terrestrial and marine, during the spring season at Umanak fjord.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Geodesy.

The Methods and Results of the U.S. Coast and Geodetic Survey as illustrated at the World's Columbian Exposition, 1893. Bulletin No. 29

of the U.S. Coast and Geodetic Survey. T. C. Mendenhall, Superintendent. Washington, 1893. Size $9\frac{1}{2} \times 6$, pp. 39-98.

The exhibits of the Coast and Geodetic Survey at the Chicago Exhibition were popularized by the publication of a number of descriptive leaflets, and these are now put together in a permanent form. The titles of the leaflets are:—The U.S. Coast and Geodetic Survey; Base Apparatus; Triangulation and Reconnaissance; Time, Latitude and Longitude; Gravity; Topography; Hypsometry; Hydrography; Tides and Currents; Description of the C. and G. S. Steamer *Blake*; Magnetism; Chart Publications; Weights and Measures; Model of United States and Alaska.

Gulf Stream. *National G. Mag.* 5 (1894): 161-166. **Libbey.**
The Relations of the Gulf Stream and the Labrador Current. By William Libbey, Junior.

Professor Libbey here explains to the Conference of American and European Geographers, held at Chicago in 1893, the remarkable effect of wind in affecting the line of demarcation between the warm and cold currents off the east coast of the United States, not only at the surface, but to a great depth in the water.

Ocean Depths.

List of Oceanic Depths and serial temperature observations received at the Admiralty during the year 1893 from H.M. surveying ships, Indian Marine Survey, and British Submarine Telegraph Companies. Hydrographic Department, Admiralty. London, 1894. Size $13\frac{1}{2} \times 8\frac{1}{2}$, pp. 20 of tables. Presented by the Hydrographic Department.

Oceanography. **Mill and Herbertson.**
Report on the Physical Observations carried on by the Fishery Board for Scotland in the Firths of Forth and Tay, and in the Clyde Sea Area, etc. By Hugh Robert Mill, D.Sc., and Andrew J. Herbertson. Plate. Size 10×6 , pp. 395-485. Presented by the Authors.

An extract from the Report of the Fishery Board for Scotland for the year 1892, which will be referred to in the Monthly Record.

Oceanography. *P.R.S. Edinburgh* 19 (1891-92): 238-242. **Buchanan.**
On some modifications of the Water-Bottle and Thermometer for Deep-Sea Research. By J. Y. Buchanan.

Oceanography. *T.R.S. Edinburgh* 37 (1893): 481-507. **Murray & Irvine.**
On the Chemical Changes which take place in the Composition of the Sea-Water associated with Blue Muds on the Floor of the Ocean. By John Murray, LL.D., and Robert Irvine.

Results of much novelty and interest are here discussed, the fact that active chemical change occurs in the sea-water permeating mud on the floor of the ocean, and the nature of that change, modify several of the theoretical methods of reasoning formerly relied upon in dealing with oceanographical problems.

Physical Geography. *National G. Mag.* 5 (1894): 154-160. **Chamberlin.**
The Relations of Geology to Physiography in our Educational System. By T. C. Chamberlin.

This paper, read to the Conference of American and European Geographers at Chicago in 1893, favours the introduction of the wider science of Physiography for use in schools in preference to the formal study of the special fields of geology and geography.

Position at Sea. *C. R.* 118 (1894): 24-27. **Favé and l'Isle.**
Détermination graphique du point à la mer. Note de MM. Louis Favé et Rollet de l'Isle.

Particulars of a diagram by which altitudes may be worked out without calculation.

Steppes. *Globus* 65 (1894): 1-6. **Krause.**
Die Steppenfrage. Von Dr. med. Ernst H. L. Krause, Schlettstadt.

This paper is illustrated by a map in colours printed in the text, showing the character of the land in North Germany.

GENERAL.

- Civilization.** *National G. Mag.* 6 (1894): 1-22. **Hubbard.**
 Geographic Progress of Civilization. Annual Address by the President,
 Honorable Gardiner G. Hubbard.

Mr. Hubbard begins a summary of the history of civilization in all parts of the world, with the striking generalization: "If parallels of latitude were drawn around the earth about fifteen degrees north and fifteen degrees south of Washington, the land within those parallels would include all the countries of the world that have been highly civilized and distinguished for art and science. No great people, except the Scandinavians and Scotch, who from their climate belong to the same region, ever existed outside these limits; no great men have ever lived, no great poems have ever been written, no literary or scientific work ever produced, in other parts of the globe." The existence of South Africa, Australia, and New Zealand might seem to justify the insertion of some such modifying clause as "in the northern hemisphere."

- Columbus.** *National G. Mag.* 5 (1894): 180-186. **Concas.**
 The Caravels of Columbus. By Victor Maria Concas.

Captain Concas was in command of the facsimiles of Columbus' ships sent to the Chicago Exhibition, and in this paper he gives a summary of all that is known of the original vessels which composed the exploring fleet.

- Columbus.** *National G. Mag.* 5 (1894): 187-196. **Ober.**
 In the Wake of Columbus. By Frederick A. Ober.

The outline of a book bearing the same title, and describing a search for relics of Columbus in Europe, and visits to the places where the first ships touched in America.

- Columbus.** **Wieser.**
 Die Karte des Bartolomeo Colombo über die vierte Reise des Admirals
 Von Fr. K. v. Wieser. Innsbruck, 1893. Size 9½ × 6½, pp. 14 and 3
 plates. Presented by the Author.

This is a reprint from the "Mittheilungen des Instituts für Oesterr. Geschichtsforschung," and contains facsimiles of the three supposed autograph maps of Bartholomew Columbus which were described in the January number of the *Journal*, p. 44.

Commercial Geography—Index.

Index to the Board of Trade Journal of Tariff and Trade Notices, and miscellaneous Commercial Information. Vols. i. to xiv., July, 1886, to June, 1893. London: Stationery Office, 1893. Size 10 × 6½, pp. 204.
 Price 2s.

Although the first word of the Index, "Abolition," is scarcely the heading under which one would look for information as to the close of the commercial tribunals of Italy, this work is of extreme utility to the student of commercial geography, and it is convenient also, the arrangement being mainly geographical.

- Educational.** **Redway.**
 The Status of Geography Teaching. By Jacques W. Redway. [From
 the *Educational Review*, New York, 7 (1894): 33-41.]

- Educational.** *National G. Mag.* 5 (1894) 137-153. **Powell.**
 Geographic Instruction in the Public Schools, by W. B. Powell.

A paper read to the Conference of American and European Geographers in Chicago in 1893. Mr. Powell elaborates the well-known method of the *Heimatskunde* as applicable in the schools of the district of Columbia.

- Educational.** *Scottish G. Mag.* 10 (1894) 82-90. **Rousiers.**
 The Teaching of Geography and Social Science. By Paul de Rousiers.

M. de Rousiers, acknowledging gratefully the advances recently made in giving life and interest to geographical instruction, points out that this improvement in spirit is apt to be accompanied by a falling-off in the arrangement of text-books, where confusion seems to take the place of order. He recommends, in order to overcome this tendency, the recognition of the relation between physical and social conditions; in fact, a recognition of the principles of geography. This is, however, not the main obstacle to proper instruction in Geography. The real difficulty, in this country at least, lies in the very general ignorance amongst teachers, and the absence of adequate university recognition of Geography as a science.

Fur-Seal.

Chapman.

Notes on the Depletion of the Fur-Seal in the Southern Seas. By Frederick Revans Chapman. Reprinted from the *Canadian Record of Science*, October, 1893. Size $8\frac{1}{2} \times 6$, pp. 446-459.

A summary of this paper appears in the *Monthly Record*.

Geography.

Kan.

De Aardrijkskunde en de Praktijk. Rede op der Verjaardag den Universiteit van Amsterdam, Uitgesproken door den Rector Magnificus. Prof. Dr. C. M. Kan.

This address on practical geography is reprinted from the Year-book of the University of Amsterdam for 1892-93, and deals with the scope and expression of geographical science alike in unravelling the past relations of land and people, and in guiding modern schemes of colonization and the development of new lands.

Historical.

Sacken.

C. R. Osten Sacken. On the so-called *Bugonia* of the Ancients, and its relation to *Eristalis tenax*, a two-winged insect. Firenze, 1893. Size $9\frac{1}{2} \times 6$, pp. 34. Presented by the Author.

Historical Geography.

National G. Mag. 5 (1894): 125-131.

Parker.

The Relations of Geography to History. By Francis W. Parker.

Paper read at the Conference of American and European geographers at Chicago in 1893.

Prince Henry the Navigator. *Globus* 65 (1894): 153-156.

Ruge.

Prinz Heinrich der Seefahrer (geb. 4 März 1394, gest. 13 November 1460). Von Professor Dr. S. Ruge. Dresden.

A short historical paper, illustrated by a portrait of Prince Henry.

Year-book—Universities.

Kukula and Trübner.

Minerva. Jahrbuch der gelehrten Welt. Herausgegeben von Dr. R. Kukula and K. Trübner. Dritter Jahrgang, 1893-94. Straassburg Karl J. Trübner, 1894. Size $6\frac{1}{2} \times 4\frac{1}{2}$, pp. xvi. and 862. Price 6s. 6d.

A complete list of the *personnel* of all the Universities and higher educational institutions in the world.

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Montenegro.

Hassert.

Die Landschaftsformen von Montenegro von Dr. Kurt Hassert. Petermanns Geographische Mittheilungen Jahrgang, 1894, Tafel 4. Scale 1 : 800,000 or 12·6 stat. miles to an inch. Justus Perthes, Gotha, 1894. *Presented by the Publishers.*

AFRICA.

Egypt.

Egyptian Ministry of Public Works.

Perennial Irrigation and Flood Protection for Egypt. 19 Plans and Sections. Ministry of Public Works, Cairo, 1894. *Presented by the Egyptian Ministry of Public Works.*

This is a series of nineteen plans, illustrating a system of perennial irrigation and flood protection for Egypt.

West Africa.

Binger.

Carte du Haut-Niger au Golfe de Guinée par le Pays de Kong et le Mossi. Levée et dressée de 1887 à 1889, par le Capitaine Binger. Nouvelle Edition, mise à jour jusqu'au 1^{er} Mars 1893, à l'aide des travaux topographiques des officiers en service au Soudan français; des travaux du Dr. Crozat du Capitaine Marchand; de la commission de délimitation de la Côte d'Ivoire; du Comm' Monteil et des différentes reconnaissances faites sur le littoral du Golfe de Guinée. Scale 1 : 1,000,000 or 15·8 stat. miles to an inch. Service Géographique des Colonies. Paris: Maison Andriveau-Goujon. *Presented by the Service Géographique des Colonies.*

The present edition of this map contains important corrections and additions, and has in many parts been entirely redrawn. Places that appear as blanks on the earlier edition have been filled in, and the positions of many places have been altered as regards latitude and longitude. All available material has been used in the compilation, in addition to the surveys of Captain Binger, and the routes of different travellers are laid down. The importance of towns and villages is indicated by symbols, and the northern limit of dense continuous vegetation is shown. Insets on enlarged scales of the Komoe and Bia rivers, and the lagoons between Lahu and Fresco are given. The map is drawn on a large scale in a very clear style, and is printed in well-chosen colours.

AMERICA.

United States.

Rand, McNally & Co.

Rand, McNally & Co.'s Indexed County and Township Pocket Maps and Shippers' Guides of Louisiana (1 : 982,080 or 15·3 stat. miles to an inch),

Mississippi (1 : 823,680 or 13 stat. miles to an inch), Missouri (1 : 1,000,000 or 15·8 stat. miles to an inch), Tennessee (1 : 1,143,660 or 18·5 stat. miles to an inch), Texas (1 : 2,217,600 or 35 stat. miles to an inch). Rand, McNally & Co., Chicago and New York. *Presented by the Publishers, through E. Stanford, Esq.*

These are new editions of maps which have been previously noticed in the *Geographical Journal*, and which will be found useful to persons visiting the United States on business or pleasure.

AUSTRALASIA.

Borneo.

Schneiders.

Der Südosten von Borneo. Nach den neuesten Gouvernements Aufnahmen u. eigenem Journal entworfen u. gezeichnet von Gottfried Schneiders. Petermanns Geographische Mitteilungen, Jahrgang, 1894, Tafel 3. Scale 1 : 2,000,000 or 35·7 stat. miles to an inch. Justus Perthes, Gotha, 1894. *Presented by the Publishers.*

New Zealand.

Surveyor-General of New Zealand.

Map of the Northern Portion of East Taupo County. Scale, 1 : 126,720 or 2 stat. miles to an inch.—Plan of Kawhia, West Taupo, and portion of Clifton Counties. Scale, 1 : 126,720 or 2 stat. miles to an inch. 2 sheets. Photo-lithographed at the Head Office, Department of Lands and Survey, Wellington, N.Z. S. Percy Smith, Surveyor-General. (*Stanford.*)

GENERAL.

The World.

Debes.

E. Debes' neuer Handatlas über alle Teile der Erde in 59 haupt, und weit über 100 Nebenkarten, mit alphabetischen Namenverzeichnissen. Ausgeführt in der geographischen Anstalt der Verlagshandlung. Leipzig, H. Wagner and E. Debes. Parts III. and IV. 1·80 marks each part. *Presented by the Publishers.*

Part III. contains maps of West and Central Germany, Polynesian Island Groups, and Central America. Part IV. contains a Commercial Map of Central Europe, Countries of the Alps (western part), and Eastern Asia. The maps are excellent specimens of cartography, and contain much information as to the tribes inhabiting certain districts, which is not usually given in general atlases. Each map is accompanied by an index.

The World.

Ravenstein.

Philip's Systematic Atlas, Physical and Political; specially designed for the use of Higher Schools and Private Students. Containing over 250 Maps and Diagrams, in 52 Plates, with an Introduction and Index of 12,000 names. By E. G. Ravenstein, F.R.G.S. London: G. Philip & Son, 1894. Price 15s. *Presented by the Publishers.*

This atlas is intended to fill a middle place between ordinary school atlases and those published for general reference. The atlas is arranged in three main divisions, viz. Mathematical, Physical, and Political Geography. In the Mathematical division, in addition to the usual astronomical diagrams, there is a good general description of the principal map projections illustrated by diagrams, and some useful notes on the scale of maps and the measurement of distances on maps. The second division, Physical Geography, contains maps illustrating distribution of land and water, orography, river-basins, geology, volcanoes, ocean currents, co-tidal lines, temperature of the ocean and salinity of the sea, meteorology, magnetic phenomena, and the geographical distribution of plants and animals. The third division, Political Geography, in addition to general political maps, contains maps showing languages, religions, density of populations, etc.; inset plans are given of the principal cities, and the boundaries are very distinctly laid down. Some confusion, however, is likely to arise from the fact that railways on the enlarged insets are shown in the same manner and colour as the boundaries in the principal map. Of the British Isles and most of the continents pairs of maps, physical and political, on the same scale, are given. In order to facilitate the comparison of the areas of different countries, equivalent projections have been largely used, and care has been taken to prevent overcrowding by a careful selection of the names given.

The publication of an atlas on this system is, beyond doubt, a step in the right direction. Faults undoubtedly do exist, but they are of a minor character, and can easily be rectified in another edition. There is room for improvement in the orographic colouring where green to indicate low altitudes is used, as this is often not at all in

keeping with the physical features of the country, especially in the case of deserts. This remark, however, applies to the majority of orographical maps. Generally speaking, this is a good atlas, and well suited to the purpose for which it has been published.

The World.

Stanford.

Stanford's London Atlas of Universal Geography, exhibiting the physical and political divisions of the various countries of the world. Folio edition. One hundred maps, with a list of latitudes and longitudes. Second issue, revised and enlarged. London: E. Stanford, 1894. Price, £12. *Presented by the Publisher.*

In the second edition of this atlas the following important additions and alterations have been made: Plates 13, 19, 52, and 82, which appeared in the previous edition, have been omitted. A new map of Europe replaces the former map. New one-sheet maps of England, Scotland, and Ireland, without hills, replace those formerly given. There is also a map of Central London, on the scale of 4 inches to a mile, and a new map of Switzerland, which has been compiled from the best official and other documents, and produced by heliogravure. Maps of the Canary Islands and Madeira have been added. The map of Turkey in Asia on one sheet, which appeared in the former edition, has been replaced by maps of the Euphrates Valley and Asia Minor. With permission of the proprietor, Constable's map of the North-Western Frontier of India, the Pamir and part of Afghanistan, has been given, as well as new maps of Siam, Madagascar, the Argentine Republic, and New Guinea.

Special large scale maps of the following are given:—Channel Islands, Canary Islands, Madeira, the Bosphorus and Constantinople, Sea of Marmora, Maltese Islands, Cyprus, Ceylon, Borneo, Madagascar, Newfoundland, Jamaica, Bahamas, Leeward Islands, Windward Islands, Falkland Islands, and Fiji Archipelago.

In all the atlas contains 100 maps and numerous insets, no less than 27 of which are devoted to the British Isles, and 29 wholly or in part to the British Colonies. British North America is well represented by a series of maps, on which care has been taken to show all means of communication by rail up to date. Five maps are devoted to Africa, on which the "Spheres of Influence" of European powers are clearly indicated.

It will thus be seen that one of the principal features in this atlas is the large number of maps it contains of the British Isles and British possessions. These are in most cases on an unusually large scale. The London atlas has in this respect a marked advantage over other atlases. In most respects the compiler has evidently been careful to use recent and reliable material in order to bring the maps up to date. There is room, however, for improvement in some of the maps, as regards the manner in which the physical features are shown, and the orthography in the map of India requires correction, as in many instances the system employed is obsolete. For purposes of general reference, the atlas ought to be particularly useful.

CHARTS.

French Charts.

Service hydrographique de la Marine.

No. 4784, Du Cap Pertusato à la Pointe de Sénétose, Les Moines, Corse, 1893.—4747, Rivière de Tourane (Song-Thu-Bou), Annam.—4765, Rivière de Hué, Côte d'Annam, 1893.—4770, Lagune entre Thuan-An et le Cua-Lac et Rivière de Ba-Truc, Côte d'Annam, 1893.—4817, Baie de Ranobé, Madagascar, Côte Ouest, 1893.—4797, Ports et Mouillages à la Côte Est de Madagascar, 1893.—4781, Mouillages à la Côte Ouest de Madagascar, 1893. *Service hydrographique de la Marine, Paris. Presented by the*

PHOTOGRAPHS.

France.

Jackson.

10 Photographs of Southern France in the neighbourhood of Nice. *Presented by Mr. James Jackson.*

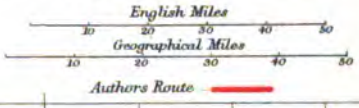
This is a series of photographs taken by Mr. Jackson in Southern France; they are chiefly marine views, and are very nice specimens of photography.

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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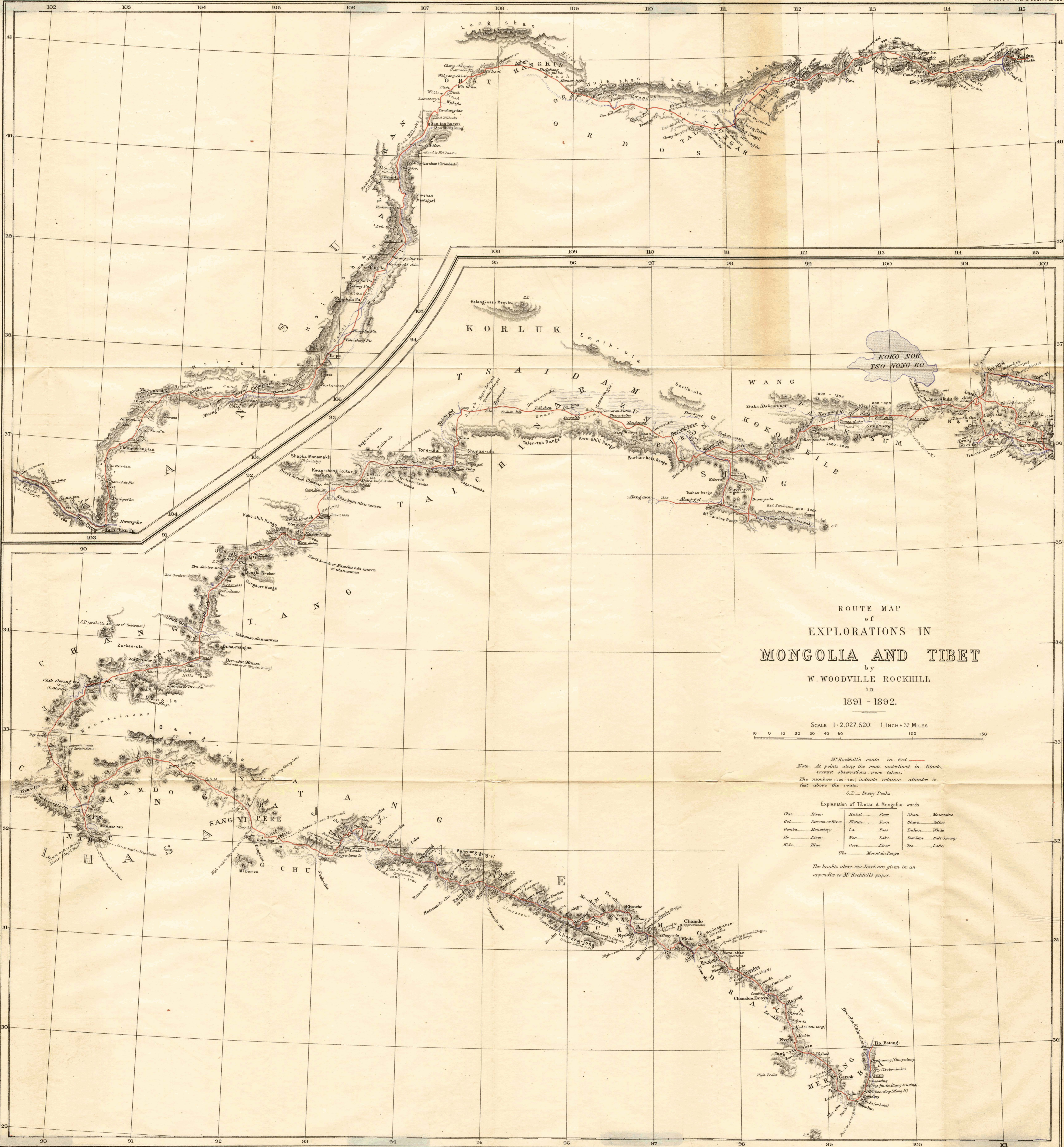
By W. WOODVILLE ROCKHILL.

ONE of the greatest profits a traveller gains from his first journeyings in an unknown country is rather the determination of the field of research than the data he then brings back, which, of necessity, are hastily gathered and frequently misunderstood from unfamiliarity with the country, the language and the modes of thought of the people. Such, at least, has been my experience, and so it happened that, not satisfied with the results of a first journey in Tibetan countries made in 1889, I found myself in September of 1891 again on my way to China to complete, in a measure, my former researches among the Tibetan tribes of the north-east, and to extend my explorations towards the interior as far as possible. I hoped, if fortune favoured me, to be able to reach India by a route of which I had heard, leading to Shigatse, in Ulterior Tibet, without passing on Lhasa territory,† for in this latter country I knew I should meet with insurmountable obstacles—man-raised barriers more difficult to overcome than any snow-covered mountain or wind-swept desert.

On November 17th I reached Peking, where I passed twelve days waiting for the renewal by the Tsung-li Yamen of the passport it had given me in 1888.

* Paper read at the Meeting of the Royal Geographical Society, February 27th, 1893. Map, p. 444.

† I should use the term *Deba-zong* instead of "Lhasa territory," but the latter is more readily understood, if less exact.



ROUTE MAP
of
EXPLORATIONS IN
MONGOLIA AND TIBET
by
W. WOODVILLE ROCKHILL
in
1891 - 1892.

SCALE 1:2,027,520. 1 INCH = 32 MILES

Note. At points along the route underlined in Black, actual observations were taken.
The numbers (200-400) indicate relative altitudes in feet above the route.

S.E. - Snowy Peaks

Explanation of Tibetan & Mongolian words

Chu	River	Kital	Pass	Shan	Mountains
Col	Stream or River	Kutan	Turn	Share	Yellow
Gamba	Monastery	La	Pass	Badan	White
Ho	River	Nor	Lake	Badan	Salt Swamp
Koko	Blue	Oan	River	Bo	Lake
Ula		Ula	Mountain Range		

The heights above sea-level are given in an appendix to Mr Rockhill's paper.

The provinces I was authorized to visit were Kan-su, Su-chuan, the Kokonor, Turkestan, and Yun-nan, no mention being made of Tibet. This form of passport I found quite sufficient, for no routes being designated on it, I was at liberty to follow the most roundabout way in going from one of the provinces mentioned to the other.

On December 1st I left Peking for Chang-chia-ko (Kalgan), accompanied by one Chinese servant, we and our luggage tightly stored away in two carts hired to convey us to Kwei-hwa Cheng.

At Kalgan I remained for four days making some purchases, and taking sextant observations to fix as well as possible this the starting-point of the route-survey I proposed carrying on from here to the end of my journey. Leaving this great frontier mart, the road led up the valley of the Yang-ho, remarkable for groves of willows, from which the river takes its name, for cave-dwellings called "fairy caves" being warm in winter and cool in summer; and for curious truncated cone-shaped towers along the foot of the hills, which the people say were once "gun towers," where the inhabitants defended themselves against Mongol or Tartar raiders. They are some 30 feet high, 12 to 15 feet in diameter on the top, and surrounded by a wall a few feet from the base. They are so numerous, and placed so regularly along the base of the hills, that the explanation given me of their use would seem incorrect; but I cannot now suggest a better one.

Passing the little Chinese village of Tsahan-obo, we entered the pasturages of the Chahar Mongols, the principal of the so-called *Yo-mu*, or "herdsmen" tribes, who are debarred by the Chinese from all save pastoral pursuits. These Chahar have to tend the imperial herds and flocks, and they supply to the Emperor a contingent of ten thousand men in time of war. Unlike other Mongol tribes, they have no chieftains of their own, but are under the rule of the Chahar Tu-tung, a Chinese Lieutenant-Governor residing at Kwei-hwa Cheng. They are generally demoralized by their proximity to and too intimate intercourse with the Chinese; many are opium smokers, all hard drinkers, and I found among them but little of the pleasing, frank, and cordial manners met with among the remoter tribes of their race.

The country between Kalgan and Kwei-hwa Cheng is about 4600 feet above sea-level, cut by low ranges of loess-covered hills running from east to west, in many places the loess over 100 feet deep. In this region, and in fact as far west as the Kokonor, rain had fallen but little for two years, scarcity was felt, and in many places there was already a famine. At Chang-ko, a day east of Tsahan-obo, the Dragon or Rain king had been prayed to, first by the men, then the women and children, but all in vain. The local official in flowing robes and tasseled hat had also besought the Lung Wang to send rain; the sky remained cloudless, and still vast flocks of sand grouse with much rustling of wings kept sweeping continually over the country,

a portent that the awful drought was not yet to end, for it is said, "When the sand grouse fly by sell your wives."

On December 18th I reached Kwei-hwa Cheng, passing vast flocks of sheep and herds of camels on their way to supply the Peking market. Abbé Huc has so well described this great frontier town that there remains little more to be said of it.* Its trade is chiefly in sheep and camels, in goat and sheep skins, tallow and camel's hair. Its people, all Chinese, and some eighty thousand in number, are about as rascally and depraved a lot as I have ever seen in China. The town is dirty and ill-built, and the inhabitants pay a ground-rent varying from 10 to 50 cash for each $\frac{1}{2}$ of acre (*mou*) to the Mongol owners.

I was anxious to learn if there were trade relations between this point and Chinese Turkestan, Hami, or Kulja. I found that only occasionally a few Chan-to visit this town, bringing little but Hami raisins and dried melons. A few more go to Pao-tu, and some push on as far as Hsi-an Fu; but the trade on the whole is insignificant.

Leaving Kwei-hwa on Christmas Day I reached two days later the Yellow River, at Ho-ko (Dugei or Dugus in Mongol), a place of considerable importance on account of its soda works, and which may prove to be the Tenduc of Marco Polo. Extensive ruins crown the hills behind it, and the town of To Cheng, called by the Mongols Togto, is a mile north of it. Crossing the Yellow River, here some 400 yards wide, I found myself in the country of the Jungar Mongols, the easternmost of the seven Ordos tribes forming the Ike-chao league. At present the first prince of the Ordos is the chief of the Jungar or Jungar-ta. In time of war he commands the Ordos contingent, and is hence known to Chinese as the Ordos Generalissimo. He succeeded to the Prince of Washun, his office being given him by the Mongol Superintendency at Peking, which is always guided in its selection by the importance of the presents made it by the different candidates.

The Ordos country along the Yellow River has been settled within the last thirty years by Shen-hsi Chinese, who had fled from their homes on the outbreak of the Mohammedan rebellion. These colonists rent land from the Mongols, and, though the whole country seemed to me a sandy waste, they told me it was fairly fertile when well irrigated. The Mongol owners of the land have retired into the interior, or adopted to a great extent, when living near the Chinese, their customs and mode of living.† It was my intention to traverse the Ordos country to Teng-

* The valley of the Hei-ho ("Black River"), where the town of Kwei-hwa stands, is bounded to the north by a range of rugged mountains stretching west to the Alashan Range. On most of our maps they are called In-shan, but this can only be a defective transcription of Ta-ching-shan, the only name I heard used. West of Pao-tu the range is called Wula-shan, then Lang-shan as far as Alashan.

† Prjevalsky on his route map of this section of country has it that it is thickly settled by Chinese. At the present day such is not the case; villages are not very numerous nor very large.

ko* on the Yellow River, but on reaching Hsiao-nor, a station of the Belgian Catholic Mission, I found it impossible to carry out this plan without considerable delay, as a guide would be necessary, and I must carry forage for the whole trip, some seven days. So I crossed over to the left bank of the river and remained on that side till I reached Lan-Chau Fu, the country most of the way a desert waste of drifting sands. Alashan (or Alaksha, as the Mongols call it),† through which my route led, extends from a little to the east of the flourishing Christian communities of San-tao-ho-tzu to Shi-tsui, where the province of Kan-su begins. Travel is rendered difficult all the way by the innumerable deep holes made over the face of the country by licorice diggers, this root being the most valuable export of this section of country. Where these pitfalls are not found, soft sand, irrigation ditches, willow brush and alkaline bogs alternate to take away what little comfort there might be in travelling through this wind-swept barren land.

Ning-hsia Fu, where I stopped for a day to hire carts to take me on to Lan-Chau, is just beginning to rise from its ruins; but even now but a small portion of the land without its walls is built over, and no Mohammedan is allowed to dwell inside the city, so fearful are the authorities of a fresh uprising. This city is the Irgekotun of the Mongols, the Egrigaia of Polo. In his time it was famed for its *camlets*, "carried over the world for sale." At present the rugs made here are equally famous among Mongols and Tibetans, to whom most of those manufactured are sold, so that they are but rarely seen in China. ‡

The plain surrounding Ning-hsia, from Shih-tsui-tzu to Chung-wei Hsien, a distance of about 175 miles, is in many places covered with drifting sand, in others it is an alkaline marsh with here and there patches of mixed loess and gravel. Chinese enterprise has converted this unpromising plain into one of the most fertile districts of the province. Huge irrigation ditches starting from Chung-wei and Ta-pa carry water all over the plain. One passes every mile or so bustling villages where wheat and rice, the country's chief products, are sold; and one finds pears and apples, persimmons and chestnuts, and all manner of vegetables. These great canals were made, it is said, in the seventeenth century by order of the Emperor Kanghsi.

* Teng-ko is in Mongol Tungor, and is Prjevalsky's Ding-hu. It is a very small village on the right bank of the Yellow River, though, curiously enough, it figures on most maps as being on the left bank. It is known to have existed in the thirteenth century, and was probably, until the late rebellion, a place of considerable importance, as it is on the direct road to Kwei-hwa and Peking.

† But the name is not, as far as I can learn, a Mongol one; at least, no one could give me a satisfactory explanation of it.

‡ Mongols and Tibetans call these rugs "Alashan Rugs," and Chinese speak of them as *tsai-jung-tan-tzu*, "velvet or plushy carpets." Sir Henry Yule tells us ('Marco Polo,' 2nd edit., i. 274) that the word *Khamlat*, whence is derived our "camlet," also bears with it this idea of plushy. Can the present rugs be Polo's camlets?

I must pass on rapidly to Hsi-ning Fu, in Western Kan-su, for my journey was to Tibetan countries, and I must not take up your time speaking any more of China, however interesting the subject may be to me.

Passing through Lan-Chau Fu, which I reached the day after the Chinese new year (January 31st, 1892), I followed, as far as Hsi-ning, the route up the valley of the Hsiho I had taken in 1889; then, stopping only a night at Hsi-ning to send word to the men who had followed me in 1889 into Eastern Tibet to join me at Luser (Kumbum), I made for that most convenient village, which I reached on February 11th. The men responded promptly to my call, and so I was at once relieved from what had given me so much trouble on my first journey—getting men who did not fear to face the real hardships and more or less imaginary dangers of the Tibetan and Mongol wilds. While my headman was busy buying mules, saddles, clothes, and supplies for the journey westward, I decided to visit the Salar and some of the agricultural Tibetan tribes near the Yellow River.

On February 17th, when I left for the proposed trip, it snowed heavily, the first snow we had had since passing Tsahan-obo, in Eastern Mongolia, and we experienced considerable difficulty the next day in making our way along the narrow, slippery bridle-paths which led us across the Nan-shan. This range, the eastern portion of the South Kokonor chain, offers a most admirable illustration of the mode of formation of the loess and of the continual redistribution going on, and the formation of new deposits under the action of the torrential rains which for months every year deluge this section of country. Here in this loess-covered country I found that the "Aborigines" (Tu-jen), and they alone, live for the most part in cave dwellings or in houses in which the rear portion is dug in a cliff of loess. Of the history of these tribes I know nothing, save that they undoubtedly occupied this country long before any of the other non-Chinese tribes now inhabiting it. The question suggests itself, Are not these Tu-jen of the same race as the Man-tzu who dug the caves in the valley of the Yang-tzu, in Su-chuan? The caves of the latter are more highly ornamented than those of Kan-su, but then the Man-tzu excavated theirs in sandstone, whereas the northern Tu-jen had only friable loess to work in, which offered no scope for ornamentation.

The first place we stopped at south of the Nan-shan was Tsapa, a place of some importance, with a small garrison commanded by lieutenant, a substantial wall, a mosque, and some three hundred families more than half Mohammedan. It is a stopping-place between Luser and Han-chung, in Shenhsi, for salt smugglers. They buy the salt at Luser from the Tibetans, who get it in the Dabesu-gobi, east of Dulan-kwo, and bring it to the market without having to pay any duty, and by following this trail no likin stations are met with, and a fair profit is realized.

Beyond Bayan-rong, an unimportant sub-prefecture, we crossed a high and difficult mountain, the Ra-ja shan, and stopped for the night at Lamo-shan-ken, a village of Kargan Tibetans. These Kargans, from long intercourse with the neighbouring Salar, have for the most part become converts to Islam, and certainly gained somewhat by the change, being cleaner, more enterprising and richer than their Buddhist compatriots. Nor can the work of conversion have proved a difficult task for the Salar; they had only to let the Tibetans see the lives they led, and how much more work they got out of their women-folk than any neighbouring people, to gain them over at once to their faith. The converts have nobly walked in the footsteps of their teachers; the men work as little as the Salar, relinquishing without a murmur all the household drudgery to the women, who seem to revenge themselves by bullying their lords and masters on every occasion. Their change of faith appears to have added a little to the characteristic pugnacity of all Sifan. Hardly a day passes that a man is not killed or maimed in some one of these Tibetan villages. The men pass most of their time making or repelling attacks, and every commanding hillock near a village is occupied by sentinels watching every line of attack.

We came to the Yellow River nearly in front of I-ma-mu-chwang, "the village of the Iman," the abode of Han Pao Ahon, the chief priest of the Salar. Crossing over on the ice we entered the village, and after some difficulty found lodgings in one of the houses, for there are no inns in the country.

The Salar (or Salaris) have no written tradition concerning their advent into China; they say, however, that the first of their people who came to this country arrived in the third year of Ming Hung-wu (A.D. 1370). They were but three, and drove before them an ox loaded with all their worldly goods, and had come from Samarkand, whence they had been driven by a civil war. They stopped where now stands Katzu-kun, the first and largest of Salar villages. They were soon followed by others of their people, and their settlements grew in number and in size, so that at the present day they number some forty thousand souls, scattered in several hundred villages between Hsun-hwa Ting and Fei-tzu (Shui-ti) chuan, a village about 40 miles further west. Their country is divided into eight "*kun*" or "thousands," hence the name usually given to it by the Chinese, Salar-pa-kun. There is, as far as I know, nothing improbable in this tradition; moreover we find the name of Salar as that of a large tribe living at the present day near Merv in Turkestan, beside the Sarik and Tekke. Though I have not read anything concerning this eastern branch of the Salar in Chinese historical works, there is every reason to believe that a more careful examination of them than I have been able to make will supply corroborative evidence of the truth of the oral tradition.

From the Salar villages I turned westward and travelled to Ku-ei-te, the trail leading over the high, steep foot-hills of the ranges which here hem in the Yellow River. The mountains south of the river were covered with forest-growth, pines, juniper, birch, and cyprus. In little clearings were Tibetan log-cabins surrounded by patches of culture where barley and wheat were grown, and to which water was often carried, as in Switzerland, by long troughs cut in pine logs propped on high poles. The houses are flat-roofed, and but a storey high; inside there is no partition wall; one end of the building serves as a stable, in the other the family sleep on a Chinese *Kang*, or stove-bed, headed by a big Tibetan cooking-stove where the tea cauldron boils, and over which is a prayer-wheel, turned in the heated air as it escapes through a big hole in the roof. Most of these Rong-wa (agricultural Tibetans) are followers of the Binbo religion, and in some corner of every house is a little altar with a bowl containing offerings of the products of the country—barley and wheat, yak hair and sheep's wool—to Shenrab, the great god of their faith. Over the houses, tied to long poles, white flags wave printed with prayers and charms to ward off danger; and below the house, in a log hutch built over the brook, a big prayer-barrel is kept turning ever by the water as it dashes by. I reached Ku-ei-te on February 26th. This frontier town lies in a narrow plain some 6 or 8 miles long. In it live some three hundred Chinese families, and in the surrounding plain are numerous agricultural Tibetans (Rong-wa). Mohammedans are not allowed to reside in or near this town—a punishment for their having massacred the sub-prefect at the outbreak of the late rebellion. The climate is warm; but it is said to be an exceedingly windy place; little snow falls here, though for six months of the year the surrounding mountains are covered with it.

Ku-ei-te produces wheat, millet, and hemp, most kinds of vegetables, also pears, peaches, apples, water-melons, and jujubes; but the place has no trade—a few lambskins, some musk, and rhubarb are all its exports.

I crossed back to the left bank of the Yellow River on leaving Ku-ei-te, and passing by Karang (Count Szechenyi's Kashan) and over the Laye Pass, made my way back to Luser, which I reached on the 29th, to find nearly everything ready for the final start westward. It was, however, March 14th before we left, so long does it take in this home of procrastination to complete arrangements.

The supplies I carried with me were for six months, and consisted of tsamba (parched barley meal), flour, tea, rice, and vermicelli (*kua-mien*), besides a stock of sugar, rock-candy, dry jujubes, raisins, etc., all most useful in these countries where small gifts are being continually exchanged, and where a present always calls for a return one of at least equal value.

My party, as finally organized, consisted of the headman, Yeh Chi-

oheng, who had been with me in 1889, a cook picked up at Kwei-hwa Cheng, and three Hsi-ning men, who had also been with me for some time on my first journey. All of them were Mohammedans, and, with the exception of the cook, typical Chinese frontiersmen—travellers from their childhood, and speaking fluently both Mongol and Tibetan. I had six ponies and seven pack mules, but, so as to keep the latter in good condition as long as possible, I loaded all the luggage, some 1500 pounds, on donkeys hired to go as far as the Dabesu-gobi country, some ten days' march, the mules only carrying barley to feed them along the route. As money I took with me 1000 ounces of silver, some 500 rupees, and goods for barter of about equal value. Each man was supplied with a sheepskin gown, fur cap, wadded trousers, heavy leather boots, felt stockings, and rain-coat, and a sheet of felt to use as a saddle-cloth in the day and a couch at night. Two copper kettles, one for tea, the other to cook food in, a couple of ladles and a bellows, completed, with two very small blue cotton Mongol tents, our equipment, which I found satisfactory and sufficient, though scarcely luxurious. Two sets of extra shoes were taken for each of the horses and mules; unfortunately we did not take a large enough supply of nails, for, not being good smiths, we spoilt many, and for a long time had to leave our animals unshod, which resulted in their feet becoming tender, and in the ultimate loss of the whole lot, not one reaching the journey's end.

Once more crossing the South Kokonor range, this time by the Hung-mao-pan-tao, I came to Sharakuto, a little frontier post commanding the roads to Gomi on the Yellow River, to Tankar, and to Dulan-kwo, west of Kokonor. Leaving behind us the low Jih-yueh shan, which here marks the frontier of Kan-su, we traversed the valley of the Rhirmo-jong (or Tao-tang-ho), the only stream of any importance which empties into the Kokonor from the south, and entered the basin of the Wayen-nor, one of the numerous lakelets which dot this region. The country is an undulating plateau, bounded by low hills running east and west. To the south-west in the direction of the Yellow River we could see, a hundred miles away, snow-clad peaks rising above the bare reddish maze of mountains. Not a tree, not a shrub anywhere, here and there a black tent and a little flock of sheep huddling together to escape the fierce incessant west wind. This is the country of the Panaka or Panakasum, who, coming from south of the Yellow River, have within the last fifty years dispossessed the Mongol owners of the land, driving them back towards the bogs and desert wastes of the Tsaidam. It is a magnificent pasture-land, but poorly watered, except at the foot of the mountains, the little streams either disappearing underground or becoming after a few miles so brackish that the water is undrinkable.

From the Wayen-nor * we could see the mountains which mark the

* Wayen is a Tibetan corruption of the Mongol word *bayan*, "rich, prosperous."

famous Gork gold-fields, from which the Yellow River and the "three days desert" (Kurban Tara) separated us. Discovered in 1888, they yielded to the Chinese, who flocked to them, over 10,000 ounces of gold in less than two years; but now they are abandoned, the primitive methods of the gold-washers being only remunerative with the richest gravels.

Some 40 miles west-south-west of the Wayen-nor, we passed into the basin of the Gunga-nor ("Egg lake"), into which the Huyuyung flows. This is the principal stream of this region, its chief feeders being the Muri-chu and Wahon-chu, which have their sources in the mountains to the south. I could not ascertain whether the Gunga-nor had an outlet into the Yellow River, but am inclined to think it has, though possibly its overflow may find its way under the loose sands which cover the eastern end of the depression in which I saw its glistening surface. As we advanced towards the high mountains to our south-west, which, by the way, are the eastern extension of the range I traversed in 1889 to the south of Dulan-kwo, and there called Timurte, black tents and flocks of sheep became more numerous. On March 25th we camped on the Muri-chu, near some twenty or thirty tents of the Chu-ja Panakasum. Here the donkeys hired at Lusar were to leave us, and it was necessary to get pack-yak and guides to take me by the direct, but rarely followed, trail, across the mountains to Shang.

On the 28th, we entered the valley of the Wahon-chu (or chuka), and made our way in two days to the foot of the pass leading into the basin of the Tsahan-ossu, one of the big rivers of the Tsaidam. It took us two days to cross this pass, the most difficult I have met with in my travels in these regions. Snow was deep on either side to some 3000 feet below the summit, soft snow hiding the jagged rocks over which we stumbled, horses and men frequently disappearing between them. The trail, hardly visible even in summer—for this pass is only crossed at rare intervals by small parties of yak hunters—we never saw, and we had to pick our way as best we could up the steep mountain sides to the top, 17,000 feet above the sea-level. Two nights we camped in the deep snow, our animals without grass or water, huddling together under projecting ledges of rock. We now entered the valley of the Tsahan ossu ("White River"); on every side were mountains of reddish granite sprinkled here and there with loess. For four days we followed this stream, which I found was the upper course of the Shara-gol ("Yellow River"), crossed in 1889 in the Tsaidam north-east of the village of Barong (or Barongkure).*

Leaving the Tsahan-ossu, we camped on April 3rd on the southern

* This river, only second in importance to the Bayan-gol itself among the water-courses of the Tsaidam, is not, as an examination of existing maps might lead one to suppose, the Upper Tsa-tsa-gol. This latter flows to the north of it, and has its sources on the west slope of the mountains where the Tsahan-gol rises.

slope of the Koko-kutul ("Blue Pass") amidst cedar and juniper trees, the first we had seen in these regions. This was the head of the fine grassy valley of Keter-gun, inhabited by some sixty or seventy families of Rerin Panaka. In its lower portion it is called Derben-chin ("Four catties"); and at its mouth, near the village of Shang, are Mongols who live in mortal dread of their aggressive, thieving neighbours.

I stopped only a few days at Shang to take some observations and make purchases of food; then, sending two of my men with all the baggage to the camp of my former acquaintance, the chief, or Zassak of Barong, I left with his headman, Dowe, my former guide in Eastern Tibet, who had come to Shang to welcome me, and two of my Chinese, to visit once more the Tosu-nor and fix its position and altitude. I met at first with determined opposition from the Abbot (Kanpo) of Shang, who gave orders that no one was to accompany me, as it was my intention to try and catch the horse and fish of gold living in the waters of the lake. I talked him out of this conceit, however, and was able to make the journey in peace, though not in comfort, for I was so unfortunate as to have my horse drowned while crossing the Yohure (or Yogore) gol on the ice, nearly sharing the same fate myself, and my two Chinese, in consequence of my bad luck and disgusted with the hardships we had daily to encounter, decided to leave me on returning to Shang.*

On April 16th I was back at Shang, where I induced an old Chinese trader I had known there in 1889 to guide me to Oim, a little valley near the Ike-gol, where the chief of Barong had his camp. Had it not been for old Ma Shuang-hsi, or "Double luck" (thus called because his father's cow had calved on the day of his birth), I should have had to find my way there as best I could, for I was nearly boycotted on returning to Shang—my two deserters and Dowe having poisoned the minds of both Mongols and Chinese against me.

The prodigious credulity of the Mongols is well illustrated, I think, by the following: Some five hundred years ago, they say, there was an Emperor of Russia, or some foreign country, who was desirous of knowing what was in the sun and moon, whether they were peopled or not, and if they were hot or cold. He took fifty Mongol men and as many women, shut them up in a crystal casket which could fly through the air, and started them off on their voyage of discovery. Since then they have never been heard of, and Mongols have frequently questioned me concerning them, and asked me what I could advance in extenuation of this piece of cruelty. No one believed me when I said I had never heard of this wonderful voyage, and all thought I was looking for their

* The Tosu-nor ("Butter Lake"), called "Lake of a myriad hills" (*Tong-ri tso-nak*), in Tibetan, is some 40 miles long from east to west and about 2 miles broad. Its altitude is 13,500 feet above the level of the sea. Its position as placed (conjecturally) on our maps is approximately correct.

long-lost brethren when they saw me observing the sun with my sextant. The Tibetans, it is but fair to add, are not a whit less credulous; more than one I have overheard saying that I had a battalion of soldiers concealed in the little camera I carried with me. My prismatic compass, others contended, enabled me to detect treasures in the earth and to see the farther side of mountains; and with my sextant I angled for the sun. When I came back from the Tosu-nor to Shang, the Kanpo, a Tibetan, asked me where I proposed going. "To Lob-nor," I replied, not wishing to discuss my plans. "I supposed that was your intention," he rejoined. "You have caught our horse and fish of gold in the Tosu-nor, and now you want to get the frog of gold of the Lob-nor. But it will be useless to try; there is in the whole world but the Pan-chen Rinpoche of Trashilh-unpo who is able to catch it." Various reasons, but principally the procrastination of the chief of Barong, kept me in his camp in the Oim valley until April 29th, when I left for the Tsaidam,* having decided to travel through it to Taichinar, and thence make my way to the Tengri-nor.

Just before leaving Oim I took into my service a Taichinar Mongol, Bitcheren Panti, or "The Little Scholar," by name. A clever man, able to turn his hand to any trade—blacksmith, carpenter, saddler, tailor, and exorcist—he had been twice to Lhasa, and I thought him a valuable addition to the party. His story is not without a tinge of wild romance. Until five years before I met with him, he had lived on the Naichi-gol, near Golmot, in married bliss; but his wife grew tired of him, left him, and became the wife of a neighbour. Marriage in these countries is easily entered into and more easily dissolved, and generally the abandoned one takes the separation with perfect equanimity. Panti, for some strange reason, felt himself wronged; he gave out he was going to Lhasa on a pilgrimage, and, having stolen all the horses of his favoured rival, he fled to the mountains and made his way to the Alang-nor, his design being to go to the Goloks country and lead a band of these brigands against his native place. When near the Tosu-nor he met a party of yak hunters from Shang, to whom he told his story. They persuaded him to go home with them; after a while, he gave in his allegiance to the ruler of Shang by presenting him with a pony, and buying a half interest in a house and a wife, he settled down to his trade of carpenter. Now, however, he was homesick, and he longed to get back to Taichinar; the few ounces of silver he could earn with me would enable him to start life afresh in his native swamps. He and his brother, of whom I shall have to speak later, accompanied me to near the Tengri-nor, and I was well satisfied with his services.

* This term "salt swamp" only applies to the plain; the mountain region on the south and east sides of it has no name applicable to the whole range, but a host of names, Burhan-bota, Kwo-shili, etc., each referring to a section of the chain.

At the village of Barong * I got four camels to carry the loads as far as the Naichi-gol,† and thus spare my mules in this horrible morass, where we waded for a fortnight through mud and water knee-deep, or else through drifting sands. Travelling as near as possible to the base of the southern mountains, so as to keep out of the great central swamps, we reached Tengelik on May 5th, and, the Naichi (or Naichiyin) gol on the 11th.

On the way we passed through the ruins of a walled camp built by the Chinese, when marching on Tibet in the Kang-hsi reign. It is known as Nomoron-kutun, "the town of Nomoron," from the little stream which flows by it. Around it the Mongols of Zun grow their barley in clearings in the dense willow brush which here covers the country, and within its deserted walls lives a Tibetan hermit. A little to the west of this is a *Mizar*, the tomb of some now-forgotten Mohammedan saint; at present the place is only known by its Mongol name of *Ungerhe-baishing*, "the cave dwelling." Occasionally we saw Mongol tents on some dry spot in the swamp, and each time with renewed wonder that human beings could live in such a place as the Tsaidam, where there is but swamp and sand, willow brush or briars; where mosquitoes and spiders thrive; where the wind always blows, the heat of day is intense, and the cold of night piercing. Fear alone holds them there—fear of the Golok and Panaka prevents them from occupying the rich pasturages along the clear streams in the mountains to the south of their God-forsaken plain.

I stayed at the Naichi-gol two days, rearranging the loads and buying what little food I could to replace that used on the road. On May 17th we left, and travelling up the Kurban Naichi valley came, on the 23rd, to the deserted site of an old camp, where the grass was so fine that I decided to remain here a few days to let the horses and mules pick up a little after the fortnight of starvation they had just passed through. Here I was joined by Bitcheren Panti's brother, the headman, or *Jalang* of Golmot,‡ and known as Samtan Jalang.

It was agreed between us that if he guided me to the Tengri-nor I should pay him 50 ounces of silver, and I promised an additional 50 ounces if we managed to reach Tashilunpo. Wherever he left me I was to give him a tent, pack-horses, provisions, etc., with which he and his brother might return home.

On May 27th we made our final start for Tibet, crossing on the 30th

* Barong-kure or baishing, in Tibetan Barong-kangsar, *Kure*, *baishing* and *kangsar* mean "village." Prjevalsky's *khyrma* is probably the Mongol word *kerim*, also meaning "village."

† Or Naichiyin-gol, "the River of Naichi;" *yin* is a genitive suffix in Mongol.

‡ This name is usually written on maps Golmo or Gormo. Golmot appears a better transcription. The name means "many rivers." The adjacent river called Patagonto on our maps is in reality called Baternoto-gol, "Mosquito Nest River," a most appropriate name for a river of the Tsaidam.

the range to the south of the Naichi River by the Sharakuiyi-kutul ("Yellow thigh-bone pass"), some 30 miles west of the Naichi-daban by which Prjevalsky and Carey had travelled. From the summit of the pass we saw, some 50 miles to the south, a long range of dark hills stretching east and west—the Kokoshili, or "Blue hills." To our west rose the huge snow-peaks of Prjevalsky's Shapka Monomakh, where the north branch of the Chu-mar (or Namchutu-ulan-muren) has its source, and on our left a cone-shaped snow-peak, the Amnye-malchin-mengku of the Mongols,* stood boldly out. Through the broad valley between us and the Kokoshili ran several small streams flowing into the Chu-mar, or losing themselves in pools of salt water or in the hillocks of sand with which the plain was studded. The soil was bare except for a few moss-covered tussocks, some stunted weeds against which the sands had drifted, and here and there a blade or two of coarse and brittle grass pushing its way through the sand. A few wild asses, some antelopes, and a stray bull yak were the only living creatures we saw in this broad expanse, which it took us three days to cross.

Passing over the Kokoshili on June 5th we continued in a southwest direction, making for the western extremity of the Dungeure ("Conch shell") range, whose rugged peaks rose 60 miles away to the south of us, occasionally above the snow-line.

Between these mountains and ourselves several low ranges of red sandstone broke the intervening plain. Grazing was better here than to the north, but the weather was bad, the wind so violent, the snow-storms so frequent and severe, that we could make but little headway. On June 1st the grass was entirely covered by snow, and all hands had to turn out and scrape it away to give our animals a chance of getting something to eat. Samtan Jalang, frightened at the uninterrupted bad weather we had had since leaving the Naichi valley, suggested that we stop over for a day for him to perform the storm-dispelling ceremony at which, he modestly stated, he was most proficient. To this I readily agreed, and at the same time we decided that henceforth we would ration ourselves at one cup of tsamba a day for each man, and 5 lbs. of tea a month for the party. This was made necessary, as the Mongols and Chinese are such enormous eaters that, if left to themselves, they can devour in a day what would satisfy ordinary appetites for five.

On nearing the head of the Namchutola River, and the end of the Dungeure Range, we came upon some small lakelets surrounded by an abundance of grass growing in tussocks. On the adjacent hills were herds of wild yak and asses; and so, though the weather was vile, we rested here for two days; and I shot a fine ass, on which the Mongols

* Possibly Prjevalsky's Mount Subeh. His Columbus Range and the west portion of his Marco Polo Range the Mongols call Kobche-ula. The east portion of his Marco Polo Range they call Konchong-kutur. Namchutu-ulan-muren means "the red river of the meadow."

feasted; but my Mohammedans would not touch it, though they looked on with envious eyes as the others gorged themselves with the savoury meat. Leaving this camp, we crossed a low range of red sandstone hills, and the main chain of the Dungebure was before us. To the west was a "massif" of snow-peaks, and at its southern base a large lake we called Trashi-tsonak ("Lake good luck"). Beyond, as far as we could see, a maze of mountain-peaks, few of which, however, were covered with snow.

In fact, throughout the journey across this high plateau, I was surprised to find so few snow-peaks. No chain, except the Dang-la, rose much above the snow-line, which my observations fixed at about 17,000 feet above the sea-level. Nor do I believe that I saw on the whole journey through Tibet a single glacier, though there was much *névé* on the Dang-la and other chains farther south.

On June 16th we crossed the Dungebure Range, and from the south slope, where we camped, I saw the Buha-mangna ("Yak head") mountain, along whose eastern side runs the high-road to Lhasa, rising amidst a confused mass of low and short ridges, all trending approximately east and west. Over these we picked our way, the weather for a while warmer—so that we left off for a day or two our heavy sheep-skin gowns—and we found green grass and some little primroses in sheltered nooks. On the 18th we camped on a feeder of the north branch of the Toktomai ("Gently Flowing") River, and that day was one of rejoicing, for it was the first since leaving the Naichi-gol—twenty-three days before—that we had had neither snow, rain, hail, nor wind, though I am fain to admit that it hailed not far from us, and that we repeatedly heard the crackling thunder peculiar to these high regions, and that shortly after sundown it blew great guns, and, finally, that a heavy white frost covered the ground when we arose the next morning.

Crossing the two branches of the Toktomai, which meet at the base of the Buha-mangna, we saw from the low hills to the south the high and snow-capped Kurban-habsere,* a shoulder, as well as I can judge, of the Great Dang-la. We were now in the basin of the Murus ("The River"), the Drechu of the Tibetans, the head-waters of the Yang-tse-kiang, into which all the rivers we had crossed since leaving the Tsaidam find their way. The country was mostly of limestone formation, grazing was good, and game plentiful, but so wild that I could not approach it; and, longing for a change of diet from the invariable menu of *tsamba*, we made a roly-poly stuffed with wild leeks, the only luxury the place afforded.

* Kurban-habsere or "the three habsere;" Atak-habsere or "Lower habsere" (probably Prjevalsky's Mount Dorsi), Tumta (or "Middle") habsere and Eken (or "Upper") habsere. To the north-east of the Atak-habsere we saw a high snow-peak, called by my guide Satokto-san-koban-mengku (Bad-boy snow-peak?), which I took to be Prjevalsky's Mount Joma.

I think I have dwelt long enough on this region, its climate and bareness, to give an idea of it. Until we reached the tents of the Namru Tibetans, in July, it changed in no appreciable way. The soil was sandy or alkaline, of limestone or granitic formation; but for ever our route was over low hills or down broad valleys with just enough grass to keep our animals from dying, and fuel so scarce that we could barely find enough dry yak droppings (*argol*) to make our kettle boil.

Twice we crossed the Murus, the second time so near its source that we could see, a few miles away, the little rivulets dashing down out of the snow-clad mountains to form the stream we were fording, and which was not over 2 feet deep, though we were in the midst of the rainy season.

Our route led in a westerly direction along the base of the Dang-la till we came to the extremity of this great range, and found ourselves on the vast lake-covered plateau which some 600 miles further west becomes the Pamir, but is here known to the Tibetans as the Naktsang.* South of the Dang-la we were in Tibet, for the desert we had just crossed is a no-man's land, once inhabited by a few bands of Golok, who found it a convenient lurking-place from which to pounce on caravans travelling to or from Lhasa or on Mongol camps in the Tsaidam, but now deserted. A few stone hearths and rough altars, on which to burn juniper spines at the New Year, alone attest the former presence of man in this deserted waste.

On July 2nd I distributed the last of our tsamba and tea, enough for eight days, if used with the greatest economy; but of this self-denial I had but too good reason to believe my men incapable, and events fully justified my fears—in two days it was devoured, and I had to give them all my scant supply of tsamba and granulated cheese (*chura*), reserving only for myself about a pound of flour and a little tea on which to reach the first Tibetan camp, wherever that might be.

July 4th found us on the top of a pass leading from one to another of the numerous lacustrine basins through which we were for ever going. There was a lakelet here half covered with ice, a few sheldrakes and ducks were flying about, and bunches of coarse grass covered the spongy soil on which the snow was melting. Our pack mules could go no farther, so here we pitched our tents by a little rivulet that trickled down from the red cliffs beside the road, and while gusts of icy wind

* The importance of the Dang-la, which in lat. 33° stretches from long. 90° E. to 97°, on the climatic conditions of the Tsaidam and north-east Tibet, cannot be over-estimated. With an average elevation of probably some 20,000 feet above sea-level, it intercepts the moisture-laden clouds driven from the south-west by the monsoon. While its northern slope is a comparatively dry, arid waste, its southern is during nearly half the year deluged with rain, hail, or snow. The high, rugged range to the east of the Dang-la and to the south of the Upper Hwang-ho (Soloma) exercises a similar influence on the climate of east Tibet. See 'The Land of the Lamas,' p. 174.

swept rain-laden clouds to us, driving the pungent smoke of our fire of wet argol into our inflamed eyes, we huddled together around the little blaze to drink a cup of tea made with muddy, brackish water, and solace ourselves with a pipe. On July 6th we came to the Tsacha-tsangbo chu * flowing westward into the Yirna-tso, which we could see some 20 miles from our route. We had much difficulty in crossing the swollen turbid stream, wading through its swift current, holding up the loads of our mules, and dragging them as fast as we could through the soft sandbanks which divided the river into half a dozen channels, and guiding them around the quicksands. On the south side of the river signs of habitations were everywhere visible in the low walls of cow-dung, which the Tibetans build inside their bleak, cheerless tents to keep out the wind; but still, look where I might, I could see no tent or flock of sheep. So once more we drowned our mighty minds in tea, and without food for the third day lay down in our clothes, now soaked for the last forty-eight hours by the incessant rain, to dream of the fat mutton and buttered tea which did not come. The next day we pushed on, making for a pass in the low mountains before us, and we had not gone many miles when we saw a number of yak and a little flock of sheep wandering over the hills, and then, in a nook, we discerned what we longed to find, and still dreaded to see—two Tibetan tents.

We entered the valley leading to the pass, and camping a mile or so from the tents, I sent Samtan Jalang and my headman to the nearest one to buy some food and ask our road. Soon they returned with a sheep, some butter and cheese, and the news that we were two days west of the Amdo-tsonak, and about the same distance from the north-west corner of the Tengri-nor, or, as these Tibetans called it, the Drolma Nam-tso.†

The people to whom my men had spoken belonged to the Namru tribe, and were under the rule of Lhasa, as were the Amdo, their neighbours to the east. They begged my men not to mention that they had sold them anything, as they had received the most formal orders to hold no communication with travellers coming from the north, a quarter they never visited save when going to the salt lakes we had passed a few days previously. The questions the Jalang had asked greatly excited their suspicion, "for," they reasoned, "if you do not know the country, what are you doing here?" So it was only after making the women of the family some presents of buttons and looking-glasses that he learnt the details I have just given.

The next day we crossed the range, getting from the summit a

* The Zacha Sangpo of our maps, but there placed some 51' too far north. See map accompanying supplementary papers of the Royal Geographical Society, III., Part 1.

† Drolma Nam-tso, "The Heavenly Lake of Drolma." Drolma, or Dolma, is the name of the deified Chinese consort of the Tibetan King, Strong-tsan-gambo. She is one of the most popular deities of Tibet.

beautiful view of the Namru-tso, a good-sized lake of azure hue, and far to the south of the snow-capped ridges of the Nyin-chen Dang-la, the mountains between the Tengri-nor and Lhasa.

A broad valley lay before us dotted over with tents, and herds of black cattle and flocks of sheep, a low range of reddish hills closing it to the south, and hiding the Tengri-nor from our view. We were now in the midst of the pasture-lands of the Namru and on Lhasa soil, so I braced myself for the war of words which I felt must soon begin. That night we camped near some tents, where we found Lhasa traders stopping, who offered to sell us tsamba and other necessary supplies on the morrow.

Late at night a beggar, whose tent was only a stone's throw from our camp, came and offered to take me to Shigatse in six days. The first four, he said, we would travel through uninhabited country, but after that tents (*drupa*) would be numerous till we reached the Tsang-gi-tsang-bo in front of Tashilunpo. During the day some other people had come to see me, but I had shut myself in my tent pleading inflamed eyes, and only saw them at night, when they could not clearly distinguish my features. They left me, however, with the evident impression that something was wrong about my party, that our ignorance of the roads was suspicious, and that our story of having lost our guide and strayed from our route was not a thoroughly satisfactory one. I went to sleep that night with an uncomfortable feeling of impending trouble, to which I had added the irritation resulting from a violent row with my Mongol guide, whose impudence had steadily increased as time went on, and he felt how important he was to the success of my undertaking.

The next morning by daylight I was awakened by shouts of the Tibetans calling to my men—as is their custom when wishing to enter a tent, to hold the dogs while they came in to see me. The spokesman of the party, a jolly-looking, dirty-faced fellow with long locks of greasy, curly hair falling on his shoulders, and dressed in a gown of the finest purple cloth, saluted me by sticking out his tongue, and making a deep bow with both hands held out towards me, then squatting down, he asked me to remain camped where I was until the Deba of the tribe could come and talk with me. They had all received orders from Lhasa to allow no one to pass through the country. The year before last (1890) the Prince of the Tongut Mongols had been stopped here when on his way to Lhasa, and only allowed to proceed when his passport had been sent there and found *en règle*. His had been the only party which had ever come here from the north. He offered to supply me with food and everything that I might require, for which he could accept no compensation, if I would comply with his request; otherwise I could have nothing. I was obliged to accede to his demands; without food of any kind, I was absolutely at his mercy. While we were

talking I noticed horsemen coming in from every quarter, each with a long matchlock slung across his back, a big sword passed in his belt, and not a few with bows and arrows besides. Before an hour some sixty or eighty of the tribesmen were squatting around fires all about our camp, drinking tea and watching us. My men now felt sure the end had come. They had all heard that death awaited, not only any foreigner who might try to enter the Lhasa country, but all his followers as well. The wild looks and warlike array of our guards filled them with terror. The Mongols passed the day burning sheep's shoulder-blades to divine their fate; a little Halha Mongol Lama, who had joined my party in the Naichi valley, chanted his litanies with wild energy, and my Chinese, with characteristic stolidity, ate their fill and asked that death might come quickly if Heaven had decreed they should now die.

The day following the Deba arrived, preceded a few hours by three officials from Lhasa, who happened to be in these parts collecting tithes for the Tale Lama. The long talks between us which followed during the next three days, the endeavours made by the Tibetans to induce me to go back the way I had come, their efforts to frighten me by pictures of the dangers of travelling in their country, dangers alike from man and the elements, it would be wearisome to relate. I begged them to give me provisions enough to go around their country to the west and thus reach India, telling them that we had only come to their country by accident, pressed by hunger and in ignorance of the roads, that I had no inclination to travel in Lhasa governed country, for my object was to reach Darjiling, not their capital. To all my arguments they opposed but one answer: "If you do not leave this country by the way you came, off will go our heads, for the laws of Lhasa cannot be disobeyed." I produced the passport of the Tsung-li Yamen; the big red seal on it impressed them a little, but as they could not read Chinese, it had very little value. I scored a point, however, when I told them that, after all, my proceedings did not concern them, that, travelling under Chinese protection, it was for the Amban at Lhasa to say what I should do and where I should go. Since they would not listen to me, I would send one of my men to Lhasa to ask that Chinese officials be sent to confer with me here. In consequence of this the Deba conceded that I might go to Nagchuka on the highroad to Lhasa from Hsi-ning, and there talk with the Kanpo, to whom he would despatch a courier advising him of my coming. I would travel by the valley of the Tsang-bo-chu to the north, while the messenger would take a direct and shorter route, and so I would experience no delay. This project suited me fairly well. I had now reached a point where my route nearly overlapped that of Nain Singh when travelling in 1874-5 to Lhasa from Shigatse around the Tengri-nor.* The road I would

* Nain Singh calls this country De Namru. *De* means "district."

follow, if allowed to proceed southward, was that surveyed by this most careful explorer, so I could not hope to add much to our knowledge of the country. If, on the other hand, I followed the route suggested by the Deba, I should see a great deal of new country. So I made up my mind that Chamdo and Ta-chien-lu would be henceforth my objective points, and that I would endeavour to reach at least the former place by routes heretofore unexplored.

My two Taichinar Mongols refused to go any further with me than Namru, and I was heartily glad of it; they had been of very little use since we had left the Murus behind, as the country was new to them—they were timorous to a degree, enormous feeders, and extremely lazy. I gave them their wages, a tent, a kettle, a couple of ponies, and enough food to last them two months, and they left at once in great hurry to get their heads out of the lion's mouth.

On July 13th we broke up camp in the Namru valley, and began our long march eastward. Just before leaving I gave the Deba a *k'atag* (ceremonial scarf), and thanked him for his courtesy and kindness. He said that, as for himself and his people, they would be well pleased to see foreigners visit their country, for they had many things strange and beautiful to sell. Moreover, he now knew that foreigners were not the bad men the Lamas always made them out to be, for I had used smooth words and shown myself amenable to reason; "but," he added, "we Namru are not our own masters, and have to obey the orders of the Lamas of Lhasa, who are bad and cruel. Should we disobey"—drawing his hand across his throat—"off would go our heads!" During my whole stay in the Namru valley, every one had been most polite and anxious to please me. I had been supplied daily with every delicacy of the Tibetan cuisine—sour milk, clotted cream (*pima*), tsamba, mutton, and buttered tea—which our long fast prevented us for days from enjoying, and the Deba had made me many presents, among others a good saddle pony, and now I left with an escort (or guard) of ten soldiers, resplendent in purple gowns, high, wide-brimmed summer hats, and all their many silver-mounted arms and accoutrements.

We followed the road by which I had come till we reached the Tsangbo-chu, which we crossed this time by a good ford, and then for three days we kept up the course of the river over a soft gravelly soil with tussocks of grass and bits of bog, through which we had much difficulty in picking our way. To add to our discomfort, there were violent storms of rain and hail daily, drenching us and our belongings, and making it most difficult to find a little fuel with which to boil our tea. The escort was worse off than we, for we had a tent, while they had nothing but their big saddle blankets in which they wrapped themselves on the approach of a storm, and supperless went to sleep. When the weather was fine they fared, however, sumptuously. On reaching camp five or six went foraging for fuel, two others filled the

kettles, and others started the fires with big goatskin bellows. The little troop was divided into two messes, each with its kettle and bellows, while every man carried his supply of tsamba, dried mutton, tea, butter, clotted cream, and wheat cakes; also a little earthenware pot in which to boil his tea. While the tea was boiling, they drank a cup or two of (*tarak*) clotted cream; then, having well licked their wooden bowls, they fell-to—tea and tsamba as first course, tsamba and tea as second, and buttered tea as dessert. When they had finished eating, they sat till bedtime talking, twirling their prayer wheels, and twisting yarn, their only amusements, for games, with the exception of knucklebones, are, I believe, unknown among them.

Occasionally we caught a glimpse of snowy mountains far away to the north, but most of the time we could see no farther than the low hills on either side of the valley.

On the fourth day after leaving the Namru camp, we passed out of the valley of the Tsang-bo-ohu over hills of soft wet gravel, in which we sank to our knees, and entered the basin of the Chang-tang-chu, which I am inclined to consider the westernmost feeder of the upper Jyama-nuchu. From this point we took a slightly southerly course, skirting the foot hills of a range some 20 miles distant, running parallel to our route. The weather grew worse, and the trail worse, if possible. Frequently we had to ford swollen streams, to drag our foot-worn horses through miles and miles of mud; sometimes, even, we rode in river beds, the only place where we could find a solid foothold. For ten days we pushed on amidst every kind of discomfort, burning our pack-saddles to dry our soaked clothes and warm our limbs—stiffened by the cold and incessant downpour.

At last we reached *terra firma* and camped near a pool in the hills not far from the stream, the Dang-ohu, flowing southward, and then the Namru showed me to the south Mount Bumza and the road to Nagchuka, and with a hasty good-bye, fearing lest they might be attacked by some of the people of the country with whom they had a long-standing feud, they rapidly rode off.

We had not gone a mile along the high-road when we saw horsemen and pack-mules travelling south, and coming up with them, I found that they belonged to the great caravan which annually at this season goes to Lhasa from Tankar and Kumbum with horses, mules, and Chinese goods to be sold in the Tibetan metropolis. There were about two hundred men in the caravan, and many of them had known me at Kumdum. They were aghast at the meeting, so near Nagchuka. If we arrived at that place together, they would be refused permission to proceed on their journey, for they would be undoubtedly suspected of having guided me there and otherwise assisted me in evading the universally known orders against foreigners. We talked the matter over, and, as it really was indifferent to me whether my progress south

was arrested here or a few miles further on, I told them to send men ahead and notify the nearest post of soldiers that a foreigner was coming, and that they disclaimed any knowledge of his movements and had nothing to do with him. In the meantime, I and my little party rode on some fifteen miles, and camped in a sheltered nook in the gravel hills which bordered the wide river bottom.

Towards evening, six or eight soldiers rode up and asked me to oblige them by remaining camped where I was until the Nagchu Pinbo could come and see me. To this I readily agreed. Some rest was absolutely necessary for the horses, now in a terrible condition, so worn were their hoofs and so lame, that they could hardly put one foot before the other. The next day two Tibetans from across the river came into camp, and from them I learnt that their country was a part of Jyade, a province under the rule of the Chinese Ambassador residing at Lhasa. I sent my headman back with them to buy a sheep and some tsamba, and when he returned he was accompanied by the chief, the Pere Pinbo. He asked me where I was going, and I told him my story and of my desire to reach Chamdo. He invited me to come over to his country, saying that he would do all he could to assist me, exchange my worn-out horses and mules for fresh ones, give me food in plenty, and find me a guide. So it was decided that as soon as I had seen the Nagchu Pinbo I should cross the river and accept his proffered assistance.

It was the 26th of July when the official from Nagchuka, accompanied by a number of chiefs, soldiers and retainers, arrived at my camp and pitched his tent near mine. I passed the day talking to them of my plans, of which they had no concern, as my route would lie wholly outside their territory, and on the morrow I bade them good-bye and crossed over the Dang-chu to the Jyade side. The Jyade (*Rgya-ode*) or "Chinese province," extends from east to west over 200 miles and more of country between the Dang-chu and Chamdo, with a probable breadth of 60 or 70 miles; touching to the north, the Dang-la and its eastern branches, and to the south, bordering on the Lhasa governed provinces of Larego, Shobando, etc. Its people have from the oldest times professed the Binbo religion (a form of the devil worship or Shamanism, which has, at one time or another prevailed over most of Asia), a creed not tolerated in the kingdom of Lhasa, which tried for a long time to crush it out of these regions. When, in the 17th century, the Chinese assumed control of Tibetan affairs, they put a stop to the incessant warfare between these two countries by forming a separate province of all the Binbo principalities, and putting it under the supervision of the Emperor's Amban at Lhasa. This province was called Jyade. Thirty-six chiefs or Debas, chosen from among the most influential headmen of the country, are appointed by the Amban, and are in receipt of a yearly stipend from the Emperor of one hundred

ounces of silver. Under these rule numerous chiefs of clans whose charges are hereditary.

Nearly the whole of Jyade is pasture-land above the timber-line (in this latitude about 13,500 feet above sea-level). The people, though poor, appeared to me more light-hearted and freer in their manners than any I had yet met with in Tibet, and this I attribute in a great measure to the absence of large lamaseries in their midst, whose inmates would keep the people in a constant state of perturbation, and crush them under endless exactions of all kinds. Binbo lamaseries are neither large nor numerous, and the Lamas of this faith with whom I have talked surprised me by their liberal views and readiness to accept new ideas. My favourable opinion of Binbo Lamas was confirmed later by the French missionaries at Ta-chien-lu, who told me that in south-eastern Tibet their work had been greatly facilitated by the good-will and assistance they had received from Lamas of this religion.

The importance of the Binbo religion has not, I believe, been heretofore suspected. All along the eastern borderland of Tibet, from the Kokonor to Yun-nan, it flourishes side by side with the lamaist faith. In Jyade, where there are certainly fifty thousand people, it rules supreme, and in all the southern portions of Tibet, not under the direct rule of Lhasa, its lamaseries may be found. So it seems that this faith obtains in over two-thirds of Tibet, and that it is popular with at least a fifth of the Tibetan-speaking tribes.

In dress and in their mode of living the Jyade differ in no appreciable way from most of the Tibetan tribes leading a semi-pastoral life. In features they resemble other Tibetans, the Lhasa and Shigatse people excepted, who are unquestionably of mixed breed, the men about 5 feet 6 inches in height, of rather slight build, with thick and usually wavy hair falling on their shoulders, to which many add the Chinese appendage of a huge queue of false hair, on which they string finger-rings and a great variety of ornaments fastened to a band of red cloth. The nose is thin and aquiline, with frequently a broad end, the teeth strong and irregular, the eyes usually well set and large. The women are not appreciably smaller than the men, and of about the same build, the younger ones frequently good-looking, but disfigured by the black paste (*toja*) with which they smear their faces to protect their skin against the wind.

The clothes of both sexes consist in a single gown with a high collar—in winter of sheepskin, in summer of *pulo* (native cloth), violet for the men, blue for the women. Sometimes they also wear a light shirt of silk (*bure*), with a high red collar. Boots with cloth tops, fastened below the knee by broad garters, complete this rather picturesque though clumsy dress. The women wear their hair in a great number of little plaits, falling over the shoulders like a cloak and reaching below the waist. Down the middle of the back is fixed a

broad band of red, green, and other coloured stuffs, on which they sew ornaments of silver, turquoise, coral, or any ornamental knick-knack they may own.

The day after reaching the Pere Pinbo's camp he brought to see me Nor-jyal-tsan ("The Standard of wealth"), the Horgo Deba, the great chief of this section of country, and who was about to leave for his home on the Su-chu, some eight days' travel to the east. After a long talk it was agreed that I should go with him; and he promised me protection and a guide all the way to Mer-jong, the first village on Chamdo territory. I presented him with fifty ounces of silver and a few odds and ends, all of which greatly pleased him. "If the sky falls," he said, "it shall strike me alone; you shall not suffer."

Our route led us in a general east-south-easterly direction across the numerous rivers which, coming down from the great mountains to the north, form the head-waters of the Jyama-nu-chu, supposed to be the Upper Salwen. The country was fairly well peopled. We passed every mile or two clusters of tents, near which were herds of yak and little flocks of sheep and goats.

On August 5th we reached the Su-chu, held by the natives to be the main stream of the Upper Jyama-nu-chu, here about 75 yards wide and 8 or 10 feet deep. We crossed it slung by the middle to the raw hide cable which spanned the river, fastened to big rocks on either side. Our luggage was got across in the same way, and the horses swam. Here, at an altitude of 13,700 feet above the sea-level, we found the first village we had seen in Tibet; and I noticed also a few patches of barley. Rhubarb was so very abundant on some of the hillsides that frequently we saw the stalks used to roof the little stone huts the people build hereabout as storehouses adjoining the tents in which they live.

We came on the 10th to the I-chu, the largest river we had yet seen, and which we had great difficulty in crossing. Then we reached the Rama-chu and saw the mountains covered with trees—stunted cedars and pines. Leaving behind the pretty Batasumdo valley, we came, on the 16th, to the Seramdo-chu, where hamlets, resembling from afar our old mediæval castles, crowned every hill, and the whole valley was green with fields of waving barley. This river we crossed in the same manner as the Su-chu.

On August 18th we camped in Nar Peihu, the birthplace of my protector the Deba Nor Jyaltsan, and a few miles below the big village of Chebo Tenchin on the Ze-chu. Here in the night, and with much mystery, came to me a man of Chebo Tenchin, who showed me a sheet of very soiled foolscap, asking me to translate the lines written on it, and which a *pyling* ("foreigner") had given him a few months before. It was a certificate by H. Bower, Captain 17th Bengal Cavalry, stating that the bearer had supplied him with transport, fuel, and fodder, and was dated December 17th, 1891.

When on the Su-chu I had heard that in the first month of the year a party of foreigners coming from the west—no one knew where—had passed eastward by a route parallel and to the south of the one I was following. Their dress, habits, and especially their black cook, had been so minutely described to me that it had left no doubt in my mind as to the truth of my informant's story; and now it was confirmed, and our roads, starting from such widely separated points as Leh and Peking, had finally met in the heart of Tibet.*

While camped in Nar Peihu I noticed many articles of peculiar excellence of manufacture, blankets, baskets, silver and iron work, also red peppers and remarkably fine wheat flour. I learnt on inquiry that they came from Po-ma, or Lower Poyul, a country some sixteen days to the south, and which the Jyade people frequently visit. But very little is known of this country, so I hope a short digression on the subject will be pardoned me. Poyul comprises two districts, Upper and Lower Po, Po-ti and Po-ma. The upper, or mountainous, section of the country is inhabited by a lawless lot of herdsmen; but the lower is an open country, where the climate is warm and the soil fertile, so that with Derge it is held to be the richest region of Tibet. Its present manufacturing pre-eminence is due to a singular cause. During the war between China and Nipal in 1792 a detachment of Su-chuanese troops was sent to the seat of war by way of Pomi, a country nearly unknown at the time to the Chinese. Arriving here, no route could be found leading to Nipal, and struck by the beauty and fertility of the land the soldiers deserted *en masse*, and marrying the women of the country they settled here. 'Tis among the descendants of these Chinese that the beautiful blankets, the fine silver work, and the famous Pomi horses are found.

The whole of Poyul is independent, though nominally it is under the high control of the I-Chin-chai or "Envoy to savage tribes living at Lhasa; a Manchu officer who is colloquially called 'the Third Amban.'"

On August 20th I reached Mer-jong, the first village or rather lamasery, on Chamdo territory, and here we said "Good-bye" to our faithful guide Aniang, the headman of my friend Nor-jyaltsan, who, with his master, had proved himself a true and steadfast friend. Had it not been for the assistance these two men gave me, I should probably have had many difficulties to encounter, but thanks to their untiring kindness I travelled in comparative comfort and without a single disagreeable incident.

Two days after leaving Mer-jong we came to the town of Riwoche

* Between the Namru country and Mer-jong Captain Bower's and my route frequently crossed each other, and along a part of the way were the same, although the names differ. On his map Khemo Tinchin figures as Chumbotinsi. Mer-jong is near his Kezalomba and to the east-south-east of it.

on the Tse-chu, a place famed for its beautiful temple and its picturesque situation at the foot of steep forest-covered mountains between which winds the broad, swift river, here spanned by a substantial bridge of huge pine logs. The Riwoche province belongs to Lhasa, and the Lamas viewed my visit with sullen discontent. From this place we followed the river down for two days, and then came to the Chinese post-station of Nyulda (En-ta, in Chinese), where the soldiers gave us the first fowls and eggs, cabbage and turnips, we had seen for many a long month.

I was not over two days and a half from Chamdo, where we hoped to be able to buy new clothes and replenish our nearly exhausted supplies with some of the good things with which we had been told the Chinese shops of this important town were full. On August 26th we reached the Sung-lo zamba, a fine bridge over the Tse-chu, by which Bonvalot and his party were led around Chamdo in 1890. Here I was met by a high Lama official, who suggested that I should take the same route, and not enter the town, in which the people, and especially the 3000 Lamas of its great monastery, were very hostile. I objected to this, telling him that, as I had come to examine the country, I could not think of going over a road already followed by foreigners; so, after a day spent in arguing the point, he gave me guides and pack animals (*ula*) to go through the southern part of the country as far as Pungda (Pao-tun of the Chinese) on the high-road to China, near where he would meet me with all the many supplies, clothes, etc., that I required, and fresh ponies in exchange for mine.

Our route lay at first over steep and high mountains, then down a valley covered with the most beautiful pine trees, their branches draped in long, cobweb-like moss of light yellow and bright orange. There were many silver pheasants in the thick underwood, and the yak drivers told me that bears, leopards, and wolves were frequently found here. Leaving this behind, we passed into another valley of great beauty, in which I found nearly every variety of tree and wild fruit known to Tibet—cedars, junipers, cypress, pines, and maples, plum and apple trees, cherry and apricot, raspberries, both the orange and red varieties, strawberries and currants.

At Kinda, a little hamlet on the Om-chu at the mouth of this valley, I found the Chamdo Lama waiting for me with all the things I had asked for, and a variety of presents from the Papa Lha, the ruler of the country, thanking me for having complied with his request not to enter the town. From this point I followed the bank of the Om-chu for a day, and then crossing the river on a raft of heavy logs, we climbed the steep Pung-la, and saw from its top the little post-station of Pungda and the highroad to China as it wound up the sides of the Ipi-la, the limestone crags along its summit riddled with holes, so that the Chinese have called it Ku-lung-shan, or "the mountain of holes."

From this point on I could stop every day in the Chinese post-stations (*tang* or *kung-kwan*) kept along this route by the Imperial government for travelling officials and couriers. The men stationed in them cultivate patches of cabbages, turnips, greens, and tobacco frequently on the roofs of their wretched dens, and in the yards of the little compounds a few fowls drag out a miserable existence, and pigs wallow in the mud which is ever to be found around Chinese quarters. All these soldiers have native wives, whom they say are better than Chinese, for they do *all* the housework, and the husband only has to look after the babies and smoke his pipe. Many of them had been in Tibet twenty or thirty years, and still saw no chance of getting back to their native land. The journey home must be made at their own expense, and they are never able to save a cash of their miserable pay. In fact, most of them are paid in brick-tea at a valuation put on it by the commissary of Batang or Ta-chien-lu, usually double the price for which they can sell it to the natives, who pay them in butter or tsamba, mutton, or yak meat, and so, as they said, "we never even see a bit of silver from one year's end to another."

Crossing the Ipi-la, we were on the territory of Chamdun (or Draya), an independent state ruled by a high ecclesiastical dignitary with the high-sounding title of Chab-gon Rinpoche Lepe-sherab. At the foot of the pass I found a gorgeous Lama and a numerous suite awaiting my arrival. He was a secretary of the great Lama, and had come all this way to beg me not to come to the town. I met all his arguments in favour of other routes by a flat refusal, and, pushing on ahead of him, reached Draya in two days and a half. I stayed here a day to make friends with the people, talking to them and showing them my few belongings. By this means I here and elsewhere got information which direct questioning would never have elicited, for Tibetans, like all Asiatics, are too suspicious to admit for a moment that curiosity can be the only motive that prompts a man to question them about their country, its products and customs.

Between Draya and Gartok (Chiang-ka in Chinese) the country did not vary from what we had seen since entering Chamdo territory—narrow valleys and lofty mountains, some covered with forest growth, others with only grass and wild flowers, others, again, with their peaks deep in snow. The valley bottoms were generally cultivated, thorn hedges enclosing each little field. The houses were nearly hid under the golden mass of wheat and barley drying on high frames erected on the roofs, and from the ends of the rafters swung ropes of drying grass, or strings of turnips. The people differed from one to another canton chiefly by peculiarities of language and the shape of their arms and ornaments. We met very little traffic, only one or two small caravans, none going far west; and I learnt with astonishment, for it was far from what I was prepared to hear, that the trade between China and

Lhasa is mostly over the road through the Horba and Derge countries I had followed in 1889. The road we were on is used by Chinese, and has importance for them alone, as they find shelter and protection at the military stations along it. In this connection it is curious to find bands of mounted robbers—the Shanghe (or Sanghe) Chakba—attacking caravans along this route, between Draya and Batang, at the same localities where their forefathers did in the reigns of Kang-hsi and Chien-lung. Ten or fifteen Tibetan soldiers always joined my Chinese escort when we had to traverse any of these robber lairs; and though we never fell in with any, every one vouched for their audacity and ferocity. These Chakba have no legal status—by that I mean that, having been nominally exterminated a few years ago by the military mandarin of Batang, no further notice can be taken of them—and they can carry on their brigandage without fear of the guardians of the high-road on which they operate.

Gartok, which I reached on September 10th, is the capital of a province of Lhasa called Merkang (or Merkam), with its northern boundary 50 miles to the north-west, on the road to Draya. I was most hospitably received by the lieutenant in command of the Chinese garrison, who was a Mohammedan from Ta-chien-lu, and a relative of people I knew there.

Leaving this place, I reached Batang on the 15th. I was much surprised to find this large place of no commercial importance. Hardly any trade passes through it, and there are only two small Chinese firms doing business here.* The bulk of such trade as there is in the hands of the Lamas; but they prefer the pawnbroking business, and to lend their money to Chinese at Litang and Chamdo, on whose integrity they can count, and who pay them a high rate of interest. I was detained here three days trying to get the Commissary (*Liang-tai*) to cash a cheque on the missionaries at Ta-chien-lu; but he refused in a most offensive manner, and I had with him the only row I have ever had with a Chinese official. At Batang my surveying work was at an end; and it was with a sigh of relief that I closed my field-book and packed up my prismatic compass. On September 24th I reached Litang, to find the place in a wild state of excitement. There was war between Litang and Chung-hsi over a question of the cultivation of pasture-lands by the latter tribe. Some five thousand soldiers were camped below the town. A fight had already taken place a day or two before, and the spoils of battle—yak and sheep—were herded in the adjacent meadow. I stopped for two days in the Chinese Yamen, and

* The war at Litang had certainly much to do with the complete cessation of travel on the road between Batang and Ta-chien-lu, but still I do not think that this can invalidate what I have previously said about the bulk of the trade passing over the Derge route. I was assured by a number of Chinese traders between the Seramdo chin and Chamdo that such was the case.

then set out for Ta-chien-lu, where I arrived in six days, to be welcomed by my good friends the Fathers of the Mission of Tibet, whom I found waiting for me, as news had reached them two days before that I was on the way.

Here, on the eastern border of Tibet, my journey was practically ended, for, though several thousand miles still separated me from the seaboard, they could be travelled in comfort and with rapidity. Leaving Ta-chien-lu on October 5th, I was in Shanghai on the 29th, exactly eleven months from the time I had left it. In this time I had travelled about 8000 miles, surveyed 3417, and, during the geographically important part of the journey, crossed sixty-nine passes, all of them rising over 14,500 feet above sea-level. I had taken series of sextant observations at a hundred points along the route, made three hundred photographs, collected between three hundred and four hundred ethnological, besides botanical and geological, specimens. For two months we had lived soaked by the rains and blinded by the snow and hail, with little or nothing to eat, and tea as our only beverage; and yet not one of us had a moment's illness from the day we left till we reached our homes again.

From Kalgan to Batang I ran a traverse on an approximate scale of 4 statute miles to the inch, using for that purpose a prismatic compass, and taking the distances with a watch, controlling three or four times a day the rate at which I was travelling by counting my steps (of 30 inches), now on a level road, then going up and coming down hill. I took on an average one bearing to every $1\frac{1}{2}$ miles along the route (about 2500 in all), besides as many side sights as possible for triangulation. On the summits of all passes, at all river crossings, watersheds, etc., the aneroid barometer was read, and throughout the journey, at 7 a.m., 2 p.m., and 7 p.m., the atmospheric pressure, the temperature, and the condition of the atmosphere (clouds, wind, etc.), were recorded. At each camp the altitude was determined by the boiling-point of water, and aneroid readings between two consecutive camps have been compared and corrected by them.

Sextant observations for latitude and time were taken whenever the weather allowed. As I was most anxious not to attract the attention of the people, I only occasionally observed the sun, doing nearly all my work at night. Every three or four days, when the weather served, I stopped for a day or two to get a rate for my watch, and at some six or eight points along the route I made daily observations (equal altitudes of sun, stars, observations for sun's azimuth, etc.) for periods varying from five to fifteen days.

As far as I have been able to compare my work with that of previous travellers, Prjevalsky to the north and Gill to the south, the results are very satisfactory, though of course I lay no claim to great exactitude for any portion of my work; it is but a preliminary reconnaissance executed alone, and under considerable difficulty.

Before the reading of the paper, the President, Sir MOUNTSTUART GRANT DUFF, said: We are always particularly glad to see Americans here, but on this occasion we are specially obliged to Mr. Rockhill, because, at the request of your Council, he has come across the Atlantic, at very considerable inconvenience to himself at this inclement season of the year, simply to read this paper before us to-night. Mr. Rockhill was prepared for his arduous and valuable work as a traveller by a very considerable and varied experience of life. When only a child of ten years old he left his own country, was educated in France, spent many years there, passing among other things through the great military school of St. Cyr. After he left St. Cyr he went into the French legion in Algiers, spent there three years; then he returned into his own country, and saw a great deal on the extreme frontier in New Mexico and the neighbouring districts; after that he passed into the diplomatic service of America, and spent ten years or thereabouts in China and the countries immediately bordering on China. He was for some time Second Secretary at Peking. He was detached on diplomatic duty to serve in Korea; there he spent some time. Then he travelled very widely in Eastern Tibet, and wrote what is much the best recent book we have upon the country, which some of you know as 'The Land of the Lamas.' He then returned again to China, and made this further expedition through Mongolia, round into Tibet, very nearly reaching Lhasa, then by a great circuit regaining Chinese territory. I hope and believe that, large as his travels have been, they are by no means yet ended, and that he has a great deal more of work to do for science. Meantime it gives me the greatest possible pleasure to introduce Mr. Woodville Rockhill.

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

SIR HENRY HOWORTH: The only two claims I have to speak are, first, that I am probably the oldest friend Mr. Rockhill has in the room; and in the next place, I have written a very long and dull book about the Mongolians. In regard to Mr. Rockhill, he is now exactly what he has always been, the same modest and proficient scholar I have long known him. You will hardly guess that he is one of perhaps three men in the world who know both Chinese and Tibetan, and the only man who is known to have waded through the enormous masses of Buddhist literature of Tibet, an absolutely unknown land to all but himself. Every name in this country has more or less of romance attached to it to those who, like myself, know of its history. Here we have on this map the town of Teng-ru, the capital of Prester John, the wonderful pontiff king Marco Polo wrote so much about. The next town we come to is Ning Hia. Then we have the Non Shon country, where we are told they led a great expedition, of which we get the most romantic accounts and legends mixed up with the curious folk-lore that still survives. Then at Koko Nor you have what is perhaps the most romantic occurrence of which we know—the great migration of a people from one side of Asia to another. The Kalmuks settled on the Volga, feeling the pressure of the Russian taxes, set off on one of the most extraordinary journeys ever made by human beings, traversed two-thirds of Asia, landed north of this range, and a portion settled down by the Koko Nor. It was here they were settled at the beginning of the last century when the great fight occurred between the sacred rulers and the secular rulers of Tibet, and these Kalmuks saved the great chief Lama from the secular emperor, who had usurped authority in Tibet, and it is thus owing to these Kalmuks that the Lamas owe their present position in Tibet. I ought to say I was present last night at a house where Mr. Rockhill was describing previous travels, and showing us of what great value were the travels of Huc. Some travellers, especially Russians, have stated that he was untrustworthy, and his sentences are not always to be taken as sober prose; but we all must feel that his picturesqueness has never been excelled by

any man who has yet travelled in these regions, and I am glad to hear from Mr. Rockhill that his accounts are not only picturesque but in the main true, in regard to what he saw. I really hardly know where to end, as I hardly knew where to begin, as the whole of this country is so full of romance to me. I thank you very much for having listened to me so patiently, and congratulate you upon having this evening so excellent a traveller, so good a scholar, and one who has brought before you so graphic an account of this most interesting and romantic country.

Captain BOWER: I have really very little to say about Mr. Rockhill's travels, save one thing one cannot help admiring. Whereas in my journey I was able to make all preparations in Leh in British territory, and then to start fairly across the desert, he, on the other hand, had a long journey before he reached the desert; the really difficult part of his journey was therefore very much more difficult than mine.

Mr. DELMAR MORGAN: The Society is much to be congratulated on Mr. Rockhill's first appearance among them this evening. For years we have heard of him and his explorations in Tibet. We have read his book and the articles published by him giving the results of his first journey, but this is the first time the Royal Geographical Society has had the opportunity of welcoming him. Mr. Rockhill's success is largely due to the pains he took to learn the language of the natives. Even as a boy he studied Eastern languages, and several years' residence at Peking enabled him to pursue his studies till he became a good Tibetan scholar. To this knowledge of the language, and to the coolness and intrepidity he displayed on critical occasions when the slightest mistake might have been a matter of life and death, Mr. Rockhill owed his success in penetrating so far into that lama-ridden country, and in learning so much of its geography.

The late General Prjevalsky, in his three expeditions into Tibet, greatly extended our knowledge of its physical geography. Mr. Rockhill has not only done this, but he has told us more than was ever known before of the religion, the politics, the habits, and the languages of that country. All this he has touched on in his paper, and our best thanks are due to him.

The PRESIDENT: You will, I know, instruct me to express your very cordial thanks to Mr. Rockhill for his admirable paper. It is very seldom we enjoy the advantage of listening to one who is not only a most distinguished traveller, but a most distinguished scholar. He has put at our disposal to-night a history of his travels; and I am authorized to say that he is about to assist us by editing and annotating most fully the documents we have for some time wished to lay before the members of the Society—the account by one of the Indian native explorers of a visit to Lhassa and other portions of Tibet. It would be very improper in me to sit down before I also express your thanks to Sir Henry Howorth, one of the greatest authorities on these parts of Asia; to Captain Bower, to whom we have listened so recently; and Mr. Delmar Morgan.

MR. ROCKHILL'S MAP.—The map to accompany this paper has been reduced from the original prepared for the Smithsonian Institute by Mr. Rockhill. It is constructed from a traverse survey, positions of many places having been fixed by astronomical observations, and the heights determined by boiling-point thermometer.

The following table of Heights above Sea-level of places on Mr. Rockhill's map, will be found serviceable:—

HEIGHTS ABOVE SEA-LEVEL.

BY BOILING-POINT THERMOMETER.

	Alt. in feet.		Alt. in feet.
Kalgan	2,555	Bolang	8,631
	Fritsche 2,706	Tolieken	8,715
	Prjevalsky 2,709	Tsahan-kol	8,525
Tsahan-obo	4,824	Naichi-gol	8,925
Kwei-hwa-Cheng	3,635	Kano	10,720
Hoko (Yellow River)	2,997	Tsahan-toha (Naichi-gol)	10,725
Chiang-pan	3,153	Chibekke (Naichi-gol)	11,241
Ashan	3,114	Buhutai (Naichi-gol)	11,793
San-tao ho-tzu	3,450	Tator (Naichi-gol)	12,133
Kwan-ti	3,404	Kure-bori	{ Prjevalsky 12,500
Shihtsui	3,665		12,285
Ning-hsia Fu	3,723	Sharakuiyi-kutul	13,788
Ta-pa	3,427	Chuwu-doksai	15,152
Chung-wei	4,005	Elesu-nor basin	14,442
Ying-pan-shui	5,326	Elesu-nor, Bank of	14,497
Chung-chang-tzu	7,373	Kokoshili-eken	15,077
	5,167	Kara-daban	15,292
Lan-chau Fu	{ W.W.R. '89 5,446	Olon-horgo	15,716
	Bell 5,500	Namchu-tola muren (Camp 2	
Hsin-Cheng	5,340	miles S. of)	15,471
Hsiang-tang	5,629	Shire-nor	15,572
	7,509	Ulan-ula (N. side)	15,898
Hsi-ning Fu	{ Prjevalsky 7,500	Ulan-ula (S. side)	15,514
	Kreitner 7,559	Dungbure-eken	15,826
	W.W.R. '89 7,608	Camp, June 17	15,289
	8,907	Toktomai-ulan-muren (1st Camp	
Lusar	{ W.W.R. '89 9,376	N. branch)	14,897
	8,861	Toktomai-ulan-muren (2nd Camp	
Sha-erh-wan	9,332	N. branch)	14,819
Tsa-pa	9,269	Toktomai-ulan-muren (S. branch)	
Bayan-rong	7,004	Murus (2 miles N. of)	14,745
La-mo shan-ken	6,582	" (1.5 miles S. of)	14,900
I-ma-mu Chwang (Yellow River)	7,112	" June 23 (2 miles W. of)...	15,317
Fei-tzu Chwan	7,634	Camp, June 24	15,729
Kuci-Te	{ Prjevalsky 7,500	Camp, June 25	16,343
	10,967	Dangla-eken	16,479
Sharakuto	{ Prjevalsky 11,300	Camp, 19 miles W.S.W. of pre-	
	10,198	ceding	16,150
Wayen-nor	9,508	Camp W. of Dangla	15,891
Kaba Talen	10,280	Chib-chwang-tao (Lake Glenelg)	
Erte-chuka	10,207	Camp S.W. of Chib-chwang-tao...	15,988
Hato	9,797	Camp 20 miles S. of preceding ...	15,807
Tso Kadri	10,136	Camp S. of pass	16,223
Tsata-chuka	11,211	Camp on pass, S.S.E.	16,355
Muri-chuka	13,750	Camp 21 miles S.S.E. of preceding	16,076
Wahon-jamkar	15,207	Camp Tsacha-tsang-bo chu (2 miles S.	
Kokosa	(by aneroid) 13,042	of river)	14,700
Tsahan-ossu (1st Camp)	12,279	Camp 8 miles S. of preceding ...	15,118
" (2nd Camp)	"	Namru Valley	15,018
" (3rd Camp)	11,555	Camp Tsacha-tsango-bo chu (July	
" (4th Camp)	12,375	15)	15,212
Koko-kutul (Camp below)	9,939	Tsacha-tsang-bo chu basin (July	
Shang Chia	{ W.W.R. '89 10,552	16)	15,370
Yogore-gol (2nd Camp)	10,791	Chang tang chu	15,687
Kawa-obo	11,845	Camp 8.5 miles E.S.E. of pre-	
Tosu-nor	13,179	ceding	15,845
Oim	12,533	Camp 18 miles E.S.E. of preceding	16,299
	9,243	Camp 20 miles S.E. of preceding	15,931
Barong-kure	{ W.W.R. '89 9,809	Camp 15 miles E.S.E. of preceding	15,278
	8,833	Trashiling (1.5 miles E. of)	14,946
Shudenge	8,799	Chingo	15,430
Shara-toha	8,735	Nashe-chu	14,176
Tengelik			

	Alt. in feet.		Alt. in feet.
Camp August Ist.....	14,747	Tse-chu	12,061
Song-chwang sumdo	13,364	Nyulda (Bower's Logamda)	11,942
Pon-ta	14,410	Sung-lo-zamba (Tse-chu)	11,722
Tsega (Su-chu)	13,210	Ge	12,515
Gentse	13,845	Kinda (Om-chu)	10,050
I-chu. Here join Bower's route.		Nuyi (Village 300 feet above	
His <i>Ita</i> valley, my I-chu valley	13,067	Nom-chu)	10,117
Angenong	14,157	Pungda (Bower's Pandesar)	12,292
Rama-chu	12,780	Bagong (Bower's Bandathing) ...	12,018
Ramngong-chu	12,672	Kungsa	11,622
Po-la-ga.....	13,672	Chamdun-Draya	11,709
Churema (Near Bower's Sher-		Ra-jong (Bower's Rajwa) (1 mile	
sando?)	12,927	below).....	12,560
Sagotong (Ru-chu). ($\frac{1}{2}$ mile N.		A-jod (Bower's Asi).....	12,870
Bower's Tashiling Monastery)	12,096	Lar-tang	12,385
Biwakanag	13,040	Rishod (Bower's Rashwa) (4.8	
Laha (Nar Peihu). (Bower's		miles above)	13,652
Khembe Nar)	12,130	Gartok (Chiang-ka)	12,240
Pene-ningu	14,111	Guhu	11,728
Mer-jong (Bower's Maru Camp		Jinkanding	11,619
115)	12,711	Gura (Dre-ch'u)	8,031
Pomundo	13,843	Ba (Batang)	8,223
Ke-chu (Bower's Kichi)	12,709		{ Gill, 8,546
Riwoche.....	12,269		

PRINCE HENRY THE NAVIGATOR.

A SPECIAL meeting of the Society was held on March 5, at the University of London, to commemorate the Fifth Centenary of the birth of Prince Henry the Navigator, the father of modern discovery and modern geography. The President, Mr. Clements R. Markham, C.B., F.R.S., occupied the chair, and there was a very large attendance of Fellows of the Society. Among those present were the Duke of York, the Portuguese Minister, Lord Amherst of Hackney, Admiral Sir Anthony Hoskins, Admiral Sir Arthur Cochrane, Admiral Sir F. Richards, Admiral Lord Walter Kerr, Right Hon. Sir George F. Bowen, the Right Hon. Hugh Childers, Lord George Hamilton, General Sir Francis de Winton, General Sir F. J. Goldsmid, Sir Eyre M. Shaw, Sir John Kirk, General W. H. Goodenough, Sir Clement Hill, Sir Henry Howorth, Sir G. Taubman Goldie, General Sir Thomas Gordon, the Hon. G. N. Curzon, Mr. F. C. Selous, Captain V. L. Cameron, and the Warden of Merton.

The PRESIDENT, in opening the proceedings, said: We are assembled this evening to commemorate the fifth centenary of the birth of that illustrious Prince to whom geographers and navigators will ever look as the founder and the creator of their science in modern times. We venerate his memory when we reflect upon the ability, the valour, and the indomitable perseverance and energy which he brought to bear upon work that is so dear to us; and that veneration is enhanced when we know that he combined with those high qualities a piety and a purity of life which have only been recorded elsewhere of a Marcus Aurelius, an Alfred, and a St. Louis. Before dwelling very briefly on

the personality and the lifework of Prince Henry the Navigator, I must refer in a few words to the authorities whence we derive our knowledge of him. In this respect we have, at this fifth centenary of his birth, great advantage over our fathers. They only knew the Prince from scattered notices in the great work of Barros and the narrative of Cadamosto. But in 1837 there was discovered in the Library at Paris the manuscript of the chronicle of Gomes de Azurara, a chronicle of the discovery of Guinea under the instructions of Prince Henry, written by order of his nephew, Alfonso V. It was compiled from the rough narrative of one of the Prince's sailors, and gives us many precious details unknown before. Since then we have had the Portuguese biography of the "Candido Lusitano" (1758); Germany has been furnished with the commencement of a biography by Professor Wappaeus, of Gottingen; and in 1868 appeared the admirable 'Life of Prince Henry the Navigator' by my late friend and colleague, Mr. Major, who was for sixteen years one of the secretaries of this Society. It was the chief work of Mr. Major's life, and I cannot help expressing my regret that he did not survive to witness a celebration which would have rejoiced his heart. We lament also the loss of those Portuguese noblemen who assisted and cheered him in his work—the Count of Lavradio, lineal descendant of the first Viceroy of India, the Marquis Sa de Bandeira, and the learned Vicomte de Santarem.

Prince Henry was born on March 4, 1394, at Oporto; but in this country we are obliged to keep his birthday on the following day, because the 4th fell on a Sunday. In Oporto the celebration commenced on Sunday, and will be continued for some days. The Prince's father was that famous King John I. who saved his country in the battle of Aljubarrota (August 31, 1385), and who proved to be as great a statesman and an administrator as he was valorous as a warrior. We are happy to think that 500 Englishmen came to swell the numbers of his army, as Froissart tells us; that he formed a close alliance with England; and that he married an English Princess. The mother of Prince Henry was Philippa, the daughter of John of Gaunt, and she had cousins in England among the Beaumonts, Audleys, Cliffords, Beauchamps, Stapletons, and other families. Moreover, our sister society at Edinburgh may also boast that Queen Philippa's great-grandmother was a Scotchwoman, a Comyn of Buchan, as may be seen recorded on the beautiful tomb of her grandson, Charles the Bold of Burgundy, at Bruges. Prince Henry was most fortunate in his parents and in his brothers. The eldest of them, King Edward, wrote a little book called 'The Loyal Councillor,' which gives a simple, dignified, and lovable picture of home affections among the members of that Royal and illustrious family. When King John organized his expedition against Ceuta in 1415, his three eldest sons were old enough to

accompany him and win their spurs. Their English mother prepared three swords for them, with which they were to be girt when they had earned their knighthoods. But she was seized with a mortal illness just before the expedition sailed. Almost her last words were that it was a fair wind, and that they would sail on the feast of St. James. Her husband took care that this should be a correct forecast. Prince Henry won his spurs by his gallantry at the taking of Ceuta; and a few years afterwards his mind became full of the great work of his life—the improvement of navigation and the discovery of the unknown coasts of Africa whereby the sea route to India might be found. For this patriotic object he gave up all pleasure, all the agreeable allurements of his position, and fixed his permanent residence as near as possible to his work. He selected the small peninsula a league south-east of Cape St. Vincent—the *Sacrum Promontorium*, so called from the circular druidical temple where the old Iberians believed that the gods assembled at night. Hence the name Sagres for the adjacent headland, where the rocky surface showed no sign of vegetation save a few junipers to relieve the sadness of the shifting sand. Landwards the north-west winds were almost unceasing; while three-quarters of the horizon was occupied by the mighty and mysterious waters of the as yet unmeasured Atlantic.

“If,” as Mr. Major says, “from the pinnacle of our present knowledge we mark on the world of waters those bright tracks which have led to the discovery of mighty continents, we shall find them all lead us back to that same inhospitable point of Sagres, and to the motive which gave to it a Royal inhabitant. To find the sea path to the treasures of Arabia and of India, till then only known through faint echoes of almost forgotten tradition, was one of the main objects to which Prince Henry devoted his life. The goal which he thus set before himself was at an unknown distance, and had to be attained, through dangers supposed to be insurmountable, and by means so inadequate as to demand a proportionate excess of courage, study, and perseverance. The scientific and practical appliances which were to render possible the discovery of half a world had yet to be developed. But with such objects in view Prince Henry collected the information supplied by ancient geography, unweariedly devoted himself to the study of mathematics, navigation, and cartography, and freely invited, with princely liberality of reward, the co-operation of the boldest and most skilful navigators of every country.” He also established an observatory and a school of navigation at Sagres, the latter under Messer Jacome of Majorca. The plane chart and the compass were already known; but I am inclined to ascribe the first use of astronomical instruments at sea to the sailors of Prince Henry. Diogo Gomez mentions his use of a quadrant, not, of course, an instrument anything like Davis’s or Hadley’s quadrant, but a much more primitive instrument. Through the kindness of the Warden of Merton we have

here to-night three very interesting instruments belonging to that college. One of them is an astrolabe of the fourteenth century: so that we are able to examine just such an instrument as was in use in Prince Henry's time. We are also able to show to the meeting a plan of the Sagres promontory, taken from the drawing in Mr. Major's book, which was obtained for him by the Marquis Sa de Bandeira. The ancient buildings, the "Villa do Infante" of the Prince's time, were, I believe, destroyed by the earthquake in 1742, but the site of the observatory is shown; and the monument to the Prince was erected in 1840 on the inner wall of the fort.

Prince Henry was made, by his father, Governor of Algarve in 1419, and Grand Master of the Order of Christ, which, as direct successor of the Order of the Templars, is the most ancient order in Christendom. It was through his command of the great wealth of this order that he was enabled to send out expedition after expedition of discovery; so that the cross of the Order of Christ must always have a special interest for geographers. For it was constantly worn by Prince Henry, by Vasco da Gama, and by other great Portuguese explorers. In 1442 Prince Henry was created a Knight of the Garter. He was the 153rd knight of that order, and the late Count de Lavardio traced down the collar worn by Prince Henry, through the intermediate possessors, to the late Earl of Clarendon. Among the public uses of these ancient orders of knighthood may, I think, be enumerated the interesting links that they thus form with past history. Surely it is a notable fact that our own princely navigator, His Royal Highness the Duke of York, who has honoured us with his presence this evening, is wearing insignia of the same order as was worn by his illustrious relative, and is enrolled in the very same knightly brotherhood and companionship that included the great name of Prince Henry of Portugal.

When Prince Henry died, at Sagres, on November 13, 1460, he had been working steadfastly and unswervingly at his glorious task for upwards of 40 years. His motto was "Talent de bien faire" ("the desire to do well"), and he had done his work so well, so thoroughly, and with such rare ability, that nothing fell out of gear when he died. The course of discovery remained unbroken. He had instilled his own spirit into the Portuguese nation, and the lofty height of glory to which that nation soared during the succeeding century was due to their spotless Prince. This, as it seems to me, is his highest praise. He not only turned the whole current of thought, in his age, to discovery, but his genius made discovery and exploration continuous, so that it has continued to progress in an unbroken stream from his day to our own. The lonely promontory of Sagres is truly the starting-point of our science.

The Prince is described by Azurara as large of frame and brawny, stout and strong of limb. His naturally fair complexion had become dark through constant toil and exposure. A miniature was found in

the manuscript of Azurara which is assumed to be authentic and to be the only true portrait. From the mourning headdress and cropped hair, compared with the date of the chronicle, it is supposed to have been painted soon after the death of his unfortunate brother, Dom Pedro, in 1449. But the statue over the centre column of the side gate to the church of Belem, at Lisbon, is, I think, more like Azurara's description of the Prince. It was erected by his grand-nephew, King Manoel "the fortunate," in his great-uncle's memory, because Prince Henry built the little chapel of Restello, for the use of sailors, on the site on which now stands King Manoel's church of Belem. The body of Prince Henry rests in the founder's chapel of the magnificent cathedral of Batalha. In the centre of the chapel are the tombs of his father and mother, John I. and his English Queen. The eldest brother, King Edward, rests under the high altar. The tombs of the other four are in a line—Pedro, Henrique, Joao, and Fernando "the constant Prince." On the tomb of Prince Henry there is a recumbent statue, with the head protected by a richly carved canopy. Three shields on the side are those of the cross of the Order of Christ, of the cross of the Order of the Garter, and the arms of Portugal. When I made my pilgrimage to Batalha, on October 30, 1889, I thought the face remarkably like that of the statue at Belem, except that it is beardless. One of the chief glories of Batalha is the magnificent cloisters, and altogether there are few grander Royal mausoleums than that in which the body of Prince Henry has its last resting-place.

Azurara tells us that the great Prince was stout of heart and keen in intellect. He was extraordinarily ambitious of achieving great deeds. Neither luxury nor avarice ever found a home with him, but he was lavishly generous. His self-discipline was unsurpassed; all his days were spent in hard work, so that by dint of unflagging industry he conquered what seemed to be impossibilities to other men. His wisdom and thoughtfulness, excellent memory, calm bearing, and courteous language, gave great dignity to his address. "Assuredly," exclaims the old chronicler, "I know not where to look for a Prince that shall bear comparison with him." "If it be the glory of England," says Mr. Major, "that, owing to her maritime explorations, the sun never sets on her dominions, it may be permitted to Englishmen to recall with satisfaction that who opened the way to that glory was the son of an English princess." His father was the greatest King that ever sat on the throne of Portugal. He was himself a most loyal and most patriotic Portuguese; and all here unite, I am quite sure, in the desire to express their sympathy with his faithful Majesty and with the Portuguese nation in their commemoration of the life-work of their most illustrious countryman.

The President, by permission of the Duke of York, read the following

telegrams: "His Royal Highness the Duke of York to his Faithful Majesty the King of Portugal.—I am present at a meeting of the Royal Geographical Society to commemorate the fifth centenary of the birth of Prince Henry the Navigator, whence myself and the society send cordial and sympathetic greetings to your Majesty and the Portuguese nation." The following was the reply: "To His Royal Highness the Duke of York.—I beg you to accept my best thanks, and please transmit to the Royal Geographical Society how pleased I am to see such an important manifestation made to the Portuguese hero that opened Africa and India to the modern world. In the name of Portugal accept, all of you, our sincere thanks.—The King of Portugal." *

SIR GEORGE TAUBMAN GOLDIE, Vice-Governor of the Royal Niger Company: I have been asked to-night to give a short description of the African regions discovered by Prince Henry. Our President has given a most able address, I am sure we shall all agree, covering the general career of Prince Henry, and I understand that we have here to-night two gentlemen who have made a special study of the subject, and who will, no doubt, give us many interesting details of the expeditions sent out by that Prince. I propose, therefore, not to deal directly with Prince Henry's work, because to do so would be to weary you with repetitions, but there is one feature of his character to which I must refer, because it is intimately allied with the subject allotted me this evening. It is that Prince Henry was content to work, not for his own generation, but for posterity. It was only with the eye of faith that he could see the extraordinary greatness to which the small country of Portugal rose during the 120 years after his death. To-day there are five or six European nations all engaged in working for posterity in the equatorial regions of the same great continent of Africa to which Prince Henry devoted his attentions, regions which cannot be expected in a single generation to yield those brilliant material results which alone command popular admiration. As you know, from time immemorial the inhabitants of these regions have lived under conditions of insecurity to property and liberty and life, absolutely incompatible with the growth of industry or the accumulation of capital. I have never wavered in my belief that the introduction of better political social conditions will gradually make equatorial Africa wealthy as well as free; but the workers of our time—and I have no doubt there are many of them here to-night—must be content, like Prince Henry the Navigator, to look at a promised land into which they themselves will never enter, and in which, with

* The following telegram was also received from the President of the Lisbon Geographical Society:—

"The Council of the Geographical Society of Lisbon congratulate themselves with the Royal Geographical Society for its significant commemoration of the fifth centenary of the immortal Infante Don Henrique."

perhaps one or two exceptions, like the King of the Belgians and H. M. Stanley, their very names will be forgotten.

The unknown Africa of Prince Henry's time may be taken as commencing with Cape Juby, opposite the Canary Islands, the regions to the north lying within the Mediterranean State of Morocco, which two thousand years ago was a province of Rome. The southernmost point reached by Prince Henry's emissaries was Cape Mesurado, in Liberia. In taking this limit, I am assuming as one of his expeditions that which actually left Portugal (after his death) in 1461, but there is no doubt that Prince Henry planned it and probably organized it. The distance between Cape Juby and Cape Mesurado, following the coast, is about 1800 miles, and my difficulty is how, in the course of five minutes, I am to give you an adequate description of that immense region without laying myself open to the charge of inaccuracy. I am rather cautious on this point, as I have just had a lesson. About a fortnight ago I was asked about the wandering tribes of the Tuaregs by an interviewer, and in order to get rid of him, for the sake of brevity, I described them as the Arabs of the Central Sahara, just as people talk of the Gallegos as the Auvergnats of Spain. A few days afterwards, I saw a short leader in one of our great London journals, which not only stated the undeniable fact that the Tuaregs are not Arabs, but indulged in some gentle sarcasm either about the inaccuracy of the reporter or my ignorance, I could not quite make out which. But you will understand that, speaking very briefly, I must speak generally. That region is divided into two nearly equal but very dissimilar parts. From Cape Juby down to the Senegal river is the western limit of the Great Sahara, so I need hardly tell you it possesses what Lord Salisbury called on a notable occasion a "light soil," that it is deficient in water, healthy in climate for those who don't mind heat, and very sparsely populated. Its inhabitants are wandering and pastoral tribes, varying in colour from light brown to dark brown. In the southern half, namely, from the Senegal river to Cape Mesurado, every one of these conditions is different. Here you have again, speaking broadly, a fertile soil, a decidedly unhealthy climate—there are many here who can vouch for that—very plentiful waterways, and a population comparatively dense, and consisting of more or less pure negro races, who are sedentary and agricultural in habit. I shall not weary you with a long catalogue of the races and tribes scattered over this immense maritime region. Such a catalogue would be useless to those acquainted with the subject, and could not possibly be remembered by those who are not. But I will say a few words about the existing political divisions.

From Cape Juby to Cape Bojador is the only part of the coast of Western Africa not yet appropriated by some recognized state. Certain claims are raised to it by Morocco, and certain others by Spain, while at Cape Juby itself there has been, since 1880, an important British

station, which has not been recognized as a British possession, but of which I hope our countrymen will not lose sight. From Cape Bojador to Cape Blanco, nearly 500 miles, is held by Spain, which also claims about the same distance into the interior; but I have noticed in the Paris papers, since the taking of Timbuctoo, an inclination to draw a line from Cape Blanco at a sharp angle with the coast, cutting Spain off with a very small section indeed.

At Cape Blanco begins the great West African possession of France known under the different names, for administrative purposes, of *Sénégal*, *Sudan Français*, and *Rivières du Sud*, which form, however, one great possession, of which the French are very naturally proud, and on which they are spending a great deal of money. It extends inland 900 miles from the Atlantic as far as Timbuctoo. With the exception of two very interesting small wedges belonging to other nations, France extends on the seaboard right down to the frontier of Sierra Leone. This British possession has a coast-line of about 200 miles, and extends about the same distance into the interior, but can go no further. I may remind you that about fourteen years ago France, then firmly established on the Senegal, commenced a policy of what is called *lateral expansion*, and has gradually cut off the coast colonies of England and Portugal from the interior. As this is a Geographical Society, and not a Colonial meeting, I merely state facts without any comment. I mentioned two small wedges in the French coast-line. The northernmost is the British possession on the Gambia, which is of special interest to us at present, on account of the late disaster there. I dare say we shall hear something to-night, from those going to tell us of Prince Henry's work, of the interesting fact that the first expedition that discovered the Gambia, was almost annihilated by coming in conflict with the natives. One cannot help thinking of the enormous stride made, during the last three or four centuries, by the public conscience of Europe. In those days, our conflicts with the natives generally arose from our trying to capture them as slaves. To-day our conflicts in Africa are due to our trying to prevent the capture of the natives as slaves by marauding chiefs like Fodi Silah, or their extermination by savage potentates like Lobengula. Not far south of British Gambia comes the small Portuguese colony of Guinea on the Rio Grande. This is doubly interesting to us to-night—firstly, because this was the last discovery of which Prince Henry heard before his death, in 1460; and, secondly, because, although Portugal still holds great African possessions south of the equator, this little territory of Guinea is all that remains north of the equator of the vast regions gained for her by Prince Henry and his successors. It is not for me to dwell on the causes of this decline before this audience—the disastrous union with Spain in 1580, and the “sixty years' captivity” which gradually destroyed the spirit of Portuguese enterprise created by Prince Henry—but I may perhaps venture to say

this, that although the power of Portugal has waned in that north-western region as in the far East, nothing can rob her of the glory of having led the van of modern exploration, a work without which, I venture to say, Columbus would not have discovered America, while Prince Henry the Navigator, whose genius and patient industry conceived and organized this great work, has built himself an everlasting name.

Captain W. J. L. WHARTON, Hydrographer to the Admiralty: It is very difficult for a modern sailor to put himself in the position of the sailors of the time of Prince Henry. I do not know how far it is possible for a modern landsman to do so, but probably he does not appreciate the difficulties quite so much as we do; and as this is an important point in the life and work of Prince Henry, I wish to endeavour to put before you the different conditions. In these days mathematicians and astronomers have observed the positions of the different heavenly bodies, calculated their orbits, and given us tables showing the position of these bodies for every second in the year. We have perfect instruments made for us by mathematicians and mechanicians with which we can observe these heavenly bodies. The watchmaker makes us perfect, or almost perfect, watches that take about our time, or, in other words, our longitude. We have almost perfect compasses that enable us to steer in any direction we wish, and also we know the varying changes, or the variation of the compass in different parts of the world. We have also the result of the labours of many marine surveyors who have mapped nearly the whole world for us. Charts are not quite so perfect as some people believe, but they are quite sufficient to enable any navigator to direct his course from one point to another with unerring certainty, and to know of anything that he is to meet in his way. We have also the more mundane but very necessary point of our provisions, which are well preserved for us, and we have no fear of scurvy. In fact, navigation in the present day has become so easy, that a feeling is growing up that any fool can navigate, and as a consequence a certain number of ships are lost every year that need not be lost. One of the conditions of Prince Henry's time was that absolutely nothing was known of navigation.

Certainly the Chinese and Arabs had navigated and studied astronomy to such an extent that they were able to make long voyages in their part of the world and know where they had got to, but Europe had fallen into a state generally called the Dark Ages, when Prince Henry rose and determined to form a school of navigation, and to press forward navigation in the unknown Atlantic, of which we must remember nothing was known south of Cape Bojador. Sailors had a most primitive quadrant, and any one can picture their endeavours to point this instrument to a star with a ship rolling about on all sides. One ceases to wonder that very often they did not know where they had been, and unfortunately they had no nautical almanac. It is not astonishing that, when sailing out of the Mediterranean, the sailor hardly ventured out of sight

of land. Prince Henry worked for several years exploring the unknown west coast of Africa, and for some years they did not get beyond Cape Bojador; why, I have never been able to understand. I have seen it stated, in lives of Prince Henry and elsewhere, that there is a long reef stretching out so far that the navigators were afraid to go round it. Our modern knowledge tells us there is nothing of the sort, that Bojador is perfectly clean, and I hope some one will be able to tell us why it proved such a sticking-point to the Portuguese navigators of that day. They, however, kept working down until the time of Vasco de Gama, who crossed to India; but the charts they left behind for their successors, as far as we are able to judge now, were very imperfect guides indeed. Prince Henry caused a large map of the world to be made by an Italian who had great distinction, Fra Mauro, but as for being a guide for a sailor, I should be sorry to find my way by it. It starts by assuming that the world is confined by a circle, therefore there is nothing like a compass bearing. At this time the utmost that was known was down to the Bight of Benin. Fra Mauro's map shows the Senegal as twin rivers. All the eastern part of the map was taken from the Arabian geographers. It was this state of things that Prince Henry set himself to put right. He established a school of navigation, set people to work at astronomy, encouraged the pushing of voyages south until they went round the Cape. As has been said, he was the originator of modern exploration, and a leader of discovery in the unknown world. This is a great claim to the remembrance of posterity, and Englishmen will always be proud to remember that he was half an Englishman.

Mr. RAYMOND BEAZLEY: I venture to think that the life of Prince Henry the Navigator is best considered as an incident in the great movement of European expansion which produced such widespread effects a little later, as the turning-point between the periods of mediæval and modern exploration. It is through this onward movement which the Prince of Portugal began that we know, to some extent at least, the whole of the surface of the globe, instead of the one-twentieth or one-fiftieth which really composed the entire geographical outlook of the Christian Middle Ages.

In Camoens' 'Lusiad,' the National Epic of Portugal, Henry is the "generous" prince who first

"Opened up those wastes of tide
No generation opened before,"

and his work is essentially one of preparation and transition, gathering up the threads of the past and preparing for the results to come—the achievements of Columbus and Da Gama and Magellan. For if the Prince himself did not live to see these results, they were none the less due to the inspiration he had given and the example he had shown.

In all his work the Infant had three aims—first, the exploration of the unknown world, and especially the discovery of the sea route round

Africa to India; second, the creation of a commercial empire for his country; and, third, the conversion of the heathen.

With these objects before him, he set himself to the task of breaking down that middle wall of superstitious terror and ignorance which had so long confined Christendom within a narrow section of the Western world.

But to take a true view of Henry's position in the story of our geographical advance, we must look back at the various stages of preparation for his work, starting from that body of knowledge and theory which the science of the Græco-Roman Empire bequeathed to Christendom. First of all, in the ages between Constantine and Charlemagne, most of the interest shown by Europeans in discovery, or travel of any sort, took the shape of pilgrimage; then the northern movement of the Vikings or Scandinavian pirates and sea rovers woke the duller nations of the West into a new activity, and produced on one side the first recorded discovery of America (Vinland); on another, the foundation of the mediæval kingdom of Russia; on a third, the extraordinary increase of Eastern pilgrimage and travel which both prepared for the Crusades, and produced the most permanent fruits of that great convulsion.

The Crusades themselves, the central era in the history of Latin Christendom and Christian exploration, resulted in a threefold extension of western geographical enterprise—in Eastern land travel, Atlantic ocean-voyaging, and scientific progress. The travels of Marco Polo and the Friar missionaries of the thirteenth and fourteenth centuries illustrate the first of these developments; the attempts of Genoese, Catalan, French, and Portuguese sailors in the Sea of Darkness, between 1291 and 1410, illustrate the second; the invention or transmission of the compass and the astrolabe, and the improvements in maps and charts through the new Italian coast surveys, or Portolani, are sufficient proof of the third.

By the movement of land travel in the Further East, it was first clearly revealed to the Christian West what might be gained from the "Thesauri Arabum et divitis Indiæ," which had been the prize of the world's trade-routes from the earliest time. By the movement of maritime enterprise in the ocean off the west of Africa, the first suggestions were given of a scheme which was ultimately successful of wresting the commercial empire of Asia out of the hands of the Moslem monopolists of the overland tracks; by the investigations in scientific geography, sailors were given the power as it were of venturing out of sight of land, and were impressed with those ideas of accurate observation upon which alone a true map of the world could be based.

The mere scientific interest would hardly have proved a lever sufficient for Henry's work; he was successful through his power of appealing to the ambition and the greed of a young and powerful nation, in whom had always been traceable a certain latent genius for seamanship.

His life may be divided into three periods: first, from his birth, in 1394, to the conquest of Ceuta, in 1415, which brought him into direct contact with Africa, and the questions of its shape, its size, its people. It was here he met the caravans of the Sahara and the merchants of the Guinea coast—his halfway house to India, which so long deluded the Portuguese with the hope of a quick approach to India. It was here that he seems to have conceived his project of circumnavigating Africa, and so of sending his ships, of war or trade or mission, direct from Lisbon to Malabar by this new ocean route.

The second stage in his life, from 1415 to 1441, was the earlier and more unsuccessful epoch in his struggle to realize this ambition. From the time that he settled at Sagres, near Cape St. Vincent, in 1418, retiring from the court and the fashionable world—an exile from the known world exploring the unknown—down to the arrival of the first gold-dust from Guinea in 1441, the Prince was, we might say, in opposition, trying to popularize an unpopular cause, fighting against a powerful and venomous resistance.

During the third and last period, from 1441 to 1460—from the time when the Infant's schemes began to promise some material profit, down to the time of his death—the murmurs of opposition and detraction were almost silent; the genius of the leader became the inheritance of his people; his work, his mission, his hopes, were adopted by the passionate enthusiasm of a nation entering upon its Heroic Age.

From the impulse given by Henry the Navigator we must derive not only the direct results, for example, of Gil Eannes, who first passed that "Finisterre" of West Africa, Cape Bojador, in 1434; of Diniz Diaz, who rounded Cape Verde in 1445; of Cadamosto and Diego Gomez, whose discoveries along the coast of Sierra Leone and among the Cape Verde islands brightened the last years of the Prince's life; of the early Portuguese settlers in Madeira, the Canaries, and the Azores, who in the Infant's lifetime made a new beginning of European colonization,—but the indirect results of the same movement must be traced back to the same source. For the voyage of Bartholomew Diaz round the Cape of Good Hope in 1486, and of Da Gama to Calicut in 1497-9, with the outcome of their efforts in the Portuguese empire in the East—the first of modern colonial dominions, and so important a turning-point, as Mr. Lecky has insisted, in the story of modern progress—were certainly no more than the realization of Prince Henry's schemes; on another side, Columbus, as we are told by his son, was first inspired with the thought of discovery in the far West by witnessing the apparently interminable progress of Portuguese exploration towards the South; lastly, the circumnavigation of the globe by Magellan (1520), the various colonial and commercial empires, of Spain, Holland, France, and England, which grew up on the ruins of the Portuguese possessions in the East, and the vital improvements in geographical knowledge and science from the

fifteenth century down to our own day, are also in more or less clear relation to the work of that

“Lusitanian Prince, who, heaven-inspired,
To love of useful glory roused mankind,
And in unbounded commerce mixed the world.”

For the whole onward and outward movement of our modern European civilization was set in motion by one man. It might have come to pass without him; but the fact is that, through him, it did as a matter of history result. “And let him that did more than this, go before him.”

Mr. H. YULE OLDHAM: There are two vital dates in the history of the exploration of the West African coast under Prince Henry's auspices: the one is 1433, when that formidable Cape Bojador, of which mention has been made, was rounded; the other falls ten years later, in 1443, when, for the first time in the Bay of Arguin, inhabited islands were discovered. Up to this period Prince Henry had with indomitable determination, against increasing remonstrances, continued his efforts along an apparently inhospitable coast. The moment, however, that the prospect of a profitable field for commerce was displayed all was changed, the Prince was loudly praised, and keen competition for the benefits to be derived from his discoveries ensued. Even from foreign lands strangers were attracted.

About ten years after this event, there was living in Venice a young member of a noble family, Alvise da Cadamosto, who was attracted somewhat accidentally into the service of the Prince. It is of him that I am asked especially to speak. Gil Yanez, Nuño Tristam, Alvaro Fernandez, and others who did brilliant service before his time, have left little but the bare record of their names and achievements. Cadamosto, however, has left a monument more durable than brass in his written description of his voyages, which incidentally throw most valuable light on the character and methods of Prince Henry.

In the year 1454, he tells us, being twenty-two years of age, and having already made voyages in the Mediterranean and as far as Flanders, he resolved to return to that country with the determination to employ his youth in acquiring riches, experience, and, if possible, fame. He never arrived in Flanders, for a storm detained the fleet, with which he had sailed, off the Portuguese coast near Cape St. Vincent, at a time when Prince Henry was living in the neighbouring village of Riposera, where, as Cadamosto says, he had retired to find quiet for his studies. As soon as the Prince heard of their arrival, he sent his secretary and the Venetian Consul on board with samples of sugar from Madeira, dragons' blood, and other products of the lands found or colonized under his care. Wonderful stories were told of these lands and the enormous profits to be made there, even 1000 per cent., and the handsome conditions offered by the Prince were explained, namely, his readiness to furnish any one with a ship and everything save cargo,

the profits to be equally divided, and loss, if loss there were, to be wholly borne by himself. It was added that the Prince would be particularly pleased with a Venetian who would undertake a voyage, as he was convinced that spices were to be found, and knew that the Venetians understood these articles better than any other nation—a striking remark, showing apparently that the Prince's schemes reached beyond the African coast to the riches of the East. Cadamosto was attracted by these overtures, and resolved to venture his fortune in the new lands. Prince Henry was well satisfied, and, after being handsomely entertained at St. Vincent throughout the winter, our Venetian was despatched in a new and fully equipped caravel in the spring of 1455.

I cannot now describe a tithe of the interesting and wonderful things that were seen and carefully recorded on this voyage; a few must suffice.

On Porto Santo he found Bartholomew Perestrello acting as governor; this was the head of that family into which Columbus subsequently married. In this island and on Madeira he heard of some of the difficulties which Prince Henry had to contend against in his efforts at colonization, a fire lit on the latter, to clear a space in the woods, having burnt so furiously as to drive the settlers into the sea, where they remained for two days up to their necks in the water. In the Bay of Arguin he found a fort had been built by the Prince to protect his traders, who were selected and licensed. A month was spent on shore near the Senegal, in acquiring information about the customs of the natives, the commerce of the country and trade with the interior, anything new being placed on one side for the Prince, who in this way received from Cadamosto an elephant's tusk and foot, to his great satisfaction.

The voyage was then continued to the Gambia, about which Prince Henry had heard, but had no precise information. On the way a Genoese, Antoniotto Uso di Mare, was encountered, who had also, like Cadamosto, been attracted to Portugal. The Gambia was reached and for the first time explored, but not to any great extent, owing to the fierce hostility of the natives; so a return was made to Portugal.

In the following year a second voyage was made by Cadamosto, and the coast beyond the Gambia explored as far as the Rio Grande, several names being given to rivers, some of which, such as the Casamansa, are still retained.

It was in this voyage that the Cape Verde Islands were discovered, the only absolutely new discovery in this region made under Prince Henry, for the Madeiras and Azores are to be seen on maps of the preceding century, and the coast as far as Sierra Leone had been visited by the Carthaginian Hanno hundreds of years earlier. I may, however, say that, from evidence recently discovered, I have little

doubt that some of Prince Henry's explorers reached America nearly fifty years before Columbus' first voyage, but that is a matter which cannot now be entered into. I can only conclude with Cadamosto's own eulogy of the Prince—"He was the most accomplished Prince of his time, the least of whose virtues would serve to immortalize another."

The PRESIDENT: We English have now done our very best to express our admiration of this great prince of navigators, and I am sure this meeting will be pleased if his Excellency the Portuguese Minister will be so kind as to give us some idea of what his opinion has been of our endeavours.

The Portuguese Minister, SEÑHOR DE SOVERAL, rose, at the invitation of the President, and said: Your Royal Highness, my lords, ladies, and gentlemen, it is with a legitimate pride and a deep emotion that I rise to thank you all in the name of the King, my Government, and the Portuguese nation for the splendid tribute paid this evening to the great Prince Henry. Yesterday at Oporto his Most Faithful Majesty, surrounded by his august family, laid the foundation-stone of a monument to the hero, and, on the waters of the Douro, the presence of a British man-of-war added to the brilliancy of the act. We see this evening here the illustrious Prince in whose veins runs somewhat the same blood as that which ran in the veins of the great navigator, and he is also a sailor. You alluded, sir, to the Order of Christ. Every one who is conversant with the work of your lamented friend, Mr. Major, knows how great was the influence of that order on the early maritime enterprise of the Portuguese. This high distinction has been conferred upon me after the signature of the treaty between Portugal and England, which ended for ever, I hope, our serious trouble about the territorial disputes in Africa. Before I resume my seat, I have to fulfil a most grateful mission which has been entrusted to me. On my way to London I stopped in Paris, and I had the honour of being received by his Royal Highness the Prince of Wales. His Royal Highness desired me to state on this occasion how great is the interest he takes in the celebration of this memorable event, and how pleased he feels to see his son associated with it. The Prince added that he felt confident that this splendid commemoration of the great services rendered by the great navigator to the whole world will cement the old and traditional friendship so happily initiated by the marriage of King John the First and Philippa of Lancaster.

The PRESIDENT: This great meeting, assembled here this evening, makes it manifest that the memory of Prince Henry's work is not forgotten in our country, and the presence of two young students who are engaged on literary labours connected with his career is a further proof of this. Mr. Beazley is writing the Prince's life, and no one in this country has so intimate a knowledge of the voyages of Cadamosto as Mr. Yule Oldham. The Society will be much pleased at having been

honoured by the presence of His Royal Highness the Duke of York this evening ; and we are gratified at the message from our Vice-Patron, His Royal Highness the Prince of Wales, delivered by his Excellency the Portuguese Minister, expressing approbation of our proceedings, and pleasure that his son is associated with them. We rejoice, also, that the proceedings to-night have been gratifying to His Excellency, and we trust they will be equally so to His Faithful Majesty and the Portuguese nation. For ourselves I trust they will serve to impress the leading facts of Prince Henry's life more firmly on our minds, and encourage us, as geographers, always to remember his motto, "Talant de bien faire."

THE EARLY CARTOGRAPHY OF JAPAN.

By GEORGE COLLINGRIDGE.

In the year 1542 Japan was accidentally discovered by Antonio de Mota, a Portuguese sailor, who, being driven out of his course, was the first European to sight its shores. A few years later St. Francis Xavier founded a mission there, to which we owe the first information that we have concerning Japan and the Japanese. As far as I have been able to ascertain, twenty-seven years elapsed after this fortuitous discovery before we find on maps any apparent result of the knowledge of the country thus acquired by Europeans.

Portolanos were made, no doubt, and in 1569 appeared Gerard Mercator's invaluable map of the world. On this map an island is set down in the locality of the southern half of Japan, with the legend "*JAPAN dicta Zipangri a MPaulo Veneto, olim Chrise.*"* The configurations of this island, when compared with a modern map of Japan, will be seen to include the south-western peninsula of Nippon and the two southern islands, Kiusiu and Sikok. What is called the "Inland Sea," between the inland shores of the above-named islands, appears therefore to have been unknown to Mercator, who makes one island of the three.

Mercator's charting of Japan is probably the first ever made on a world map by European cartographers ; for, as I hope to be able to show, the "Zipangri" referred to in Mercator's inscription, Marco Polo's Zipangu, Toscanelli's and Christopher Columbus' Cipango, have nothing to do whatsoever with Japan.

The name "Cipango" has been written in many different ways, and its similitude to Japan, Ji-pen-koué, Ge-pen, Jih-pun, etc., has been commented upon at great length by able authors, who, however, would have

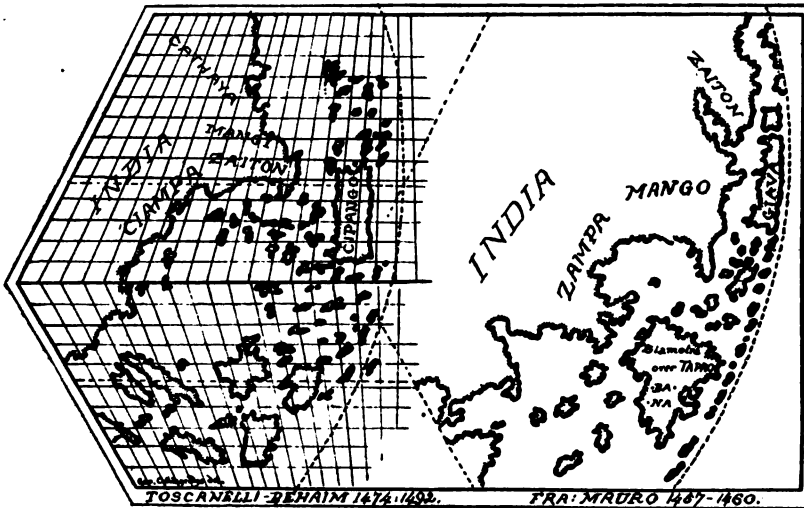
* I am quoting from Jomard's copy. Nordenskiöld says (Nordenskiöld's Facsimile Atlas, pages 96, 132, 2nd col.), "It is reproduced in full size, but without some of the important legends."

been wiser had they inquired first on what foundation they were building. When a close inquiry is made into the subject, the only apparent reason for believing that Cipango was Japan consists in the fact that when that island was discovered, another island of the name of Cipango was found to occupy, *on maps*, its approximate position, and that Marco Polo had said that "Zipangu" was an island in the Eastern Ocean. Now, if the Eastern Ocean of Marco Polo can be shown to be the Java Sea, and Cipango to be an island of the Eastern Archipelago, the whole fabric of Ji-pen-Koué construction will fall to the ground. The method I followed to ascertain the truth in this matter is simple enough. I searched on old maps for the origin of the charting of Cipango, and I read up Marco Polo's descriptions carefully.

There has always been a wonderful amount of conservatism with geographers; fortunately, they are not prone to invent when they can possibly avoid it. Toscanelli and Martin Behaim were the first geographers of the Renaissance to place Cipango on the spherical representation of the earth; but they copied, I was going to say traced, their Cipango from Fra Mauro's map. Fra Mauro's celebrated Mappamundi, itself based on older maps the origin of which can be traced to the very dawn of geography, was the most important and complete document that Toscanelli and Behaim could have recourse to for information, and although it belonged to a type of maps then on the eve of reformation, its configurations, apparently, were not to be despised. The Toscanelli map in which Cipango appears is now lost, but it was described so minutely by Toscanelli in his letter to the court of Portugal in 1474, and also in the letter he sent afterwards to Columbus, that we know it to be similar to Behaim's unique globe of 1492. Behaim's Cipango (Cipanga in Jomard's copy) is, as I have said, almost a tracing of Fra Mauro's large island similarly situated in the Eastern Ocean; but Fra Mauro's island bears the name of *Giava*. It is, in fact, Java, and not Japan, as a comparison of the two will show at once. This changing of Fra Mauro's *Giava* into Cipango prevented the identification of Java, and caused the mistake to be ignored to this day. Toscanelli then proceeded, in order to make use of the name stolen from the proper Java, to apply it to a large island south of the equator. It would be difficult to find out the exact reason that urged Toscanelli to convert Fra Mauro's *Giava* into Cipango; several reasons may be suggested, to which I shall refer by-and-by.

Those islands of the East Indian Archipelago, Java, Bali, Lombok, and Sumbawa, as represented on Fra Mauro's Mappamundi, must have been drawn from a portolano, for they bear, especially Java, the characteristic correct features of those documents; but Toscanelli, totally ignorant, no doubt, if the true form of Java, took no heed of its correct features as represented on Fra Mauro's map. He apparently ignored, also, the circumstances that compelled Fra Mauro to place his *Giava* and

other islands south and north, instead of west and east as they should be; otherwise, when he stretched out the world on its spherical projection, having more room for those islands, he would have placed Java and its eastern prolongation of islands in their true west and east position, south of the equator, had he known them to be truly represented as to form and topographical contiguity. One of his reasons, therefore, for changing the name of Giava to Cipango must have been derived from the importance he attached to Marco Polo's descriptions. The importance that the Venetian traveller himself gave in those descriptions to Cipango must also have caused him to increase the dimensions of that island. Another reason was no doubt suggested to Toscanelli by the easterly position occupied by Fra Mauro's Giava, which answered to



Marco Polo's Eastern Ocean. He evidently thought that that island had been misnamed, and, in consequence, he transferred Fra Mauro's nomenclature to the south of the line, giving it to the large island bearing the name *Siamotra* over *Taprobana* and TAPROBANA in large capitals.

We must now see what Marco Polo's evidence is in the matter; but before doing so, it may be well to offer some explanation for Fra Mauro's strange mistake in placing Java north of the equator, and in the approximate latitude of Japan. The circumstances that compelled him, as I have said, were of a twofold character—tradition and want of space. Before the construction of globes and the revival of graduated maps, all maps of the world of any importance were represented within a circle formed by the circumfluent ocean. In maps of the world of this description, Java and other islands of the Eastern Archipelago are represented in the Eastern Ocean. The following are some of the maps:

The St. Sever Mappemonde, of the eleventh century ; a map of the twelfth century, from a manuscript in the library of Turin ; Marino Sanudo's map of the world, from the beginning of the fourteenth century ; Andre Bianco's map of the world of 1436, etc. Precedent, therefore, commanded Fra Mauro to place Java and other islands in the East. Owing to the peculiar shape of his map, and the absence of graduation, he was compelled to place the Indian Archipelago south and north, instead of west and east ; furthermore, having no graduation to guide him, he did perceive that he placed those islands north of the equator ; nor is it certain that the equator, or the position of the East Indian Archipelago with respect to it, troubled him much, although he put on record a protest against the want of space. This protest his followers availed themselves of, but not in the right direction. The want of space was noticed by Fra Mauro precisely in the Eastern Ocean, for he says, *In questo mar oriental sono molte isole grande e famose che non ho posto per non aver luogo.* The large and famous islands that he did not set down for want of space were, no doubt, Borneo, Celebes, and the Philippine group.

Marco Polo, writing from hearsay, describes, in my opinion, Java, and perhaps other islands contiguous to Java, under the name of Zipangu. The other islands may have comprised the whole group of the East Indian Archipelago as far as Sumbawa, Zipangu being the early form of Sumbawa. Zipangu, to use a common expression, was the peg on which hung the tale of a kind of reflex-Java, for Marco Polo describes the real Java in another part of his book. Zipangu is described in the second, third, and fourth chapters of his Third Book. In the second chapter Marco Polo says that the island of Zipangu is in the Eastern Ocean, at the distance of about 1500 miles from China. As he gives precisely the same distance to Java, it will be noticed that there may be some confusion here, and that the distance refers to the East Indian Archipelago ; for Japan is much nearer to the coast of China, the distance being 500 miles, whereas 100 miles barely separate Japan from the continent at Korea.

The next item of importance is the description of the "extraordinary richness of the sovereign's palace," and the general wealth of the island in gold, silver, and precious stones. These descriptions may be considered as partly fabulous, but, however, have always referred to Java. Ptolemy's Jabadiœ, or Sabadibe, identical with the Sanscrit Jawa Dwipa, which is now known beyond doubt to refer to Java, is, both in Ptolemy's descriptions and in the Hindu poem Râmâjana, described as abounding in gold and silver. Odoric of Pordenone gives a description of the king's palace in Java, almost in Polo's words, when speaking of Cipango. Marco Polo then describes various customs, and gives a graphic account of a military expedition sent against Cipango by the great Khan Kublai.

All the customs referred to are applicable to Java, especially the burning of the dead, practised to this day. The great Khan Kublai

may have sent military expeditions to Japan. We know for certain that he sent several to Java, and the one described by Marco Polo bears many signs of having been sent to Java or some island of the Eastern Archipelago. The date coincides approximately with one of the expeditions sent to Java. But a stronger reason for believing that it was sent against the Javanese is given by the reference made to "the efficacy of a diabolical charm, consisting of a jewel or amulet introduced into the right arm between the skin and the flesh," and according to which combatants "were rendered secure from the effects of iron, either to kill or wound." We have here an essentially Javanese belief, which is common also to several islands of the Eastern Archipelago. Nicolo de' Conti describes it thus: * "Et nell' isola maggior di Giaua dice hauer inteso che vi nasce vn' arbore, ma di rado, in mezzo del quale si trova vna verga di ferro motto sottile,

* Ramusio, 'Delle Navigazioni et Viaggi,' fol. 344 F., date 1563.



et di lungezza quanto é il tronco dell' arbore, vn pezzo del qual ferro é di tanta virtù, che chi lo porta adosso che gli tocchi la carne, non può esser ferito d' altro ferro, & per questo molti di loro s' aprono la carne, & se lo cuciano tra pelle & pelle, & ne fanno grande stima." "The island of Java, called *Major*, produces a tree of great rarity, in the middle of which there is found an iron rod, very thin, and as long as the trunk of a tree. He who carries about him a small piece of this iron rod, so that it may touch his flesh, is invulnerable by iron, and for this reason many persons open their skin and insert it in their bodies. This is esteemed of the highest importance by them." *

The third chapter bears the title "Of the Nature of the Idols worshipped in Zipangu, and of the People being addicted to Eating Human Flesh." It is hardly necessary to refer here to the Hindu figures representing deities, or idols, as they were called. The ruins of Singha Sari and other antiquities of Java, with their Hindu mythological figures, have been well described by some few authors. In Raffles' 'Java,' all the figures erroneously attributed to Japan may be seen, from the Brahman bull, the human figures with elephants' and other animals' heads, to the figures of Hindoo deities, each double-headed, three-headed, or four-headed, and with several pairs of arms.

It was, no doubt, to the worship of these idols that the inhumanity, supposed or otherwise, of the people of Java was attributed. Nicolò de' Conti ('India in the Fifteenth Century,' p. 16), describing the inhabitants of Java, says, "The inhabitants of these islands are more inhuman and cruel than any other nation. . . . They exceed every other people in cruelty . . ." Zudovico Barthema, writing about sixty years later in 1503, is less sparing in his appreciation of the Javanese. He consecrates chapter xxviii. of his book of travels to "their cruell manners in selling their parentes to the Anthropophagi to be eaten." †

In the fourth chapter Marco Polo describes the "Sea of Chin," between Zipangu and China. This chapter is conclusive; it is impossible to make out that it treats of any other locality except Java and its eastern prolongation of islands. In all contemporaneous writings and maps the "Sea of Chin," or Chinese Sea, extends from Java and the Spice Islands to the shores of China. This is the sea in which the Chinese junks performed, and perform to this day, their annual navigations, sailing along the coasts of Anam, and thence to Singapore, Sumatra, and Java, etc., and returning with their freights when the favourable monsoon set in. It is curious that Marsden, in his edition of Marco Polo, did not notice what discrepency there was in assuming Cipango to be Japan, when in his own words, commenting on the homeward-bound voyages of the Chinese junks, he says, "Such also at the present day is the

* The travels of Nicolò Conti, in 'India in the Fifteenth Century,' edited by R. H. Major, for the Hakluyt Society, p. 32, anno 1857.

† 'Voyages of Vertomannus,' A.D. 1503 (Richard Eden), p. 232. Aungervyle Society's edit., 1884.

state of navigation amongst the Chinese, whose junks are employed in trading to Java (*sic*) and other islands of the Archipelago, but, not being adapted either by their construction or mood of rigging to work against a contrary wind, require two monsoons for the performance of their outward and homeward-bound voyages. The account here given of these periodical winds is substantially correct. In the China seas the north-east or winter monsoon, being that which is favourable for sailing from the southern ports of China to the Straits of Malacca or Java, commences about the month of October or November, and lasts till about February or March; the south-west monsoon sets in about April or May, and blows till August or September, during which latter season the junks return homewards."

In conclusion, one small item requires elucidation; the name "Cipango" does not appear to bear much resemblance to Sumbawa. But both names, the one derived from the literature of Marco Polo, and the other derived from the cartography of Sumbawa, have at least a dozen different orthographies, and Cipango and Sumbawa are perhaps the most opposite. If we make a more homogeneous choice, we shall find Zimpagua instead of Cipango, and Zimpagu instead of Sumbawa, the latter name being the one given to Bali in close proximity to Java in Fra Mauro's Mappamundi.

BARON TOLL'S EXPEDITION TO ARCTIC SIBERIA AND THE NEW SIBERIA ISLANDS.

At the meeting, January 24, of the St. Petersburg Academy of Sciences, Baron Toll read a report on his interesting expedition.

In 1889 the Academy had received from a merchant, M. Sannikoff, information to the effect that the body of a mammoth had been discovered under the 73rd degree of latitude, on the Balakhna river, which flows into Khatanga Bay; and it at once invited Baron Toll to take the leadership of an expedition for the investigation of the discovery. The bad state of Baron Toll's health compelled him, however, to decline the offer, and M. Chersky was sent out to make collections of post-tertiary mammals in the far north-east, on the rivers Yana, Indighirka, and Kolyma. After Chersky's untimely death, the proposal to start for the Khatanga was renewed to Baron Toll, and it was decided that he would not only examine the mammoth find—which, after all, might prove to be of no importance—but also make a general exploration of the very little known Anabar region. He left St. Petersburg on January 2, 1893, in company with Lieutenant Shileiko, who undertook the topographical and astronomical work of the expedition, as well as the magnetical observations.

At Irkutsk the explorers learned from Mme. Chersky (who had accompanied her husband during his last journey) that the mammoth

had been discovered much further east than had been supposed—40 miles south of Svyatoi Nos, the starting-point of Dr. Bunge's expedition to the New Siberia Islands in the year 1885. On March 21, the explorers left Irkutsk. They soon reached the Aldan, whence they began to travel in reindeer sledges. The Verkhoyansk range was crossed by the Tukuran pass, 5000 feet high, and from Verkhoyansk the explorers went westwards, across the Omoloi mountains, to Kazachiye village, which was reached on April 8. Talking there with his old acquaintances, Baron Toll came to the conclusion that he would be able to make in this same spring an excursion to the New Siberia Islands, travelling in dog-sledges on the ice. He started immediately after Easter, with M. Sannikoff and several men, to visit the place where the mammoth body had been seen, 170 miles north-east of Ust-Yansk. Four days later they were at work, and in two days the men, who already had won some experience in this sort of work during a previous expedition, had reached the mammoth. However, Sannikoff's hopes were not fulfilled. Only small pieces of the skin, with the wool thereon, parts of the extremities, and the lower jaw of a young mammoth were unearthed. The skull had long since been broken, and the tusks had, of course, been taken away. These relics were all lying in recent alluvial sands, deposited by the Sanga-Yuryakh river, which had washed them out from the underlying post-tertiary beds. It was thus decided to return later to the spot, when it would be free of snow, and in the mean time to pay a visit to the islands.

On May 1, MM. Toll and Shileiko, accompanied by one Cossack and three Lamutes, left the mainland and landed on the south coast of the Malyi Lyakhov island. Exploration was begun at once, and at the very start M. Toll came across the interesting fact that under the perpetual ice, in a sweet-water deposit, which contained pieces of willow and bones of post-tertiary mammals (the mammoth layer), were complete trees of *Alnus fruticosa*, 15 feet long, with leaves and cones. It was thus evident that during the mammoth period tree-vegetation reached the 74th degree of latitude, and that its northern limit stood at least three degrees farther north than it stands now. The importance of this discovery is self-evident.

Moreover, at this spot, as well as during further exploration, especially on Kotelnyi Island, the origin of the thick layers of ice which are seen everywhere under the sweet-water post-tertiary deposits of the New Siberia Islands could finally be settled. It was obvious that this ice did not originate from snow; it has everywhere a granular structure, and must be thus considered as originating from the ice-sheet of the Glacial period.

The geological history of the archipelago during the Devonian period could also be surmised. As to the present conditions of climate and animal life, they appeared under a quite different aspect from what

they were in 1886. In that year, even on May 13, the temperature was 6° Fahr.; while in 1893 it was raining on May 6 on the Great Lyakhov island. True, this was the first rain of the season, and it was followed by snowstorms, but it was a forerunner of summer. In reality, on the Kotelnyi island, the west coast of which was followed by the expedition as far as 75° 37' N. lat., the first winged guests made their appearance in the middle of May; the gulls first (*Larus argentatus*), then the geese, the Turfans (*Sommateria spectabilis*), the *Tringa islandica*, the Robber Gull (*Lestris pomarina*), and others. The latter found plenty of food in the mice (*Lemmus obensis*)—the only winter inhabitants of the islands. The mice displayed a feverish activity; some of them migrated from one island to the other, others migrated to the continent, while others again came from the continent to the islands. White bears were met with frequently enough. One of them, an old giant, well fed on mice, was killed by Lieutenant Shileiko, and food was thus obtained for the dogs, with which—having no proper food (dried fish)—the party had to share the wild reindeer killed by the clever Lamute hunters.

On the return journey frosts became less and less frequent, and the travellers had themselves to drag their sledges, as the *toroses* (heaps of ice), which are well cemented together by hard snow during the winter, were now loose, protruding amidst a loose snow or surrounded by water. Still, the return journey, 150 miles, was performed without accident, and all the instruments and collections were safely landed on the mainland on June 8.

The second part of the journey, over the *tundras* and across the Khara-ulakh range to the Lena, was accomplished on reindeer-back, the expedition only dividing into two parties at Aijergaidakh, as Baron Toll had to revisit the mammoth spot. Now that the snow had gone, it was further confirmed that only parts of an incomplete corpse were buried at this spot; no further relics could be unearthed.

The ride on reindeer-back, from the Svyatoi Nos to the Lena, a distance of 800 miles, proved that the *tundras* can be crossed at any time of the year if the traveller rides a good reindeer, which easily crosses the most swampy places, and when he has in addition, for crossing the rivers, a *vyetka*, that is, a boat made out of a poplar tree, or of three larch planks. During this journey the two explorers had again an opportunity of making a fuller acquaintance with the peculiarities of the polar climate. In July, at the shores of the Arctic Ocean, in lat. 72°, the temperature was 93° Fahr. above zero, and the sky remained quite clear all the time, thus favouring very much Lieut. Shileiko's observations; however, the heat made them suffer a great deal from the gnats.

After having crossed the Khara-ulakh range in two separate parties, they met together at Kumakh-sur, where they took a boat, in order to descend the Lena and to explore its delta. The weather was not very favourable on account of wind and rain; nevertheless, they sailed with-

out accident past the steep rocky banks of the great river and its islands, which are dangerous, especially at Tas-ary, there being not one landing-place for scores of miles. During the stoppages, interesting palaeontological collections, chiefly Triassic, were made, and some interesting photos of ice-banks were taken. The delta was crossed by following one of the countless branches of the river, one which was not marked on the maps. Only owing to the great experience of the boatman could they reach without accident the mainland at the Olokhon-Cross, whence they had only 66 miles to cover in order to attain the mouth of the Olenek.

Bolkalakh was chosen as a spot for accurate determinations of its astronomical position and a basis for further surveys. But while Lieut. Shileiko was at work, Baron Toll was making excursions in the neighbourhood. He re-established the cross on the grave of the great explorers of the last century—Pronohishcheff and his wife—who died here from scurvy in 1737, and he made collections of Triassic and Chalk fossils, first discovered here by the late Czekanowski, the spot giving an excellent basis for the further geological exploration of the Anabar region.

On August 24, they started westwards in a long caravan of nearly fifty reindeer, in order to explore a region which had not been visited by a European for more than 150 years, since the times of Lapteff and Pronohishcheff. They had only one guide, a Dolgan, and five Yakuts. The chief aim of the expedition, the bay of the Anabar, was reached on September 2, at Cape Buskhaya. Good weather soon set in, and for a full month they had a succession of bright and warm days. Lieut. Shileiko was thus enabled to make a fundamental survey (compass and distance-measurer) of Anabar Bay, as well as of the Anabar river, as far as the mouth of the Uja, at the limits of tree-vegetation—that is, for a distance of 270 miles. At the same time, the high crags of the bay and the river (attaining in places heights of 300 feet) afforded Baron Toll the possibility of obtaining a full picture of the geological structure of the region, and to gather a rich collection of the fauna of the Lower Chalk deposits, of which the plateau between the Lena and the Anabar, and probably also the country farther north, up to the Khatanga, is composed. In the five different horizons of the Lower Chalk, which he thus investigated, he found all the Mesozoic fossils, and especially the ammonites of doubtful age which had previously been found in North Siberia, either isolated or in boulders, and thus he was enabled to ascertain their proper place in the succession of fossils of that age. The question as to whether the Boreal part of the Jurassic sea reached what are now the coasts of Siberia, will probably have to be answered in the negative.

As to the distribution of land and sea in post-tertiary times, the coasts of the Anabar bay, especially at Buskhaya, are very instructive. In one cliff, one may see that the Lower Chalk deposits are covered with a layer of angular boulders, twenty feet and more in diameter,

together with smaller ones, many of them being polished and scratched. They consist of a dolerite basalt, which appears *in situ* only 270 miles above Buskhaya. This layer cannot be considered as anything else than a moraine. It is covered by a layer of granular ice, which is covered in its turn by a layer of loess. Traces of glaciation which had not been hitherto discovered in Northern Siberia are thus evident, and the boulders which were found by Middendorf and Fr. Schmidt in the region once invaded by the post-tertiary sea, are boulders which have been washed by the sea out of the glacial deposits.

After having completed their work on the Anabar, the explorers, instead of returning by the already known route to Bulun, preferred to take a new one, and to connect their surveys with the well-known spot, Dudinskoye on the Yenisei, which is well connected by surveys with Turukhansk and Yeniseisk. However, Baron Toll had still to go first back to Bulun, in order to settle his accounts with the tradespeople who had advanced supplies for the expedition, and to take his collections, which had been brought in the mean time from Kazachiye to Bulun. As to Lieut. Shileiko, he lost no time in moving westwards:—towards the great lake Olokhon-kol, and thence to the entrance of the Popigai into Khatanga bay, and up the Khatanga river, in order to meet Toll at Khatangskoye village. So they parted on September 30, in full summer weather; but four days later, the *tundra* was so well covered with snow, that the journey could be continued on sledges. This was a great comfort after having made a ride of no less than 2000 miles. On November 5, Baron Toll was back on the Anabar, after having been at Bulun and stayed there for full ten days. Moving westwards, he crossed the plateau which separates the Anabar from the Khatanga and is watered by the Popigai and the Bludnaya, and is formed of a mass of dolerite basalt. The days grew shorter, snowstorms were not unusual, and the frosts attained 53° Fahr. below zero. Nevertheless all went well, and on November 16 the two explorers met at Khatangskoye, both in good health.

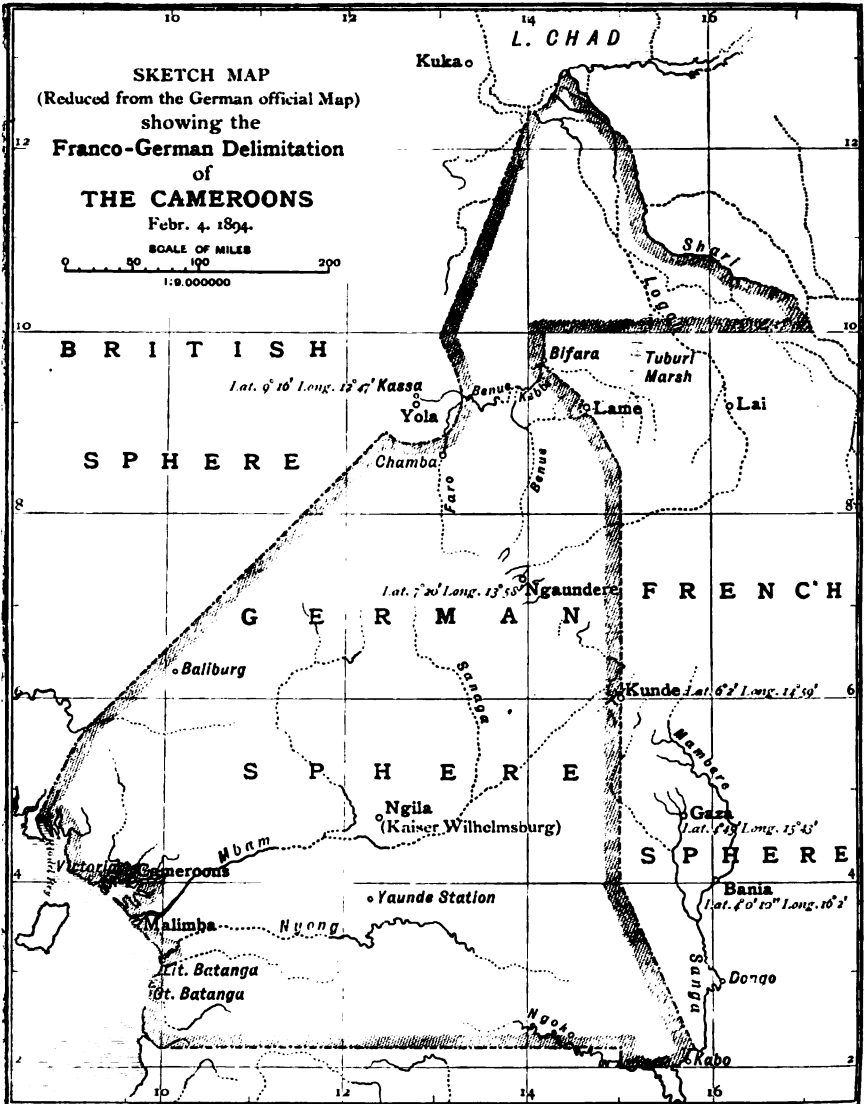
Thence they started for their home journey, which they accomplished with remarkable rapidity. It took them only ten days to reach Dudino (or Dudinskoye), on the Yenisei, and one month to reach Yeniseisk. Twenty-three days later they were at St. Petersburg, the whole journey from Khatangskoye having thus taken only fifty-three days.

The results of the expedition are—over 3000 miles of survey, based upon thirty-eight points, astronomically determined; nine months of meteorological observations in the *tundras*; hypsometrical measurements along the whole of the route; 150 photographs; and very rich collections, botanical, zoological, and ethnographical.

Nothing need be added to show the importance of this extraordinarily successful expedition, during which the arctic *tundras* have been explored by two such excellent explorers for nearly fifty degrees of longitude.

THE FRANCO-GERMAN TREATY AND THE "HINTERLAND" OF CAMEROONS.*

THE dispute between France and Germany about the Hinterland of the Cameroons Protectorate has been settled by a convention signed at



Berlin on February 4. The boundary, as now defined, begins on Lake Chad, at the mouth of the Shari, ascends the river to Lat. 10° N., and

* For the Anglo-German Arrangement, see *Geographical Journal*, January, 1894.

then follows that parallel to the meridian of Bifara, a village at the head of the navigation of the Mayo Kebbi, one of the headstreams of the Benue. That place, as well as Lame to the south-east of it, is allotted to France. From the latter the boundary follows a straight line to the intersection of the parallel of $8^{\circ} 30'$ N. and the meridian of 15° E. of Greenwich. The meridian mentioned forms the boundary as far as Kunde, but further south it is to be formed by a line passing 43 geographical miles to the west of Gaza and 62 miles to the west of Bania, and reaching the river Sanga at a point $18\frac{1}{2}$ miles to the north of where it crosses the parallel of 2° N. It then follows that parallel to the Ngoko, a western tributary of the Sanga, and finally passes along that river to its intersection with the old boundary-line, which reaches the coast at the Rio Campos.

The important ivory marts of Kunde and Gaza have thus been assigned to France, whilst Germany has been conceded access to the navigable Sanga, a tributary of the Congo. In laying down the boundary no notice whatever has been taken of existing political or tribal divisions, and Adamawa now lies within three European "spheres," those of England (who holds the capital, Yola), of Germany, and France. The total area of the German Protectorate of "Kamerun," as the name is spelt in German official documents, is 188,400 square miles, accepting the boundaries as they are delineated upon the map accompanying the treaty.*

THE SAHARA.†

DR. SCHIRMER has done good service in summing up in a convenient form our present knowledge of the Sahara. His work includes an investigation, on the one hand, of the causes which have brought about the existing facts of its physical geography, and, on the other, of the influence exercised by such physical characteristics on the life of its inhabitants. The results being arrived at by a careful examination of the whole body of facts accumulated by the labours of explorers and geologists, or to be gathered from the writings of historians, it may be taken as a trustworthy exposition of the conclusions which the present state of our knowledge allows us to form.

The old theories as to the origin of the desert are proved incorrect by what we now know of the variety both of geological formations and of relief. It is in the *régime* of the winds (though not in the way originally supposed) that the true explanation is to be found. The

* We need hardly mention that the Portuguese discoverers of the coast of the modern Protectorate called the principal river Rio dos Camaraões, or Shrimp river. The transfer of such an application to a mountain or a vast territory cannot be called a very happy idea.

† 'The Sahara,' by Henri Schirmer. Paris, Hachette, 1893.

Sahara is, in fact, a monsoon region, with a general influx of air-currents in summer, and divergent winds or calms in winter. In the latter case dryness results as a matter of course, while in the former the greater contrast in temperature with the Mediterranean in the north than the Sudan in the south causes a preponderance of the northern monsoon, and although this blows from the sea, it is by its very direction a dry wind. Secondary causes, such as the barrier formed by the Atlas range, also add their effect. The mountainous regions, however, such as Aixaye Tibesti, are favoured with regular summer rain, and in other parts occasional storms arise from upward currents by which the lower strata of the atmosphere are cooled. The intense evaporation leads to a progressive diminution and concentration of surface waters, giving rise to the *Chotts* and *Sebchas* so common in the desert, while the original relief of the ground, due to running water, has since been modified by other agents, notably the atmospheric disintegration of the rocks, and the erosion and transport of material by the wind. Vast accumulations of sand-dunes and chaotic forms of surface result, by which the ancient hydrographic systems are often completely masked. The water which falls in the mountains makes its way for long distances underground, the position of artesian springs being determined by the structure of the ground. Much water is often found beneath the sand-dunes, in which it is held as in a sponge. With reference to the opinion which has been held, that the climate has changed within historic times, Dr. Schirmer gives cogent reasons for thinking this unlikely, an important one being the great specialization of the Sahara flora, necessarily the work of a great length of time.

An interesting chapter is devoted to the flora and fauna, and to the special means by which these adapt themselves to the extreme temperature. Coming next to the human inhabitants, while it is impossible yet to decide whether the Berbers were the original occupants, the author shows on what insufficient grounds the idea has found favour, that traces of a distinct race with negro affinities exist, these occurring chiefly along the main caravan routes, where a constant movement of negro slaves has taken place. The existing races have adapted themselves to the climate, which with a suitable diet is decidedly healthy, and, although of spare habit, are noted for the power of resisting fatigue and for longevity. The moister oases are less healthy, and the dark colour of their inhabitants is probably due to the greater power of resisting malaria shown by the negro element. The broad division of the population is that between nomads and the stationary element. The general characteristics of the desert all invite to the former mode of life, which, however, can only be maintained when reinforced by the proceeds of plunder. The inhabitants of the oases, with their various appliances for cultivation, are more advanced in civilization, but are always at the mercy of the nomads, and often live in relations of servitude to them.

A general state of misery and decadence results, and the supply of necessaries never comes up to the demand.

This want can only be supplied by commerce, which the two staples of the desert, dates and salt, render possible. Besides the local interchange of products, the portion of the Sahara between Europe and the wholly different world of the Sudan, has led to a transit trade across it, which was probably carried on as far back as the Roman epoch. According to the features of the country, natural routes, such as that from Fezzan to Lake Chad, have come into use; and from the writings of the Arab historians, Dr. Schirmer traces the vicissitudes to which the chief of these have been subject since the ninth century, A.D., according as the rise or fall of native empires (such as that of Melli) have brought one or another into prominence. The trans-Saharan commerce has a complex organization, and requires much mutual co-operation, the merchants subsidizing the nomads, to secure their good-will and protection. The volume of trade, however, is surprisingly small, judged by modern standards.

The concluding chapters deal with the history of European enterprise in the Sahara, and the possibilities of future development by France, the subject of the proposed trans-Saharan railway being carefully considered. The author shows the exaggerated notions which prevail as to the wealth of some of the countries which it might tap—especially Timbuctu and the Central Niger, for which, moreover, the Senegal is the natural outlet. The Haussa countries, on the other hand, are held by England. Thus, although the hostility of the natives makes the railway the only feasible way of opening the country, one must not be too sanguine as to the advantages to be gained. While all schemes for the general reclamation of the Sahara must be viewed as visionary, much may be done by Europeans in the way of improved cultivation of the oases.

Some excellent illustrations are given, showing typical forms of Saharan scenery.

THE EXPLORATION OF THE LUKUGA.

THE mystery of the Lukuga exists no longer since M. Delcommune has traced that river from Kalumbi, the furthest point reached by Mr. Joseph Thomson in 1879, to its confluence with the Lualaba. M. Delcommune, with his companions Dr. Briart and Didderich, reached Lake Tanganyika on August 20, 1892. It was his intention to trace the Lukuga from the point where it leaves the lake, but the disturbed state of the country prevented this plan from being carried out. In consequence of this state of affairs he was compelled to make his start from Mpala, much further to the south. Having left that place on October 6, 1892, he

reached Kalumbi on the 21st, and thence followed the river as far as the Lualaba, reaching the confluence on November 13.

The upper Lukuga traverses the Kakazi Hills in a gorge bounded by steep rocks rising to a height of a thousand feet. Near Wakensa's village, about 30 miles below Kalumbi, and 90 miles from the lake, the valley of the river widens and becomes marshy. Soon, however, the river once more flows through hills, and forms rapids, until at Bulu, only 35 miles from the Lualaba, it finally enters a broad plain, and divides into numerous branches enclosing large islands between them. The total fall of the river between the lake and the Lualaba, a distance of 235 miles, amounts to 1035 feet.* The river is navigable only below Bulu, and its volume was found to be very small, although there is evidence that immense floods rushed down it at some previous epoch. Rocks, the surface of which had evidently been smoothed by water, now rise as much as 25 feet above the present level of the river; whilst shells, carried down from Tanganyika, are discovered far away in the valley. Everything tends to prove that the Lukuga was not always an outlet of the lake, but only became so at a time when the latter had risen to an extraordinary height, and its pent-up waters forced themselves a passage through this the weakest portion of the enclosing rampart of hills. At its mouth the Lukuga was found to be 187 feet wide, and 5 feet deep, and its discharge amounted to 50 cubic meters a second. This, however, was in the middle of November, in the dry season.

The country to the south of the Lukuga consists of a succession of undulating plains with scattered clumps of trees, and irrigated by numerous streams. The Baluba, who inhabit this country, are nominally dependent upon Simbo, one of Msiri's sons, who resides at Ankoro, on the Lualaba, 70 miles above its confluence with the Lukuga. They are a brave people, and with their bows and poisoned arrows have victoriously repelled the Arabs. On the middle and lower course of the river the population is very dense, and the villages are surrounded with plantations of manix, and there are also a few groves of bananas. The first oil palm was observed near the Niemba, a southern tributary of the Lukuga, at an elevation of 2750 feet above the sea. Goats and poultry abound, and the Lukuga swarms with hippopotami and crocodiles.†

* Assuming Lake Tanganyika to be 2665 feet, as computed from several months' barometrical observations by Mr. Popelin, and the confluence to be 1630 feet as determined by M. Delcommune. According to Captain Stairs, the lake-level is 2654 feet.

† *Le Mouvement géographique*, No. 7, 1894.

THE MISSING SWEDISH EXPEDITION.

MR. STEIN has announced that his expedition has been postponed. Consequently all hope of succour for the lost Swedish explorers, Bjorling and Kallstenius, has had to be abandoned through that agency. Mr. Nilson has, however, left Dundee as a passenger on board the whaler *Eclipse*, in the expectation of being able to reach Cape Clarence next July or August. Dr. Ohlin has also proceeded to St. John's, Newfoundland, in the hope of obtaining a passage in another whaler. The *Aurora* is expected to return to St. John's on April 25, but it will not be decided until then whether she is to extend her voyage to Baffin's Bay this year. If not, Dr. Ohlin hopes to obtain a passage during the summer in the *Falcon*, when she goes north to bring back Mr. Peary's party.

The President appealed for subscriptions to the "Björling Relief Fund," in a letter to the *Times* of April 7, being anxious to help the Stein expedition, as well as to send a contribution towards the aid of such measures as were adopted in Sweden to succour the gallant young explorers or to ascertain their fate. As the Stein enterprise is postponed, the proceeds of the "Björling Relief Fund" will now be entirely devoted to the latter object; and those English geographers and Arctic officers who have subscribed will thus be able to show their sympathy for the fate of the two young martyrs in the cause of science. It must be remembered, also, that the two men who are with the Swedish explorers are Britons. The name of one is Gilbert Dunn; of the other, Herbert Macdonald.

It is necessary, for the efficient performance of the duty connected with these lost explorers, that a vessel adapted for ice navigation should at once be bought or hired, that a proper commander should be found, and that she should be despatched to Baffin's Bay. After visiting the Cary Islands, her orders should be to proceed direct to Cape Clarence, and obtain the information contained in Bjorling's cairn. Her commander's future proceedings will subsequently be guided by the record in the cairn. It will be necessary to make a thorough search northwards from Cape Clarence to Cape Faraday, and southwards to Jones Sound. Having rescued the missing men, or ascertained their fate, the vessel would return in the autumn.

Two British subjects, lost under such circumstances, cannot be abandoned to their fate without something very like discredit to this country, and the deadly peril surrounding the brave young Swedish heroes concerns every civilized people in the world.

THE MONTHLY RECORD.

THE SOCIETY.

The Duke of York.—At the meeting of the Council of April 9, H.R.H. the Duke of York was elected an Honorary Member of the Society. At the same time it was resolved to request His Royal Highness to allow himself to become an Honorary President of the Society. The Duke has been graciously pleased to accede to this request.

Royal Medals and other Awards for 1894.—The Royal Medals of this year for the encouragement of geographical science and discovery have been awarded by the Council as follows:—The Founder's Medal to Captain H. Bower, for his remarkable journey across Tibet, from west to east. The Patron's or Victoria medal to M. Elisée Reclus, for the eminent services he has rendered to geography, as the author of the 'Nouvelle Géographie Universelle,' which has just been completed in nineteen volumes after labours extending over twenty years. The Murchison Grant has been awarded to Captain Joseph Wiggins, for his services, extending over a quarter of a century, in opening up the Kara Sea route to Siberia, and the navigation of the river Yenisei. The Back Grant to Captain H. J. Snow, for his rectification of the chart of the Kuril Islands, the result of observations made during many years' voyages. The Gill Memorial to Mr. G. E. Ferguson, a native of Sierra Leone, for important cartographical work in West Africa. The Cuthbert Peek Memorial to Dr. J. W. Gregory, on account of his journey to Lake Baringo and Mount Kenia, and the series of useful scientific observations made by him. The three Honorary Corresponding Members chosen are, Dr. H. Mohn, Director of the Meteorological Institute, Christiania; Mr. Justin Winsor, Librarian of Harvard University; and Mr. Frederick Jeppe, of Pretoria, South African Republic.

The Remainder of the Session.—The following arrangements have been made for the evening meetings during the remainder of the Session:—On May 7 Colonel Sawyer will give an account of his journeys in the Bakhtiari country; on May 21 an extra meeting will be held to hear Mr. Theodore Bent's account of his recent expedition to Hadramaut, South Arabia; on June 18 Dr. H. R. Mill will describe the results of his survey of the English lakes; and on June 25 Dr. G. S. Robertson will give some account of Kafiristan, in which he has resided for so long.

Honour to the Society's Librarian, Dr. Mill.—The Royal Society of Edinburgh has awarded the Makdougall-Brisbane Prize, a gold medal, to Dr. H. R. Mill, for his researches on the physical geography of the Clyde Sea area, which extended over nearly three years. The results were communicated to the Royal Society of Edinburgh in three parts:

I. Physical Geography; II. Salinity; III. Temperature. The first two have been published in the *Transactions R.S.E.*, and the third is in the press. The main features of the work are the elucidation of the effect of configuration on the seasonal march of temperature in water, and of the action of large bodies of water in modifying the climate of the surrounding land.

The Anniversary Dinner.—The anniversary dinner of the Society will be held in the Whitehall Rooms, Hotel Metropole, on the evening of the anniversary, May 28th. Full particulars will be found in the Notice to Fellows on p. iv of the advertisement pages.

EUROPE.

Bathymetrical Survey of Haweswater.—Dr. H. R. Mill and Mr. E. Heawood continued their systematic soundings in the English lakes by a survey of Haweswater in the last week of March. This lake is particularly interesting on account of its situation and outline. It is the highest of the English lakes, having its surface 694 feet above Ordnance datum, and occupies the lower end of a narrow valley, the sides of which slope steeply, and the upper end as well as at least one tributary valley bear evidence of the former existence of lakes of similar form. About one-third of Haweswater at the lower end is nearly cut off from the rest by a great delta formed by the Measand Beck, and is named Low Water, while the rest of the lake is called High Water, and the narrow channel connecting the two is termed the Straits. Low Water was found to be very shallow, only a small patch near the Straits being over 25 feet in depth, and in that there was one sounding of 52 feet. High Water presents the usual features of a mountain lake, being a narrow, steep-sided, almost flat-bottomed trough. Near the centre there is a small area, the depth in which exceeds 100 feet, but the deepest sounding found was only 103 feet. Thus Haweswater, so far from being the deepest lake, as was formerly supposed, is surpassed for shallowness only by Derwentwater, Bassenthwaite, and Buttermere. Wastwater, Windermere, Ullswater, Conistone, Ennerdale, and Crummock, are all deeper. A complete account of the soundings made in the lakes, and a discussion of their bearing on the geography of north-western England, will be presented to the Royal Geographical Society at an early date.

The Geology of the Alps.—In connection with the London University Extension Classes, a course of ten lectures was recently delivered at Croydon, by Miss M. M. Ogilvie, D.Sc., on "The Geology and Scenery of the Alps." This is probably the first occasion on which the subject has been fully and systematically treated before an English audience. In April, 1884, Prof. Bonney gave a lecture before the Royal Institution on "The Building of the Alps" (*Nature*, vol. 30, pp. 44, 65); which is still most useful as a general summary of the subject, but so wide a question could not be fully discussed in one lecture. Miss Ogilvie proposes to arrange her lectures for publication; the result will be most welcome, as no separate work on the subject exists in the English language. The three introductory lectures were devoted to general questions bearing on the main subject—denudation, sedimentation, volcanic phenomena, Earth-movements, general structure of mountain-ranges, etc.; the fourth gave a short sketch of the Alps as a whole; four lectures discussed the various areas in detail—Western Alps, Eastern Alps, Bavarian Alps, and North Tyrol, "Dolomites" of South Tyrol. The ninth lecture was devoted to the Mid-Tertiary and succeeding epochs of transition in the Alps; the last lecture gave a wider view of mountain-structure, more especially of the various mountain-chains of Europe. The relation of geology to physical geography was discussed

throughout; the nature of the rocks, the foldings to which they have been subjected, and the enormous denudation which the area has undergone, being clearly brought out. Reference was also made to the influence of geological structure in determining the distribution and history of the people and lines of communication.

A Caucasian Guide Book.—Mr. Douglas Freshfield, with the assistance of Mr. Mummery, Mr. Woolley, and other recent travellers in the Caucasus, has in preparation a Climber's Guide to the portion of the Caucasian chain between Kasbek and Elbruz. It will contain a complete table of routes from England, with time-tables, cost, and a selection of routes to the mountain centres from the chief towns on both sides of the chain, as well as such details as to the topography of each district and the expeditions already accomplished as can be collected from mountaineering journals. Four district maps will be given, and probably a few outlines from Signor V. Sella's panoramas. As two of the maps, originally produced for the Royal Geographical Society, have been taken off the stone, the edition will be necessarily limited to 150 copies. It is hoped that the book will be issued in the spring of 1895.

ASIA.

Mr. Bent's Expedition to Hadramaut.—Two letters have been received from Mr. Theodore Bent reporting the successful termination of his expedition to Hadramaut. The first, dated Shehr, March 7, 1894, says: "We have again reached the coast after manifold adventures in the interior. We managed a journey north of the Hadramaut valley, which brought us to the sand and the confines of the great central desert. Here we found a ruined city, and one of the sacred places of the country which interested us. Then we got two tribes to take us eastwards to some valleys running north into Hadramaut, and then we came back here by another and, as it proved, very dangerous road. We were fired at from places by hostile villagers, and on one occasion the bullets struck close to our horses, but luckily no one was hurt. We had endless difficulties with our camelmen and guides, and at one time our position looked exceedingly serious. The Sultan here has received us very well, and is arranging for another trip eastwards, which will take us about a fortnight; we shall then proceed by dhow to Aden on our way home. I hope by the end of April we shall be in England. Imam Sharif (the Indian Surveyor) has made an excellent map of all the country we have passed through, and our botanist and naturalist have done good work, so I hope we shall be able to give a good account of ourselves when we return." The second letter is dated Aden, March 28. "Here we are back again, safe and sound. We made another expedition nearly to Seehut, which gave us the bearings of the Hadramaut valley to the coast, but it was not attended with much archaeological success. Most of the ruins appear to be further inland; however, we have a good supply of them from the other expedition, and this latter was topographically of value. Imam Sharif has done his mapping splendidly, and is preparing me a rough tracing of his work here, to be followed by a more detailed edition, when he has had time to work up his observations carefully in India. We have to wait here for a boat till April 8, and shall not be home before the 24th. However, we rather want a rest, and Mrs. Bent wants time to develop her photographs." Meantime Mr. Bent has returned to England, and will give a paper on his journey at an early meeting of the Society.

Demarcation of the Indo-Afghan Frontier.—One of the arrangements recently arrived at between the Amir of Afghanistan and Sir Mortimer Durand relates to the demarcation of the contiguous districts of the two countries on the Indian north-western frontier. Three officers have been appointed for the Khaiber, Kuram, and Baluchistan sections respectively, the political officer in the Khaiber

being in charge of the first. Here the border-line west of the Sitsobi Pass, at the head of the Bara valley, already follows the crest of the hills to the Safed Koh, overlooking the Kuram valley. East of Landi Kotal a line will have to be drawn to the Kabul river, a few miles below Fort Dakka and Lalpura. Hence to the southern extremity of Chitral territory, above Asmar, the boundary will be the range of hills dividing the Mohmaud country from Bajaur. In the Kuram valley Mr. Merk will start from the Sita Ram peak of the Safed Koh, and follow the crest of the hills between the Kuram and Khost rivers until the latter is struck. For the demarcation of the Waziri border, south of the Khost river, final arrangements are not yet made; but in the Zhob valley, Lieut. McMahon, with Captain Mackenzie as survey officer, will start from Kandar Domardi, the junction of the Kandar and Gonial rivers, and demarcate the whole of the Kakar country to Chaman, and thence southwards along the Shorawak borders. The portion from Shorawak to the Helmand is reserved for next season's work.

Miss Taylor's Recent Journey in Tibet.—Mr. W. W. Rockhill has sent us some interesting notes on the route followed by Miss Annie R. Taylor in her recent adventurous journey in Tibet. Miss Taylor, with five Asiatics, started from Tan-chau, in the Chinese province of Kan-su, on September 2, 1892. After crossing the Chinese border, they soon reached the Yellow River (or Ma-chu), which was crossed at its first bend westwards, and entered the Golok country, which is described as treeless and very hilly. Passing through the Sa-chu-Ka country, the party at length reached the Dre-chu. From Gala, a small town on the other side of the river, the route lay over the Rab-la, described as one of the most difficult passes in Tibet, to the large and important town of Ke-gu. Leaving Ke-gu, the tea road was followed as far as the Pau-gau Lamasery, where it was quitted for a mountainous route over the Pass O-mai, till Tash-e-Gumpa, situated on the river Tsa-chu, was reached. Having again struck the tea road, the party entered the district Damchung, watered by the Long-chu; crossing this river and the Dam-jau-er-la, one of the highest and most dreaded Tibetan passes, they at length reached the Sok-chu, the river followed up by Captain Bower on his late expedition. They were now in close proximity to the Bo-chu river, which confines the Lhasa district, the sacred province of U. Having crossed the Da-chu river, Miss Taylor's party were suddenly taken prisoners and so prevented from attaining their object. The return journey was made by way of Tash-e-gumpa, Ke-gu, along the tea road to Ta-chien-lu, and from thence down the Yang-tse river to Shanghai. In connection with this journey, Mr. W. W. Rockhill sends the following notes: "Miss Taylor, on leaving Tao-Chu (Kan-su), went to the great lamasery of Labrang (her La-ber-long), south of the Yellow River and on the border of China; thence she took a trail leading nearly due west through the southern part of the Golok country and across the upper Za (or Tsa) chu, the river which flows by Kanze, till she came to the upper Yang-tse-Kiang (or Dre-chu). She crossed this river between the point where A——K—— crossed it in 1881, and where I did in 1889. Her Tash-e-gumpa is probably A——K——'s Chioti gomba (my Chuché gomba). The Za-chu, I should say, she calls 'Sa-chu-Ka country.' Gala I am unable to identify, but it is certainly one of the numerous hamlets along the banks of the Dre-chu near Tumbumdo and Zonyik gomba (see A——K——'s and my route maps). Having crossed the Dre-chu, Miss Taylor turned south and crossed 'the Rab-la, one of the most formidable passes of Tibet, and, leaving behind us the large town Ma-ni-tang, we came to the town Ke-gu.' In 1889, when going to Jyekundo (her Ke-gu and A——K——'s Kegudo), I crossed the Taglung-la, altitude 16,650 feet above sea-level. She probably crossed this or a neighbouring pass. Her Ma-ni-tang embarrasses me—I know nothing about it, but perhaps it may be Tumbumdo; she does not say,

however, that she passed through it. Leaving Jyekundo, she probably travelled due south to near Chamdo (I heard of this route in 1889), and then, turning west, crossed the upper Tse-chu (her Tsa-chu). This river comes from the west or north-west. Then, following the eastern extremity of the great Dang-la range, she came to the Su-chu (her Sok-chu), about forty miles to the west (or north-west) of where I traversed it in 1892. From this point her route is clearer. She reached the Pon-chu (her Bo-chu), which is a large affluent of the Su-chu on the right bank, about forty miles west of my route, and thence continuing in a south-west direction, her route crossed mine a little to the east of Chingo (approx. lat. $32^{\circ} 06'$, long. E $92^{\circ} 35'$), and came some 50 miles further to the south-west on to the Dang-chu (her Da-chu), which forms the boundary between Lhasa and Jyade. Here she was about one day and a half north-east of Nag-chu-ka (her Nag-chu-ko-Kang), and on the high-road between Hsi-ning (Kan-su) and Lhasa. She was stopped by the same officials who, in August, 1892, blocked the road to Lhasa for me on the same Dang-chu, probably a day's ride higher up its course. The road she followed is indicated on my last route survey as the road to Jyekundo, and is known as the upper Jyekundo road, or Gong-lam. There are two other trails leading from Nag-chuka to Jyekundo (at least they are distinct in this part of the country), and known as the 'Middle road' (Bar lam) and 'Lower road' (Og lam). On the return journey, Miss Taylor followed from Jyekundo to Ta-chien-lu (Sa-chuan), exactly the same route as that taken in 1881 by A—K—, and by myself in 1889."

Depth and Temperature of the Lake of Tiberias.—M. Th. Barrois, during his researches in 1890 into the deep-water fauna of this lake, added much to our knowledge of the contour of its bed (*Comptes Rendus Paris Geog. Soc.*, 1893, p. 449). This was long based solely on the soundings taken by Lieut. Molyneux, R.N., in 1847, which gave the greatest depth as about 156 feet. The idea lately current that much greater depths existed, was due, M. Barrois shows, partly to an error in the seventh edition of McGregor's 'Rob Roy on the Jordan,' through the mistake of feet for fathoms, and partly to the report by M. Lortet in 1883 of depths of 820 feet, based on his dredgings when studying the fish of the lake. A number of lines of soundings taken by M. Barrois in the deeper northern part of the basin failed to reveal any such depths, which, if they occur at all, must be of the nature of a sudden abyss, such as has been found in the Lake of Annecy in France. M. Barrois's results agree well with those of Molyneux, and show that the deepest parts are in the axis of the Jordan valley and about the middle of the length. The thermometric observations also gave results agreeing with the general character of the lake as a shallow basin. They establish (1) the large daily variations of surface temperature; (2) the small depth of the zone subject to diurnal variation; (3) the uniform temperature of the deeper layers. This last is higher than in Swiss lakes of the same depth, owing to the difference of latitude and altitude, and to the existence of hot springs.

AFRICA.

Dr. Donaldson Smith's Expedition to Somaliland.—Dr. Donaldson Smith, a young American gentleman who has already been to Somaliland, is now in London organizing an expedition on a large scale, with which he hopes to penetrate from the north coast of Somaliland to Lakes Rudolf and Stefanie, and thus connect the explorations of Count Teleki and Lieut. von Höhnel with those that have been made further to the north. Dr. Smith is himself well qualified to carry out observations, and he means to take with him a scientific expert, whose work will add greatly to the value of the expedition. Dr. Smith hopes to leave before the end of May.

Mr. R. T. Coryndon's Expedition to Central Africa.—A few days ago, Mr. R. T. Coryndon, who has already had experience as a collector in Matabeleland, left England for the Zambesi, *viâ* the Cape. He means to proceed by Lake Nyasa to Lake Tanganyika. He will land on the west coast of the latter as far north as possible, and proceed to establish his camp in the Congo forest. Mr. Coryndon's main object will be to make collections in natural history, but he has qualified himself for carrying on geographical work, and as he will probably occupy his camp for a year or more, we may expect valuable results.

Machin and the Discovery of Madeira.—The romantic story of Robert Machin, an Englishman, who, in the reign of Edward III., is said to have fled his country with his lady-love, and to have been driven by a storm upon the island of Madeira, is referred to in most books dealing with the early discoveries of the Portuguese. One of the two capitania of the island is at the same time stated to have been named *Machico*, in memory of the fortuitous discoverer of the island. Azurara, in his 'Chronica' (1453), mentions a capitania *Machico*, but says nothing about Machin; Galvão (1563) gives a version of the story, but calls the adventurer *Macham*; whilst a more circumstantial version of the legend first appeared in 1660, in Manuel de Mello's 'Espanafora amorosa.' J. I. de Brito Rebello, in a supplement to the 'Diario de Noticias' of Lisbon, published in commemoration of Prince Henry's centenary, rejects the story of Machin and his lady-love as being absolutely legendary, and suggests that the "capitania" was named after *Machico*, a Portuguese seaman, who was among the discoverers of the island, and died there. In proof that a seaman of that name existed he publishes a deed, recently discovered by Sr. Ernesto do Canton in the Torre de Tombo, by which King Ferdinand gives to one *Machico*, "mestre da sua barcha," a house in the Rua nova of Lisbon. This deed is dated April 12, 1379. The *Machico*, whose name is connected with the history of Madeira, may have been a son of this master of the royal "bark."

Baron von Uechtritz and Dr. Passarge on the Benue.—This German expedition promises to become of real importance from a geographical point of view; for Dr. Passarge, its scientific member, not only supplies geological information and collects natural history data, but he likewise makes astronomical observations and prepares a good map. The expedition arrived at Akassa, at the Niger mouth, on July 9, 1893, and being favoured by the Royal Niger Company, who courteously furnished it with a steamer, was able to leave for the Benue on the 11th. When beyond Ibi it met Herr von Stetten, on his return to the coast; and on its arrival off Yola, on August 30, 1893, M. Mizon, who had arrived on August 19, was still there with his two steamers. The Sultan of Adamawa received the members of the expedition most kindly, presented them with five horses—a great distinction—and gave them permission to depart. They left Yola on October 5, crossed the Benue, and travelled by land to Garua, on the Mayo Kebbe, where they arrived on October 13. The "Sultan" invited them to establish a station. They then turned to the south-east, but when nearing Rai Baba, the capital of Bubanjida, a country no longer tributary to Adamawa, they were attacked by a strong force, largely consisting of horsemen. This attack they repulsed successfully, although their whole force only numbered 80 porters. Since then they appear to have returned to Yola, where further instructions await them. Dr. Passarge furnishes interesting information on the geology of the country traversed. Once beyond the alluvial plains of the Delta, the Niger and Benue are bounded by sandstone plateaus, which generally begin at a considerable distance from the river, and are surmounted by crystalline rocks. The valley-plain of the river is covered with loam, and many of the hills which rise within it are of volcanic origin. The soil in the sandstone region is laterite, and savannahs predominate. Near Yola and elsewhere Dr. Passarge made astronomical observations,

which considerably affect our maps of that part of Africa. The Kasa Hill, close to the Benue to the north of Yola, lies, according to Dr. Passarge's observations, in lat. $9^{\circ} 15' 9''$ N., long. $12^{\circ} 46' 5''$ E. The longitude was obtained by observing eight culminations of the moon. According to Lieut. Mizon, who observed four eclipses of Jupiter's satellites, the longitude of his camp to the east of Yola is $12^{\circ} 40' 6''$ E., which would place Kasa in $12^{\circ} 39' 5''$ E. A good map of the country between Yola and Garua is published in the *Mittheilungen aus Deutschen Schutzgebieten*, 1894, Tafel 4.

The Longitude of Tabora.—The longitude of this, the most important place on the road from the east coast of Africa to the great lakes, seems at length to have been determined with sufficient accuracy for ordinary purposes of cartography. Captain Speke in 1864 placed Kaze (Tabora) in lat. $5^{\circ} 0' 52''$ S., long. $33^{\circ} 1' 34''$ E., his longitude being computed from eleven sets of lunar distances. Dr. Kaiser, who observed a culmination of the moon, places the Belgian station, due south of the existing German station, in long. $32^{\circ} 53' 10''$ E. Dr. Rindermann made careful observations, in 1893, at a camp lying 1100 metres = $35''$ due east of the existing German station. He was furnished with a superior theodolite, and had undergone a course of instruction. His longitude is dependent upon an eclipse of the moon, which occurred on May 11, the occultation of a star, and three culminations of the moon, the result being long. $32^{\circ} 52' 23''$ E., whilst the latitude is $5^{\circ} 1' 14''$ S. (*Mittheilungen aus Deutschen Schutzgebieten*, vii. 1894, p. 66).

AMERICA.

Pre-Columbian Voyages to America.—By special permission of the Pope, the Archives of the Vatican bearing on pre-Columbian voyages to America were searched for the first time in 1892, and facsimiles of the documents found were exhibited at the Convent of La Rabida during the World's Columbian Exposition at Chicago, and discussed in a paper by Mr. W. E. Curtis, published in the *National Geographic Magazine* for January, 1894. Mr. J. C. Heywood searched for and catalogued the various documents, the most interesting of which are those relating to the Bishopric of Gardar, in Greenland, and to the line of demarcation between Portuguese and Spanish influence. According to Adam of Bremen, who died in 1076, Norwegians first reached Greenland at the end of the ninth century, and the bishopric of Gardar certainly existed in 1124. The settlements on the American continent known as Helluland, Markland, and Vinland, though not admitting of absolute identification, witness to the civilizing influence of the bishops of Gardar. Letters of Pope Gregory X. in 1174 show that part at least of America was expected to furnish money for the crusades. The Archbishop of Drontheim informed the Pope that it would take him five years to visit his archdiocese, and six years to collect the tithes. The people, besides, had no money, and no grain or fruit was grown; they could only offer, for the expenses of the crusades, skins and teeth of animals. From a letter of Pope Nicholas V., it appears that in 1418 heathen foreigners with a fleet invaded the country, burned the buildings, and carried off many of the people. Some interesting documents relate to the line of demarcation. The kings of Portugal had for many years demanded from the popes exclusive rights of discovery and colonization on the western coast of Africa. These demands were granted until they covered all the region from Ceuta around Africa to India. Columbus, believing that he had only discovered a new route to the eastern part of India, Ferdinand of Spain secured three papal letters to prevent any interference with the new claims of Spain. A letter of May 3, 1493, gave to Spain exclusive right to all lately discovered lands, and islands which might still be found if not already possessed by some Christian power. Another letter, dated May 4, gives a definition of the

famous line of demarcation; that line is fixed 100 leagues to the west and south of the westernmost island of the Azores. "To the south" was added because the region was particularly desired by both Spain and Portugal. In proposing this line to Pope Alexander VI., the Spaniards only knew that it would fall far from San Salvador, and that it might prevent jealousy on the part of Portugal if Spanish ships were kept 100 leagues from the most western of the Portuguese possessions. But the Portuguese at the same time believed San Salvador to be part of India, to which they claimed an exclusive right. In June, 1494, the demarcation-line was moved 170 leagues further west, a change which unwittingly gave Brazil to Portugal. Mr. Curtis's paper contains a translation of the text of all the letters and other documents to which reference has been made.

The Shawangunk Mountain in New York State.—Mr. N. H. Darton has an interesting paper in the current number of the *National Geographic Magazine* describing a very clear instance of rock-structure influencing geographical forms. The Shawangunk mountain in Ulster County, New York, is a long ridge undulated into longitudinal valleys, along which streams flow northward parallel to the axis of the mountain. The western edge is marked by a series of magnificent cliffs towering over gentler though still abrupt slopes. The margin of the cliff is cut into headlands, and runs back into deep bays like a sea-coast, and in some of the bays there are cliff-bound lakes of great beauty, which are popular summer resorts. Geologically the structure is simply a sheet of hard white grit, in part quartzite, in part conglomerate, and not more than 300 feet thick. This rests unconformably on a much thicker mass of soft Hudson shales; and the whole has been crumpled into a mountain-ridge and reduced by erosion to its present form. The cliff-line marks the edge of the sheet of grit, and the soft shales beneath are weathered into slopes, which are removed so rapidly by sub-aërial erosion as to undermine and cut back the cliffs at many points. Vertical jointing promotes the precipitous forms of the edge of the grit. The paper is illustrated by several sections, and an ingenious stereogram representing a model of the district dealt with, cut into six blocks, and showing at a glance both the superficial configuration and the geological structure.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

The Hydrography of Fresh Water.—In a series of articles in the *Annales de Géographie* (October, 1892, April, 1893, and January, 1894) M. Marcel Dubois has dealt with the methods by which the phenomena of fresh-water circulation should properly be studied, with an attempt at a more rational system of classification than those generally in use. Nothing, in fact, can be more unscientific than the consideration of river-systems as so many units, without regard to the distinctive characteristics impressed by conditions of climate and relief, as, e.g., the comparison of the Siberian rivers, fed by a scanty rainfall and frozen for a large part of the year, with those of moist tropical climates. The only legitimate basis of comparison is that of the total amount of water discharged in a year in its relation to the extent of country drained. Lakes (which must be included with rivers in the investigation, since there is no hard and fast division into two categories) and glaciers are among the facts of climate and relief, of which the effect is more marked, both affording means of storage of water, and so tending to regulate the flow. Taking the various climatic zones separately, it is, of course, in that of the tropical rains that the greatest rivers occur, and in this the large islands (as those in the Malay Archipelago) and in a less degree peninsulas (India, Indo-China) have the largest of all in proportion to the area drained. Of these two peninsulas, the former, from its soil and relief, is more subject to the effects of

evaporation. The great continental masses of Africa and South America differ in important respects, the former (owing to its relief) being marked by the presence of lakes and cataracts, which help to retain the water, while in the latter, the extent and regularity of the plain of the Amazon give an example of simple downflow on the vastest scale. Facts of climate and soil are more operative in the former, causing various degrees of evaporation and absorption. In the temperate zone—(omitting certain regions where the tropical monsoons encroach) the North American plain is marked by its huge lakes, where, however, the circulation (partly owing to winter freezing) is far inferior to that in Africa. In Europe and Asia glaciers play a most important part. The former as a whole is copiously supplied by the winds from the Atlantic, but eastwards the rains diminish, and the Siberian rivers lose their importance when we consider for how large a part of the year stagnation reigns. In the southern temperate zone the area is small, but striking contrasts result from geological features. Finally, in the Polar regions the phenomenon of circulation in the form of glaciers becomes rather a secular one.

Shore Formation near Hyères.—A peculiar instance of littoral formation is noted by A. Salagnac in the *Annales de Géographie* (vol. ii. p. 448, with illustration). The Roubaud is a small stream which flows through Hyères and takes an east-south-east course to the sea. On meeting the bank of sand and shingle thrown up by the tide along the coast, its course is deflected, and a lagoon parallel to the shore is formed, the stream forcing its way through the barrier only when reinforced by rain and aided by a favourable wind. On a still day in December, 1883, it had cut itself a channel through the bank, and at the line of meeting of the fresh water with the current of the Mediterranean a sort of breakwater was formed of small pebbles piled one above another, behind which the stream gently mingled with the sea. A storm of wind and rain, however, soon restored the normal conditions. Similar phenomena have been noticed with regard to small streams entering the Moray Firth, east of the mouth of the Spey.

GENERAL.

The Relation of Geography to History.—Mr. F. W. Parke: read a paper on this subject to the Conference of American and European Geographers in Chicago, which is now published by the National Geographic Society. He regards geography with its kindred sciences of inorganic matter as the science of the physical conditions of life, and holds that the social evolution of life can best be studied from its structural and meteorological environment. He holds that Carl Ritter's general principle that every characteristic area of the Earth's surface has had a determining influence on the special evolution of mankind, requires several modifications: 1. The same surface structure may influence man very differently in each stage of development. What would prove an obstruction to growth in one phase of evolution will be in another phase of the greatest assistance. Thus the aborigines of India deteriorated in a land which presented great advantages to the Aryans. 2. The racial life of peoples has a tendency to overcome or control the influence of structure. The Aryan race in the tropics or in Norway retained the same general tendencies and habits. 3. The human spirit in all ages, lands, and stages of growth has had the same general tendencies. This is evident in the universality of like myths among peoples who have never been in contact, and live as far apart as Eskimo and South Sea Islander. With these provisos a knowledge of geography is indispensable to the study of history. In teaching, a beginning may be made by showing the common relations of similar forms of structure. Mountains, swamps, etc., are important as places of refuge for tribes who have passed the lower phases of their development in the plains. The steppes or prairie

was best adapted to nomad life; and when tribes learned to lead a settled existence on one particular spot, they moved forward in civilization. The tribes who had reached a certain stage of civilization fled, for sake of peace or security, from the open fertile lands to the great structural fortresses of mountain and desert. Each natural fortress by its structure had a special influence; Egypt, with its valley unity, led to monarchy and monotheism; Greece, with its numerous mountain-walled valleys, fostering independent communities, favoured polytheism. Wood and timber were a means of progress, both demanding and supplying tools. An isolated position which is at one stage necessary to progress becomes later a barrier. The plateau continent of Africa has been isolated from the world by the cataracts on her great rivers blocking the natural lines of movement. River valleys often mark the lines of migration—notably so in the case of the Danube; and now the same river cuttings have become the track of our railway lines. In the highest stages of life the great plains again become the resort of men from all surrounding races, where they can be fused into one nation. History and geography are thus to be studied together, the practical observations of each throwing light on the theory of the other.

University Recognition of Geography.—In the report of the Commissioners appointed to consider the draft charter for the proposed Gresham University in London, recently issued by the Stationery Office, geography is included “among the most important subjects deserving of professorial representation in the faculty of Arts” in the department of philosophy. The report further states: “The subject of geography has recently attained academic recognition in English universities, and London offers unique advantages for the development of this subject upon scientific lines, and the Royal Geographical Society would cordially support a movement in this direction.” The letter urging the recognition of geography sent by the Council of the Society is printed with the evidence offered to the Commission.

OBITUARY.

Verney Lovett Cameron.

By E. G. RAVENSTEIN.

IT is with deep regret we announce the death of Captain Verney Lovett Cameron, which took place on Easter Monday, the 26th of March, at Leighton Buzzard. Captain Cameron, on that day, had followed Lord Rothschild's stag-hounds. When returning home he was thrown by his horse, and died soon afterwards from the injuries received.

Cameron was the son of the Rev. J. H. L. Cameron, the late Vicar of Shoreham. He was born on July 1, 1844, at Radipole, near Weymouth, entered the Royal Navy in 1857, and saw service in the Mediterranean, the West Indies, the Red Sea, and on the east coast of Africa, where he was engaged in chasing slave-dhows.

In 1872, when the Royal Geographical Society resolved to send an expedition for the relief of Dr. Livingstone, who had not been heard from for a considerable time, Captain (then Lieut.) Cameron volunteered his services. The Committee, however, declined his offer, and entrusted the command to Lieut. Llewellyn Dawson. As is well known, this carefully planned expedition collapsed, for when about to start for the interior, Mr. H. M. Stanley unexpectedly arrived at the coast, and announced that Dr. Livingstone had been discovered by him, and needed no further assistance.*

* See *Proceedings*, R.G.S., xvi., 1872, pp. 413-442.

As there remained a balance of £2682 out of the £5857 collected for this object, the Council of the Society determined to fit out a second Livingstone expedition. Lieut. Cameron was selected to command it, and proceeded to Zanzibar in the company of Sir Bartle Frere. His instructions were to effect a junction with Dr. Livingstone, and, having done this, to assist him in every way. At the same time the desirability of making a thorough examination of Lake Tanganyika was pointed out to him. Dr. W. E. Dillon, Lieut. Murphy, and Mr. Robert Moffat,* a son of the famous missionary, were associated with him in this enterprise.

On March 28, 1873, the expedition left the neighbourhood of Bagamoyo for the interior, and arrived at Unyanyembe on August 5. Whilst delayed there, owing to the disturbed state of the country, Livingstone's servants arrived with their master's body. Lieut. Murphy and Dr. Dillon, who was seriously ill (he died on the road, November 18), resolved to accompany the party to the coast, whilst Cameron was determined to go on. He started on November 11, two days after his companions had turned their faces eastward, and, marching by circuitous roads through a region still unexplored, reached Ujiji, on Lake Tanganyika, on February 21, 1874. He was fortunate enough to recover there a box containing some of Livingstone's papers, together with one of his maps.

Between March 13 and May 9, 1874, Cameron explored the southern half of the lake. He determined its altitude more carefully than had been done before, and discovered the Lukuga, an outlet which was stated to flow to the Lualaba. That this latter was in truth the upper Congo became perfectly clear to Cameron when he reached Nyangwe in August. He very much desired to force the course of this river to the sea, but, not being able to procure boats, he reluctantly turned to the south. He left Nyangwe on August 28, in the company of Tipo Tip, arrived at Kilemba, the capital of Urua, in October, and remained there until February 25 of the following year, enjoying all the while the hospitality of Jumah Merikari, the "kindest of the many friends," whom he found among the Arab traders. During this period of enforced delay, he visited Lake Moryo, with its pile-dwellings, and Lake Kasali, a back-water, or a "broad" of the Lualaba.

The journey to the west coast was effected in the company of one Alvez, a black Portuguese. Alvez was by no means a desirable companion, and his good will had to be paid for dearly. On November 7, 1875, thirty-one months and ten days after he had left the Indian Ocean, Cameron arrived at Catumbela, near Benguela, and once more beheld the sea.

Cameron was the first European who crossed Tropical Africa from east to west, and this feat alone entitled him to a place of distinction among African explorers. But he did more than this. He determined many latitudes and a few longitudes, ascertained the height of numerous places above the sea, and furnished a fair account of the countries which he had traversed, and of their resources. The geographical societies of London and Paris, in recognition of his services, voted him gold medals, the Queen created him a C.B., the University of Oxford conferred upon him the honorary degree of D.C.L., and the Admiralty promoted him to the rank of Commander. He published a narrative of his journey under the title 'Across Africa' (1877), of which a second edition appeared in 1885.†

In 1878-9 Cameron travelled in Asiatic Turkey, and after his return published a work entitled 'Our Future Highway,' in which he advocated the construction of a railway from Tripoli to Homs, Aleppo, Baghdad, and Bushire, to be eventually extended to Kasachi.

In 1882, jointly with Sir Richard Burton, he visited the "Gold Coast for Gold."

* Moffat died soon after leaving the coast.

† For preliminary accounts, see *Journal R.G.S.*, 1875, pp. 184-228; the *Proceedings* for 1873-1876; 'Ocean Highways,' 1874; the *Geographical Magazine*, 1874-1876.

Gold was found, as a matter of course, but not in quantities sufficient to remunerate the companies which were formed to work the mines.

More recently Captain Cameron has been connected with several companies formed with the view of developing the resources of Central Africa, including the "African Transportation Company," the "Katanga Company," and the "Companhia do Zambezia."

CORRESPONDENCE.

Peak K₂ (Godwin-Austen).

I HAVE to call attention to a woodcut in that excellent work, 'Jummoo and Kashmir Territories,' by the late Mr. F. Drew, given on p. 370, as "K₂, 28,265 feet as seen from Turmik." This woodcut has quite recently been reproduced in the *Alpine Journal*, February, 1894, p. 38, by Mr. W. M. Conway, to support certain views regarding the form of the actual summit. Mr. Whympster also has used this woodcut to illustrate an article on ascents in the Himalayas, *Leisure Hour*, January, 1893, p. 193, and it may be made to do duty again by some other geographer writing on this part of the Himalayas. In this communication I give my reasons for believing the peak seen by Mr. Drew to be another and a very fine peak, K₁, or Masherbrum.

Peak K₂ has no saddle between two district summits; I feel sure if it had such a form the surveyors who carried out the triangulation work would have observed as usual to both points. Such a feature would be most useful to the topographer, and facilitate the identification of his plane table points, which often show for only a few minutes amidst the clouds that surround them. I should certainly have noticed such a marked outline, but I have only two sketches of K₂ to assist my memory. The best and nearest view I got of it was from a point above the Baltoro glacier, about 17 miles distant, K₂ showing just above an intervening high ridge, 11 miles across the glacier, on its northern side. A copy of this sketch was published in the *Illustrated London News*, February 27, 1892. It is a good reduced reproduction, but K₂ has been made far more pointed and needle-shaped than in the original. In neither of my sketches is there the slightest indication of two distinct summits, as in the woodcut.

Drew writes thus: "It is not easy to get a sight of this mountain. I once saw it from a distance of nearly 70 miles, standing up in the form given in the sketch, *clear above all the great ridges.*" (The italics are mine.) He does not give its bearing from where he saw it, and he says "ridges," not "ranges." I would not recommend any one to go to the Tormik valley to get a fine view of K₂, and I am convinced that Mr. Drew was mistaken, and that he never saw that peak from the side of Tormik, i.e. from the westward. The peak which he did see, and which he made so good a sketch of, was K₁ (Masherbrum). From the neighbourhood of the Tormik valley K₂ is not visible unless a peak of at least 18,000 or 19,000 feet be ascended, and then if it came into view it would not show "clear above all the great ridges," but would lie beyond great ranges of 20,000 feet and upwards, and stand among a mass of snowclad peaks of great altitude. From the summit of Mashalla, 16,920 feet, a principal station of the survey further south, with a far more open ray, K₂ stands beyond and among many lofty peaks, and above heavily snowclad slopes.

The ray from the side of the Tormik valley to K₂ bears east-north-east (see sketch map); at about 25 miles distant it cuts the very high ridge, some 18,000 feet, which bounds the Biafo glacier on the south-west; following on, at about 40 miles up to 50 miles the ray lies upon the very lofty snowy mass west of the Mustagh pass, and which is considerably over 20,000 feet. K₂ is 18 miles still

further east of this, so that, if visible from the highest peak near Tormik, it could by no possibility present the appearance shown in Mr. Drew's sketch, viz. a very considerable snowy peak appearing above a flattish ridge quite bare of snow.

From Tormik, and very probably near the Ganto La, a pass Drew would cross into or out of that valley when on an official tour, he would see K_1 , 55 miles away, precisely as depicted by him, and bearing due west, the only intervening ridge being that of Buspur, 15,000 feet and upwards, which has no snow on it, at the northern end in the summer months. From the Ganto La the view up the Braidoh valley is a grand one; K_2 has a most striking appearance, and Mr. Drew might very easily have been misled as to his own position with respect to K_2 , and its identity. In September, 1860, I ascended a peak called Munbluk, one and a half mile south of the Ganto La; and in the following year I crossed the pass. I think I should remember seeing K_2 and using it for fixing my position if it had been visible from that quarter of Baltistan.

Now as to details, K_1 , or Masherbrum, has two well-defined points separated by a saddle; both were fixed by the Kashmir Triangulation, being 25,676 and



25,627 feet respectively, the lowest being to the south-west, whence the main ridge descends from it in the same direction, agreeing so well with the woodcut. The dark snowless, somewhat flat ridge rising higher to the south can be no other than the Buspur; the Triangulation Station 14,490 feet is even indicated by the slight elevation on the left-hand side, the higher portion to the south being Gurindo (*vide* atlas sheet). I must here call attention to the way this woodcut has been printed in the *Alpine Journal*. It has been placed so crookedly that all the slopes are thrown out 8° or 9° from the position they are shown in Mr. Drew's work, thus bringing down the higher mass on the south (Gurindo) to the same level with the point on the north (Buspur Triangulation Station). Such an error as this so materially alters the original as to render it quite misleading.* Until my attention was lately drawn to this woodcut I had never looked at it critically, or noted the position on the map from whence it is said to have been taken. I have laid off the ray on my Plane Table Survey, a photograph copy of which on the scale of the original I fortunately possess. I cannot put my finger on any point west of K_2 where Drew, at 70 miles, could have obtained such a view of it as that given in his book.

H. H. GODWIN-AUSTEN, Lieut.-Col.,
Late Deputy Superintendent Survey of India.

* In Mr. Whympers's paper the woodcut is set up correctly.

**MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY,
SESSION 1893-94.**

Ninth Ordinary Meeting, April 9, 1894.—CLEMENTS R. MARKHAM, Esq.,
C.B., F.R.S., President, in the Chair.

ELECTIONS.—*Henry E. Allhuson; Robert Hood Anderson; The Lord Cottesloe; Captain John Steven Cowans (Rifle Brigade); Sir Walter Eugène De Souza; John Eunson; Arthur Larcom; R. W. Philpott, B.A.; Captain Thomas F. B. Renny-Tailyour, R.E.; Frederick Courtney Selous.*

The Paper read was :—

“A Journey across Central Asia.” By St. George R. Littledale.

The late Captain Cameron.

The PRESIDENT made the following remarks :—

Before entering upon the regular business of the evening, I feel it my duty to refer to the very sudden death of our gold medallist and very good friend, Lovett Cameron. I am almost afraid to say how long ago it was since I first made his acquaintance on the coast of the Red Sea, but he was always the same good-natured, generous, enthusiastic fellow; and he was endowed with a pertinacity which I have seldom seen equalled. He showed that quality in a high degree when he was a young lieutenant at Sheerness, full of enthusiasm for African discovery. He sought for an African appointment, and was rejected once, I think twice, but he went on pegging away until he got it, and when he had got it he started, and pertinaciously resolved to do the work before him in spite of all dangers, in spite of fevers, and I think I am bound to say regardless of expense. He was obliged to have some one to fight his battles for him in England, and it became my duty to do so; I fought them. In the mean time Cameron became the surveyor of the southern half of Tanganyika, discoverer of the Lukuga outlet, the first European who crossed Africa from east to west, and so became known to the whole civilized world. We must all admire his fine qualities, which enabled him to achieve so much, and many of us, I am sure, will regret the loss of a very good and genial friend. This afternoon the Council passed a resolution of deep regret at this sudden loss, and of sympathy for his widow and family.

The Missing Swedish Expedition.

I think I must also refer, before we pass on to the business of the evening, to those brave young Swedes who are now lost in the Arctic regions. Alfred Bjorling was a youth who had devoted himself from boyhood to discovery. When only seventeen, he was the first to ascend the highest mountain in Northern Scandinavia; when nineteen, he assisted in scientific investigations in Spitzbergen; when twenty, he was exploring the northern part of Greenland beyond the Danish settlements, and then got further than any European had ever been along the inshore of Melville Bay; and when only twenty-one he started on this adventurous expedition, with one companion, Evald Gustaf Kallstenius, a young student of natural history at Upsala. They went away in a schooner of 35 tons into Baffin's Bay, and were at last driven by the ice on to one of the Cary Islands. I have been on these islands myself, and they are dreary enough. There was found Bjorling's last record. He and his party went away in a boat to Cape Clarence, hoping to find an Eskimo settlement on the western side of Baffin's Bay. The record merely said, if any ship found it, would the captain have the kindness to call at Cape Clarence. This will be two years ago next autumn. One longs to be able to help, if it be only by a subscription, for one dreads to think of the terrible miseries they must have

gone through. To my great astonishment, I heard three days ago that the expedition which was announced as about to start from America to search for them is not going; but I hear that two, if not three, Swedish gentlemen have started in vessels to see what can be done either to succour them or to ascertain their fate. I am quite sure that, when you tell your children heroic stories for their example, you cannot find one more pathetic than that of these two youths, who certainly do great honour to their country. They are martyrs to science in the noblest sense. The least we can all do is to subscribe and assist in those searches that are being undertaken, and a subscription has been opened at the Society's rooms for the purpose of helping the Swedes in their endeavours. I really believe that it is just possible that they may still be alive. On Saturday I received by post a little white book, the narrative of four Russian sailors who lived without help or succour for six years on Spitzbergen, sent to me by Baron Nordenskjöld, and I look upon it as a signal of hope. So let us hope on, and do what we can to help these gallant young fellows.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

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

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

A. = Academy, Academie, Akademie.	Mag. = Magazine.
Ann. = Annals, Annales, Annalen.	P. = Proceedings.
B. = Bulletin, Bollettino, Boletim.	R. = Royal.
Com. = Commerce, Commercial.	Rev. = Review, Revue, Revista.
C. R. = Comptes Rendus.	S. = Society, Société, Selakab.
Erdk. = Erdkunde.	Sitzb. = Sitzungsbericht.
G. = Geography, Geographie, Geografia.	T. = Transactions.
Ges. = Gesellschaft.	V. = Verein.
I. = Institute, Institution.	Verh. = Verhandlungen.
J. = Journal.	W. = Wissenschaft, and compounds.
M. = Mitteilungen.	Z. = Zeitschrift.

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.

EUROPE.

- Alps.** *Jahrbuch Schweizer Alpenclub* 28 (1892-93): 264-274. **Simon.**
Alpine Gipfel-Charaktere. Eine Plauderei mit Skizzen und einem Panorama. Von S. Simon.

This paper contains some excellent illustrations of mountain peaks composed of crystalline and of calcareous rocks from the author's sketches and photographs, showing the dependence of scenery on geological formation and structure.

- Alps.** *Jahrbuch Schweizer Alpenclub* 28 (1892-93): 285-298. **Forel.**
Les variations périodiques des glaciers des Alpes. Par le Prof. Dr. F.-A. Forel à Morges.
Die deutschredenden Gemeinden im Grauen oder Oberen Bunde (Rhätien) der Schweiz. Von Rev. W. A. B. Coolidge. Separat-Abdruck aus Nr. 376 und 377, 1893, "Oesterr. Alpen-Zeitung." Size 10½ × 7½, pp. 10. *Presented by the Author.*

- Alps.** *Jahrbuch Schweizer Alpenclub* 28 (1892-93): 285-298. **Forel.**
Les variations périodiques des glaciers des Alpes. Par le Prof. Dr. F.-A. Forel à Morges.

An extremely interesting report, which will be summarized in the Monthly Record. It is illustrated by an excellent series of maps showing the regions of advancing glaciers at different periods from 1875 onwards.

- Alps—Dachstein Group.** **Simony.**
Begleitwort zur zweiten Lieferung des Werkes das Dachsteingebiet. Ein geographisches Charakterbild aus den österreichischen Nordalpen.

Nach eigenen photographischen und freihandaufnahmen illustriert und geschildert von Dr. Friedrich Simony. Wien. Ed. Hölzel 1893. Size 14 x 11, pp. 76. *Plates. Presented by the Publishers.*

Dr. Simony's fine photographs, to which the text of this memoir is subordinate, are excellent examples of views taken from the proper standpoint, each showing some special feature of structure or scenic form, and none sacrificing character to artistic effect. They are worthy of the venerable alpinist's high reputation.

Austria—Croatia.**Mohorovičić.**

Der Tornado bei Novska vorgelegt in der Sitzung der südslavischen Akademie der Wissenschaften und Künste vom 22 April 1893, von A. Mohorovičić. Agram, C. Albrecht, 1894. *Presented by the Author.*

Detailed account of the effects of a tornado which wrecked a goods-train at the station of Novska, accompanied by details of the meteorology of Croatia and a series of maps and diagrams.

Black Forest Lakes.*Globus* 65 (1894): 201-206.**Sauer.**

Zirkussees im mittleren Schwarzwalde als Zeugen ehemaliger Vergletscherung desselben. Von Dr. A. Sauer, Heidelberg.

This paper on the glacial action indicated by the cirque-lakes of the Black Forest will be referred to in the Monthly Record.

England—Palaeolithic Haunts.**Smith.**

Man the primeval Savage, his haunts and relics, from the hill-tops of Bedfordshire to Blackwall. By Worthington G. Smith. With two hundred and forty-two illustrations by the Author. London, Edward Stanford, 1894. Size 9 x 6, pp. xviii. and 350. *Price 10s. 6d. Presented by the Publisher.*

After an introduction, in which the author sketches his conception of primitive man, he treats in detail of the finds of human remains and flint implements at Caddington, near Luton, and in other parts of the south-east of England, mainly in the valleys of the Lea and the Thames. Most of the illustrations represent flint implements, but several depict imagined scenes in palaeolithic life with a refinement scarcely reconcilable with the text.

France—Calais.*Archæologia* 53 (2): 289-388.**Dillon.**

Calais and the Pale. By the Honourable Harold Arthur Dillon, Sec. S.A. *With maps.*

This interesting research into the history of the last English possession in France contains a map, on which the boundary-lines are laid down as closely as is now possible to show the limits of the Pale in 1556.

France—Lakes.*Annales G.* 3 (1893-94): 20-41, 213-226.**Magnin.**

Contributions à la Limnologie française. Les Lacs de Jura. Par le Dr. A. Magnin.

A valuable description of the lakes of the Jura mountain system, which will be referred to elsewhere.

Germany—Lakes.*Verh. X. Deutschen G.-tages* (1893): 105-115.**Ule.**

Die Temperaturverhältnisse der Baltischen Seen. Von Dr. Willi Ule. *Profiles.*

Dr. Ule has studied the distribution of temperature in the water of a number of the small lakes on the Baltic lake-ridge.

Germany—Thüringerwald.*M.G. Ges. Jena* 12 (1893): 101-133.**Begel.**

Forstwirtschaftliches vom Thüringerwald Von Fritz Begel. *With map.*

A discussion of the extent and present condition of the Thuringian Forest.

Lake Constance.*Verh. X. Deutschen G.-tages* (1893): 79-104.**Zeppelin.**

Über die neue Bodensee-Karte und die Gestaltung (Relief) des Bodensee-Grundes. Von Eberhard Graf Zeppelin. *Map.*

The survey of the Lake of Constance has been executed with great thoroughness, and its results are here discussed briefly.

Russia—Moscow, Magnetic Conditions.**Fritsche.**

Die magnetischen Localabweichungen bei Moskau und ihre Beziehungen zur dortigen Local-Attraction. Von Dr. H. Fritsche. Extract from B.S. imp. Naturalistes de Moscow, 1893 No. 4. Size 10 x 6½, pp. 40. *Five Maps.*

Dr. Fritsche here presents a discussion of his magnetic survey of the neighbourhood of Moscow, and shows on a series of maps the anomalies of dip, declination, horizontal and total intensity for a tract of country round Moscow, about 100 miles from east to west, and 50 miles from north to south.

Scandinavia. *Z. Ges. Ersk. Berlin* 28 (1899): 1-106, 393-488. **Sieger.**

Seenschwankungen und Strandverschiebungen in Skandinavien. Von Dr. Robert Sieger. *With Maps and numerous Tables.*

This exhaustive paper was referred to on p. 262 of vol. ii. of the *Geographical Journal*.

Switzerland. *Jahresb. G. Ges. Bern* 11 (1893): 115-131. **Graf.**

Beiträge zur Topographie und Geographie der Schweiz. Vortrag von Herrn Prof. Dr. Graf.

Historical account of Swiss cartography.

Switzerland—Bibliography. **Graf.**

Bibliographie Nationale Suisse. Fascicule IIc. Plans de Villes et de Lieux habités, reliefs et panoramas, Publié par le Bureau Topographique Fédéral. Rédigé par le Prof. Dr. J. H. Graf. Bern, K. J. Wyss, 1893. Size 9 × 6. *Presented by the Federal Topographical Bureau.*

Switzerland—Mountain names. **Wäber.**

Jahrbuch Schweizer Alpenclub 28 (1892-93): 235-263.

Die Bergnamen des Berner Oberlandes vor dem XIX. Jahrhundert. Von A. Wäber.

An interesting discussion of the early mountain names in the Bernese Oberland.

United Kingdom. *J.R. Statistical S.* 57 (1894): 104-148. **Hamilton and Rawson.**

Ocean Highways: their bearing on the Food and Wages of Great Britain. By the Right Hon. Lord George Hamilton. (With discussion.)

Ocean Highways: Approaches to the United Kingdom. By Sir Rawson W. Rawson.

These papers, while essentially economic and statistical, are so far of geographical interest in their treatment of a set of conditions which are directly due to geographical causes. Lord George Hamilton considers the population dependent on ocean-borne supplies, and shows the economic necessity of British naval supremacy, while Sir Rawson Rawson analyzes the amount of trade carried on by the principal approaches from the sea, and the origin of the trade brought through each approach. Statistics show that in 1892 London carried on 31·8 per cent., and Liverpool 29·8 per cent. of the total import and export trade of the country; the ports next in order being Hull (6·2), Glasgow (3·9), and Harwich (3·1).

United Kingdom—Geological Survey. **Geikie.**

Annual Report of the Geological Survey and Museum of Practical Geology. For the Year ending December 31, 1892. Extracted from the 40th Report of the Science and Art Department, 1893, pp. 246-275.

The Work of the Geological Survey. A paper read before the Federated Institution of Mining Engineers. By Sir Archibald Geikie, F.R.S., Director-General. Extract from the *Transactions* of the Institution. Pp. 26. *Presented by the Author.*

Sir Archibald Geikie's address gives a remarkably complete though concise account of the origin, methods, and accomplished work of the Geological Survey.

Wales—Fishguard Invasion. **Rowlands.**

The Fishguard Invasion by the French in 1797. Some passages taken from the diary of the late Reverend Daniel Rowlands, some time Vicar of Llanfnglwyn. London, T. Fisher Unwin, 1892. Size 7½ × 5½, pp. 234. *Illustrations.*

An account of the French invasion on the Welsh coast, near Fishguard, on the 22nd of February, 1797, and of the surrender of the troops on the 24th of February.

ASIA.

Armenia, etc.

Maclean and Browne.

The Catholicos of the East and his People. Being the Impressions of Five Years' Work in the "Archbishop of Canterbury's Assyrian Mission." . . . By Arthur John Maclean, M.A., and William Henry Browne, LL.M.

London, Society for Promoting Christian Knowledge, 1892. Size $7\frac{1}{2} \times 5$, pp. xvi. and 360. *Map and Illustrations. Price 5s. Presented by the Editorial Secretary, S.P.C.K.*

A description of the life and customs, ancient and modern, of the Eastern Syrian Christians (Nestorians) of Kurdistan and Northern Persia, with an account of their religious services, and specimens from their rituals.

Asia-Minor.**Naumann.**

Vom Goldenen Horn zu den Quellen des Euphrat. Reisebriefe, Tagebuchblätter und Studien über die Asiatische Türkei und die Anatolische Bahn, Von Dr. Edmund Naumann. Mit 140 Illustrationen. München 1893. Size $12\frac{1}{2} \times 8\frac{1}{2}$, pp. xvi. and 494. *Map. Presented by the Author.*

This is a popular account of a journey through Asia-Minor undertaken in the first instance in connection with the Anatolian railway. The first part deals with the land journey from Constantinople to Angora, including a number of deviations from the direct route; the second continues the narrative from Angora to Diarbekir, and thence by Erzerum to Trebizond, and there is a third part containing scientific and technical information. The present state and future projects of the Anatolian railway system are fully discussed. The illustrations in the text are interesting on account of the successful use of several colours in printing.

Asia-Minor.*Globus 65 (1894): 123-130, 185-191.***Prittwitz and Kannenberg.**

Ein Forschungsritt durch das Stromgebiet des unteren Kizil Irmak (Halys). I. Von G. v. Prittwitz u. Gaffron, II. Von Kannenberg.

A richly illustrated description of the journey of a party of German officers in the lower Kizil-Irmak Basin, an abstract of which appeared in the *Journal* for April, p. 327.

Central Asia.*Globus 65 (1894): 233-238.***Immanuel.**

England, Russland und Afghanistan. Geographisch-politische Betrachtung anlässlich des englisch-afghanischen Abkommens vom November 1893. Von Fr. Immanuel. Wittenberg. *With a map in colours.*

The map accompanying this paper shows the boundaries of British, Russian, and Afghan territory on the Pamirs at different dates.

Central Asia—Irrigation.**Moser.**

L'Irrigation en Asie Centrale. Étude géographique et économique, par Heuri Moser. Paris, Société d'Éditions Scientifiques, 1894. Size $9 \times 5\frac{1}{2}$, pp. 379. *Map. Price 6 francs. Presented by the Author.*

This book will be specially reviewed.

India.**Sleeman.**

Rambles and Recollections of an Indian Official. By Major-General Sir W. H. Sleeman, K.C.B. In two volumes. A new edition. Edited by Vincent Arthur Smith. Westminster, Archibald Constable and Co., 1893. Size 8×5 , pp. (Vol. I.) xxxvi. and 448, (Vol. II.) x. and 368. *Presented by the Publishers.*

This forms No. V. of Constable's Oriental Miscellany. It contains a memoir of the author and a bibliography of his writings.

India—Madras Observations.

Hourly Meteorological Observations made at the Madras Observatory from January, 1856, to February, 1861. Madras, 1893. Size $12\frac{1}{2} \times 10$, pp. vii. and 299. *Presented by the Government Astronomer, Madras.*

Indian Frontiers—Hunza and Nagyr.**Leitner.**

The Hunza and Nagyr Handbook: being an Introduction to a knowledge of the Language, Race, and Countries of Hunza, Nagyr, and a part of Yasin. By G. W. Leitner. Second Edition. Woking, Oriental University Institute, 1893. Size $15 \times 10\frac{1}{2}$, pp. xxvi. and 247. *Presented by the Author.*

Japan—Whale-Fishing. *Sitzb. preussischen A. W. Berlin (1893): 1053-1072.* **Möbius.**

Ueber den Fang und die Verwerthung der Walfische in Japan. Von K. Möbius.

Herr Möbius found an anonymous Japanese work on whale-fishing, dated 1829, in the library of the Berlin Zoological Museum, and being interested in the large number of pictures accompanying the text, he induced Professor R. Lange to translate part of the description. This is now published with reproductions of eight of the original illustrations, showing how the whale was attacked on all sides by eight-oared boats and

by strong nets and harpoons. The subsequent towing ashore, cutting-up, and boiling down are vividly portrayed, showing, by the number of men employed and the appliances used, that the manufacture of whale-oil and whale-bone was an important industry in Japan in the early part of the century.

Malay Archipelago—Engano.**Modigliani.**

L'Isola delle Donne. Viaggio ad Engano di Elio Modigliani. Illustrato da xxv. Tavola, 50 figure intercalate nel testo ed una Carta geografica Milan, Ulrico Hoepli. 1894. Size 10×7, pp xii. and 312. Price 5 fr.
Presented by the Publisher.

This volume will be specially noticed.

Sakhalin.*Petermanns M.* 40 (1894): 49–60.**Immanuel.**

Die Insel Sachalin. Von Fr. Immanuel.

An excellent summary of the geography, economic conditions, and population of Sakhalin, from recent Russian sources, with a map of the island.

AFRICA.**Algeria.***Scottish G. Mag.* 10 (1894): 185–199.**White.**

The Situation in Algeria. By Arthur Silva White. With maps.

Mr. White formulates a series of reasons for the arrested development of Algeria, and suggests the reforms most urgently required towards remedying that condition. Six maps are given, showing (1) Surface features and vegetation, (2) Political divisions and lines of communication, (3) Orographical features, (4) Mean annual temperature, (5) Mean annual rainfall, and (6) Progress of French conquest. Each map includes Tunis as well as Algeria.

Algeria—Biskra.**Pease.**

Biskra and the Oases and Desert of the Zibans, with information for Travellers. By Alfred E Pease, F.R.G.S. London, E. Stanford, 1893. Size 7×5, pp. xvi. and 112. *Maps and Illustrations.* Price 4s. 6d.

Contains a good description of Biskra and its neighbourhood, with hints as to routes, climate, and rainfall, the people, excursions, sport, etc., derived from a six months' residence in 1892–93.

Congo-State—Lukuga.*Mouvement G.* 11 (1894): 27–28.**Wauters**

L'Exploration de la Lukuga, l'émissaire du Lac Tanganika par l'expédition Delcommune. Par A. J. Wauters. *With Map.*

This note is referred to in the Monthly Record.

Congo State—Equateurville.*B.S.R. Belge G.* 18 (1894): 34–60.**Lemaire.**

Etat Exploration du Congo. District de l'Equateur. Station d'Equateurville. Observations météorologiques faites du 1^{er} Mai 1891 au 31 Décembre 1892.

The result of these observations are shown in a series of diagrams, and are discussed in a somewhat general way.

East Africa.*Abrégé B.S. Hongroise G.* 22 (1893): 53–74.**Inkey.**

Notes de voyage dans l'Afrique orientale par Ladislav Inkey.

The original paper in Hungarian occupies pp. 153 to 177 of the Bulletin. It will be referred to in the *Journal*.

Egypt.**Gayet.**

Itinéraire illustré de la Haute Égypte, les anciennes capitales des bords du Nil, avec Cartes de la Haute Égypte et de la Basse Égypte. Par Al. Gayet. Paris, Maison Quantin, *not dated*. Size 7½×4½, pp. 290. Price 5s.

This volume is mainly of archæological interest. It describes the principal places on the banks of the Nile between Cairo and the island of Philæ, including Memphis, Beni-Hassan, Tell-el-Amarna, Siut, Abydos, Denderah, Theber, Esneh, Edfu, and Assuan.

Egypt—Irrigation.**Willcocks.**

Report on Perennial Irrigation and Flood Protection for Egypt. By W. Willcocks, M.I.C.E. With a Note by W. E. Garstin. Cairo, National Printing Office, 1894. Size 12½×9½. *Map and illustrations.*

This report is accompanied by thirteen appendices containing discussions on various matters connected with the Egyptian Irrigation question. Appendix III. deals

with the Nile; VII. Geology of the Nile Valley; X. the Wadi Rayan reservoir; XIII. Letter by Dr. Schweinfurth on the subject of the Salt in the Wadi Rayan. The plans, etc., illustrating the report were noticed in the *Journal* for April, p. 354.

French Sudan.

Oliver.

The French Soudan up to date—January, 1894. Compiled. . . . By Capt. S. P. Oliver. Part II. *With Maps*. From the *Proceedings of the Royal Artillery Institute* for 1894, pp. 117-139.

German East Africa. *M. Forsch. Deutschen Schutzgebiet* 7 (1894): 43-56. Herrmann. Die Wasiba und ihr Land. Von Kompagnieführer Herrmann.

German East Africa—Tabora. *Z. Ges. Erdk. Berlin* 28 (1893): 305-308. Danckelmann. Die geographischen Lage von Tabora. Von Dr. von Danckelmann.

Matabilliland. *J. R. Colonial I.* 25 (1894): 397-436. Selous.

The history of the Matabele, and the cause and effect of the Matabele War. By F. C. Selous. With discussion.

Sahara. *Z. Ges. Erdk. Berlin* 28 (1893): 296-304. Rohlfs.

Woher kommt das Wasser in den Oasen der Sahara? Von Gerhard Rohlfs.

Somaliland. *B.S.G. Italiana* 6 (1893): 466-500, 802-842, 961-989. Bricchetti-Robecchi. La prima traversata della Penisola dei Somali. Estratto del *Giornale di viaggio dell'ing. L. Bricchetti-Robecchi*.

Extracts from the journal of M. Bricchetti-Robecchi on his remarkable journey across Somaliland. Illustrated by numerous diagrammatic sketches.

South-west Africa. *Petermanns M.* 40 (1894): 60-64. Dove.

Beiträge zur Geographie von S.W. Afrika. Von Dr. K. Dove. Der vertikale Aufbau des Landes.

This paper will be referred to in the *Monthly Record*.

Yoruba-Country.

Ellis.

The Yoruba-speaking peoples of the Slave Coast of West Africa. Their Religion, Manners, Customs, Laws, Language, etc. With an appendix containing a comparison of the Tshi, Ga, Ewe, and Yoruba Languages. By A. B. Ellis. London, Chapman & Hall, 1894. Size 9½ × 6, pp. viii and 402. Price 10s. 6d.

Lieutenant-Colonel Ellis of the First Battalion of the West India Regiment, whose death during the recent campaign in West Africa must be fresh in the minds of our readers, was a profound student of West African peoples and languages, as his former books of Ewe- and Tshi-speaking peoples and on the history of the Gold Coast testify. His researches in this direction are completed by the volume now before us on the Yoruba-speaking peoples, the publication of which almost coincided with his death. The Yorubas are an inland people who have only recently occupied the sea border on the Slave Coast between Badagry and the Benin river, being driven southward by the Mohammedanized tribes of the north. Colonel Ellis conveys a large amount of information regarding the people and their country with a literary skill which makes the perusal of the book a pleasure to the least ethnological reader.

NORTH AMERICA.**Alaska—Ethnology.**

Murdoch.

Ethnological Results of the Point Barrow Expedition. By John Murdoch. —Ninth Annual Report of the Bureau of Ethnology to the Secretary of the Smithsonian Institution, 1887-88. By J. W. Powell, Director. Washington, Government Printing Office, 1892. Size 11½ × 8, pp. 1-441. *Map and Illustrations*.

A fully illustrated and exhaustive account of the Eskimo of Alaska.

Bering Sea and Alaska.

Dawson.

Notes on the Geology of Middleton Island, Alaska. By George M. Dawson. From *Bull. Geol. Soc. Am.*, vol. iv., 1892. Size 10 × 6½, pp. 427-431.

Geological Notes on some of the Coasts and Islands of Bering Sea and vicinity. By George M. Dawson. From *Bull. Geol. Soc. Am.*, vol. v., 1894. Size 10 × 6½, pp. 117-146. *Illustrations*.

Notes on the occurrence of Mammoth remains in the Yukon district of Canada and in Alaska. By George M. Dawson, LL.D. From *Quarterly Journal Geol. Soc.*, Feb., 1894. Size 9 × 5½, pp. 9.

These papers will be summarized in the Monthly Record.

Salishan Languages—Bibliography.

Pilling.

Bibliography of the Salishan Languages. By James Constantine Pilling. (Smithsonian Institution—Bureau of Ethnology.) Washington, 1893. Size 10 × 6½, pp. 86. *Presented by the Smithsonian Institution.*

This bibliography contains 320 titles referring to the Salishan or Flathead languages of Oregon and British Columbia.

United States—Elevation.

Gannett.

The Average Elevation of the United States. By Henry Gannett. Extract from the Thirteenth Annual Report U.S. Geological Survey, pp. 283-289. Washington, 1894. Size 12½ × 8½. *Map in Colours.*

See *Journal* for April, p. 333.

United States—New York.

National G. Mag. 6 (1894): 23-34.

Darton

Shawangunk Mountain. By N. H. Darton.

Shawangunk (pronounced *Shongum*) Mountain lies between the Hudson river and the southern Catskills in Ulster County, New York, and presents an interesting case of the dependence of geographical features on geological structure. More detailed reference to Mr. Darton's work appears in the Monthly Record.

CENTRAL AND SOUTH AMERICA.

Brasil.

Z. Ges. Erdk. Berlin 28 (1893): 243-295, 309-366.

Vogel and Ammon.

Reisen in Mato Grosso 1887/88 (Zweite Schingú-Expedition. Von Dr. P. Vogel. Mit Anhang: Devonische Versteinerungen von Lagoinha in Mato Grosso (Brasilien). Von Dr. Ludw. v. Ammon.

Description with illustrations of the physical observations of the expedition including the determination of the fossils.

Colombia.

Jahresb. G. Ges. Bern 11 (1893): 33-72.

Röthlisberger.

Ein Streifzug in die Llanos von San Martin. Vortrag des Herrn Prof. Ernst Röthlisberger.

The visit to the Llano of San Martin near Bogota here described took place in 1883.

Colombia—Yesal caves.

Jahresb. G. Ges. Bern. 11 (1893): 174-176.

Tellex.

Erforschung der Höhlen von Yesal. Brief von Hrn. Heliodoro Tellex, übersetzt und mitgeteilt von Hrn. Prof. E. Röthlisberger.

A short description of an exploration of a series of limestone caves in the department of Santandar, Colombia, which took three days to carry out.

Guiana.

Timehri 7 (1893): 44-74.

Hartsinok.

The Indians of Guiana. Translated from the Dutch of J. J. Hartsinok.

A curiously minute account of the native inhabitants of Guiana in 1770.

Peru—Amazon Provinces.

P. Philosophical S. Glasgow 24 (1893): 146-169.

Ross.

Exploration of the Amazonian Provinces of Central Peru. By Alexander Ross. *With map.*

In this paper Mr. Ross says more on the commercial aspect of his journeys in Central Peru than in his purely geographical paper published in the *Proceedings R.G.S.* for 1892.

Jamaica.

Musson and Roxburgh.

The Handbook of Jamaica for 1894: . . . comprising Historical, Statistical, and General Information concerning the Island. Compiled . . . by S. P. Musson and T. Laurence Roxburgh. London, E. Stanford, 1894. Size 9 × 6, pp. vii. and 555. *Map. Price 8s. Presented by the Publisher.*

Uruguay.

Pena and Ronstan.

The Oriental Republic of Uruguay at the World's Columbian Exhibition, Chicago, 1893. Geography, rural industries, commerce, general statistics. By Carlos Maria de Pena and Honore Ronstan. Translated into English by J. J. Rethore. Montevideo, 1893. Size 10 × 7, pp. 54.

Contains a large detailed map of the Republic of Uruguay.

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Germany.

Königl. Preuss. Landes-Aufnahme.

Karte des Deutschen Reiches. Scale 1 : 100,000 or 1·5 stat. miles to an inch. Sheet 324, Kosten, Herausgegeben von der Kartogr. Abtheilung der Königl. Preuss. Landes-Aufnahme, 1893. *Price 1.50 mark each sheet.*

Glasgow.

McDonald.

Road Map of the County of the City of Glasgow and the vicinity. Compiled from actual survey. Dedicated to the Hon. James Bell, Lord-Lieutenant. A. B. McDonald, M.I.C.E., C.E., City Engineer, 1894. Scale: 12 inches to a mile. *Presented by A. B. McDonald, Esq., M.I.C.E., C.E.*

This is an entirely new survey of the city of Glasgow and the vicinity, which has been carried out in a very efficient manner by Mr. A. B. McDonald, MEM. INST. C.E.; City Engineer, at the expense of the Corporation. The scale adopted is 12 inches to

a mile, and the map includes the area of the county of the city of Glasgow, the boundary of which is shown by a chain-dotted line. The manner in which the map has been produced leaves nothing to be desired, and as a whole it may well be considered as a striking example of local enterprise.

Switzerland.**Swiss Federal Staff**

Topographischer Atlas der Schweiz im Maasstab der Original-Aufnahmen, nach dem Bundesgesetze vom. 18. Dezember 1868 durch das eidg. topogr. Bureau gemäss den Direktionen von Oberst Siegfried veröffentlicht. Scale 1 : 25,000 or 2.5 inches to a stat. mile. Sheets:—248, Vorder Wägghthal; 260, Schwiz; 288, La Muratte; 290, Lignerolles; 291, Vallorbe; 378, Sarnen; 379, Stanserhorn; 433, Gimel; 435, Bussigny; 441, La Dôle; 463, Léohurette; 470, Les Ormonts. *Price 1 fr. per sheet. Presented by the Topographical Bureau, Swiss Federal Staff.*

AFRICA.**Algeria.****Service Géographique de l'Armée, Paris.**

Carte topographique de l'Algérie. Scale 1 : 50,000 or 1.26 inches to a stat. mile. Service Géographique de l'Armée, Paris. Sheets:—No. 25, Djebblaa; 55, Duvivier; 57, Cap Magroua; 68, Akbou; 78, Oued Mougras; 207, El Mokreum; 272, Chanzy; 299, Lalla Maghnia. *Price 1 fr. 50 c. each sheet.*

Central and South Africa.**Bartholomew.**

Central and South Africa. By J. G. Bartholomew, F.R.G.S. Scale 1 : 5,600,000 or 88.3 stat. miles to an inch. John Bartholomew & Co., Edinburgh, 1894. *Price, mounted on cloth, 3s. Presented by the Publishers.*

This is a new edition of a map which has been favourably noticed in the *Geographical Journal*; it has been corrected where necessary, and brought up to date. It is drawn on a sufficiently large scale to be useful for general reference.

AMERICA.**South America.****Bartholomew.**

Commercial Map of South America. By J. G. Bartholomew, F.R.G.S. Revised by John Samson, F.R.G.S., of the *South American Journal*. Scale 1 : 10,000,000 or 159.4 stat. miles to an inch. J. Bartholomew & Co., Edinburgh, 1894. *Price, mounted on cloth, 3s. Presented by the Publishers.*

In this map the compiler has availed himself of all the latest and most reliable material. All the lines and railways have been carefully laid down and brought up to date by Mr. John Samson, and a number affixed to each by means of which the companies to whom the lines belong can be found. All means of communication by steamer are shown, and the rivers navigable for trading-boats are distinguished from those which are not, and insets, on larger scales, of places of importance are given.

United States.**Johnston.**

General Map of the United States, constructed from the best authorities. By W. & A. K. Johnston, Edinburgh & London, 1894. Scale 1 : 3,984,000 or 62.9 stat. miles to an inch. 2 sheets. *Price £1 1s. Presented by the Publishers.*

This is an entirely new map of the United States, compiled from most recent surveys and brought up to date. It is printed in well-chosen colours, rivers, lakes, and seas being shown in blue. The coast-line throughout has been taken from the Admiralty Charts. Inset plans of some of the principal cities of the United States are given on an enlarged scale, and the railways are correctly laid down. It is accompanied by an index containing all the names that appear on the map. The portion of Canada north of the United States boundary has been most carefully laid down, and, taken as a whole, the manner in which the map has been produced reflects credit on all concerned in it.

United States.**Rand, McNally & Co.**

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Nebraska,	1 : 1,120,000 " 17.6 " "
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Rand, McNally & Co., Chicago and New York. New editions, 1894. *Price 25 cents each. Presented by the Publishers, through E. Stanford, Eq.*

These maps are new editions of a series in course of publication by Rand, McNally & Co., of New York and Chicago. Each map is accompanied by an index containing information that will be useful to persons visiting the United States on business or for pleasure.

GENERAL.

German Colonies.

Langhans.

Deutscher Kolonial-Atlas. 30 Karten mit vielen Hundert Nebenkarten, entworfen, bearbeitet und herausgegeben von Paul Langhans. Erscheint in 15 Lieferungen jede mit 2 Karten. Sechste Lieferung. Gotha: Justus Perthes, 1894. *Price 1 mark 60 pf. each part.*

This part contains Map No. 5, German industries in Central Europe, and Map No. 17, which is Sheet 3 of a map of German South-West Africa, on which also several insets are given. These maps are beautiful specimens of cartography, and contain an amount of information which must have entailed infinite labour to bring together.

The World.

Vidal-Lablache.

Atlas Vidal-Lablache, Maitre de Conférences de Géographie à l'École Normale Supérieure Histoire et Géographie. 137 Cartes, 248 Cartons. Index alphabétique de plus de 40,000 noms. (L'Atlas complet paraîtra en 24 livraisons. Livraison, 23. Paris: Armand Colin et Cie., Editeurs. *Price 1 fr. 25 c. each part.*

This is a very interesting part of this atlas. Map No. 52 contains projections and astronomical diagrams. No. 52a and c is a map showing the transformations of the earth's surface in recent times. No. 52b contains diagrams of the relative superficial areas of continents, catchment basins, oceans, etc., and an interesting map giving lines of equal distances 400 kilometres apart from the coast-line, both inland and on the oceans. No. 108r is a general map of New Zealand. No. 108f and g show the principal routes of traffic by land and water, the magnitude and importance of the traffic being indicated by the breadth of the line, and the tint of colour employed. The navigability of the rivers is shown, as are also the English and French coaling-stations. Steamer routes on the Atlantic and Pacific are coloured red, while those which pass through the Suez Canal are coloured green. No. 108h is an orographical map of Eastern Australia.

As usual with this atlas, each map is accompanied by well-written explanatory notes, and numerous insets are given, in addition to the principal maps.

CHARTS.

Admiralty Charts.

Hydrographic Department, Admiralty.

Charts and Plans published at the Hydrographic Department, Admiralty, January and February, 1894. *Presented by the Hydrographic Department, Admiralty.*

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1905	m = 4·97	England, south coast:—	Southampton Water. 2s. 6d.
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No. A to P Index Charts, sixteen sheets. 2308 Norway, west coast:—Brand fiord to Leka. 2309 Norway:—Leka to Donnassö. 2311 Norway, west coast:—Fleina to Vest fiord, and the Lofoten Islands. 2312 Norway, west coast:—Loften Islands to Andö. 2313 Norway, north-west coast:—Andö to Helgö. 2365 Baltic Sea:—Rostock to Arkona Light, sheet 1. 2366 Baltic Sea:—Arkona to Dievenow river, sheet 2. 2806 United States:—Charleston Harbour. 827 India, west coast:—Vengurla to Cape Comorin. 2737 India, west coast:—Viziadrug to Cochin, with the Laccadive Archipelago. 270 China Sea:—Macclesfield Bank. 2432 Tartary:—Tumen Ula to Strelak Bay, including Peter the Great Bay. 1430 Tartary:—Slavianski Bay. 691 Australia:—Normanby Sound, and Prince of Wales Channel. 2354 Torres Strait:—Cape Grenville to Booby Island.

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Chile.**Oficina Hidrografica, Santiago.**

Planos de la Costa de Chile (No. 43). Rade de Curanipe; Rada de Buchupuroo. Oficina Hidrografica, Santiago, Chile. *Presented by the Oficina Hidrografica, Santiago.*

N. Atlantic Ocean.**U.S. Hydrographic Office.**

Pilot Chart of the North Atlantic Ocean, March, 1894. Published monthly at the Hydrographic Office, Bureau of Navigation, Navy Department, Washington, D.C. Charles D. Sigsbee, Commander U.S. Navy, Hydrographer. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.**Brazil.****Stone.**

7 Photographs of the R. Amazon, Maranh, Ceara, etc., Brazil. Taken by Sir J. Benjamin Stone, Kt. *Presented by Sir J. Benjamin Stone, Kt.*

New South Wales.**Brooks.**

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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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JUNE, 1894.

VOL. III. NO. 6.



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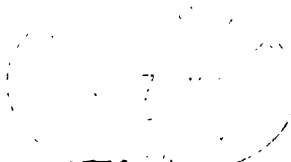
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A JOURNEY ACROSS CENTRAL ASIA.*

By **ST. GEORGE R. LITLEDALE.**

HAVING been bitten with a desire to procure specimens of that Central Asian rarity, the wild camel, and to travel through an almost unknown country across Asia to Peking, Mrs. Littledale and I, accompanied by a fox-terrier, left England on January 31, 1893. Deep snow completely demoralized the train service to Constantinople, and the intense cold was a thing to be remembered. Leaving Constantinople by steamer, we stopped at Samsun for a few hours; hearing by chance that there was an English traveller on board another steamer, we concluded it must be Lord Dunmore. On paying him a visit, he handed over to us his Ladakhi servant Ramazan, who had been with him on all his wanderings, and who proved invaluable to us later on. The late Sir Robert Morier, with his usual kindness, had for the third time obtained for us permission to cross Russian Turkistan. On arriving at Batum, we found that the customs officials had received orders from St. Petersburg to assist us in every way, thanks to the kindness of Mr. Howard, Secretary of the British Embassy, who had interested himself most effectually on our behalf; the result being that our mass of baggage, guns, etc., was passed through unopened and without a moment's delay. In crossing Central Asia we met a host of old friends, whom we were delighted to see again. We also paid a hurried visit to the grand ruins of Samarkand, but the weather was too cold for sight-seeing. We travelled from Samarkand by tarantas. At Marghilan, General Korolkof took immense trouble trying to find our old servants, whom we wished to re-engage. Reaching Osh, we found waiting for us, at the club, Azim, our old chef, who

* Paper read at the Meeting of the Royal Geographical Society, April 9, 1894.
Map, p. 540.

had been on two expeditions with us on the Pamirs, and who was described to me as being the best cook and the greatest blackguard in Central Asia. We were horrified to hear of the awful fate of Iris, a Jiguit who had crossed to India in 1890 with us. He volunteered to take a Russian dispatch from a post on the Pamir to Marghilan, some Kirghiz having previously tried and failed. Owing to the fearful weather his horse died, and on foot he fought his way for days through the snow; then his feet were frost-bitten, and, having fired away all his revolver-cartridges to keep off the wolves, he defended himself with his sword. His hand then became useless, and he was found lying in a dying state by some Kirghiz, who carried him to Marghilan, but too late, alas! to save his life. Thus perished one of the truest, bravest, and most faithful servants we ever had.

Our old friend, Colonel Grombchefskey, now Naichalnik at Osh, kindly arranged that we should be put up at the club, and took all trouble off our hands by organizing our caravan to Kashgar, consisting of thirteen baggage and five riding ponies, at the reasonable hire of eight roubles apiece. We were in despair about an interpreter, as ours had proved most unsatisfactory. While we were talking, I remarked to Grombchefskey that he was probably at that moment listening; walking quickly to the door, I flung it open, to find him with his ear at the keyhole.

On the 8th of March we left Osh. Nothing could exceed the kindness of Colonel Grombchefskey; he made arrangements that each night we should find sheep, firewood, and two yurts ready for us, doing away with all necessity of pitching our tents. Certainly the Russians are the most hospitable people in the world. There was a good deal of snow on the road between Osh and Gulcha. In the mornings the tracks were very slippery; but the sun had great power, and in the middle of the day the ice became slush. We met numbers of Kirghiz leaving their winter quarters at Osh, and going in the direction of Marghilan for the young grass; later on they return, and gradually follow the Gulcha river to their summer quarters on the Alai.

A couple of easy marches from Gulcha took us past Kirgil Kurgan to Suffi Kurgan; from thence we were obliged to carry two days' supply of firewood. We had been warned that we were not to attempt to cross the pass if a Jiguit, who had been provided, said the weather was doubtful; but next morning, all being propitious, we started for the Terek Davan. At first the ascent was gradual, but after the track had turned up a narrow valley the snow changed to ice, and it was bad travelling. There had been a partial thaw, the water had come down the valley over the snow and been frozen, and it was with the greatest difficulty we advanced. The bright sun on the glistening ice, which had formed into most fantastic shapes, made the scene most beautiful. We met a caravan coming down; the men said we should find it very bad higher

up. We had not much comfort to offer them as to the lower portion, having already seen one of our horses slide downhill a considerable distance in a sitting posture. A few weeks later the Terek becomes utterly impassable, and all caravans have to take the longer route by the Taldik pass and the Alai plateau until the ice in the ravine is melted. Before reaching the summit the valley opens out, and at Ravat there is a rest-house, an enclosed courtyard with sheds for horses, and two small rooms; the cook, of course, occupied the one with a fireplace, and we spent a miserable night in the other. The weather was bitter even at Gulcha; a glass of water would freeze during breakfast or dinner. Next morning we followed a steep icy path to the top of the pass; height by aneroid, 13,350 feet. We were badly in want of felt shoes, as our shooting-boots were not adapted for the low temperature. At this point our poor little fox-terrier decidedly thought life was not worth living.

Down the other side the descent was not so steep; the water there had apparently again flowed over the snow and frozen. With a toboggan we could have had a charming run of about ten miles. Our yurt was pitched at Kok Su, in a delightful grassy spot, with glorious views—a perfect ibex country. Close to our camp there were some curious circles formed with stones; the Kirghiz said they were graves of a giant people before their time. The river had washed away the bank, and half a circle was gone. Climbing down, I found some bones exposed. I scraped away and got the skull, which after dark I smuggled into camp, fearing to arouse any superstition. To Irkistan, the frontier post of Russia, was a longish march, but the scenery quite repaid us for any fatigue; the mountains were magnificent. In a couple of marches we reached Ulukchat, the Chinese frontier post, and we noticed at once a different type of feature among the Kirghiz. The Chinese amban was civil, and wished to provide food for the horses; but I explained that they were all hirelings, and it was unnecessary. The old gentleman had been kicked on the ankle by a horse, and he was most anxious we should prescribe; in our ignorance we did our best.

The second march after leaving the fort was through the most desolate and weird scenery imaginable; dark narrow passages (you could hardly call them anything else), where in many places it would be impossible for two pack-animals to pass, led through hills sometimes of red clay, at others sandstone weathered into the most grotesque shapes. It was like a goblin's den in a pantomime. We had noticed for some days a misty appearance in the sky, which completely hid the sun; this we attributed to dust from the desert. We reached Kashgar on March 22, having taken fifteen days, and marched 250 miles from Osh. Mr. Macartney most kindly put us up, and helped us in many ways. We are also deeply indebted to Monsieur Petrofski, the Russian political agent; he and his wife both tried hard to dissuade Mrs. Little-

dale from attempting the journey we proposed, but when they found that we meant business, M. Petrofski's unique knowledge of the country and its ways made his advice and assistance invaluable. Our precious interpreter was drunk in the bazaar, and that was the last straw; so we packed him and the cook, who was no better, home again. And there we were, without cook or interpreter. Mr. Macartney got us another Ladakhi, Rozahun by name; but neither he nor Ramazan could speak a word of English, and my Hindustani was decidedly elementary. When engaging him I promised to give him the same wages as Ramazan; the latter meekly remarked I had never promised him anything, and at the same time he took the opportunity of asking where we were going. It shows the faith Englishmen have inspired in the natives of India when a man would be willing to start off on a long journey, with perfect strangers, without knowing where or for how long he was going. We also engaged a man who spoke Turki and Chinese. If I wished to ask a Chinaman anything, I first had to speak to Ramazan in Hindustani, who translated it into Turki, and our interpreter retranslated it into Chinese; so every question involved six translations before I received the answer, which frequently had nothing in common with the question.

We purchased in Kashgar about 5000 roubles' worth of silver yamboos, known on the China coast as sycee silver; they were chunks of silver of various weights, no two of a size, and making nearly two pony-loads. What can be expected of a country where such a barbarous currency exists? In making a bargain, it was not only requisite to arrange the weight of silver to be given, but also whose scales were to be used—a very necessary stipulation, as with the pair I had there were three different arrangements by which the scales could be fraudulently altered to suit yourself, as you might happen to be a buyer or seller; and then there was the endless question as to the quality of the silver. I always, if possible, contracted that my scales were to be employed, and, whenever their accuracy was impugned, triumphantly pointed to a stamp, which I was informed and believed was that of the Taotai of Kashgar; months after I discovered that my much-vaunted stamp was simply the price of the scales!

On March 29 we left Kashgar with three covered carts, each having one horse in the shafts and three abreast in front; the carts had large wheels. By putting our tents on the bottom and our bedding above, and by arranging curtains to keep off the dust, we really made them not uncomfortable; they travelled so slowly we were able to read and play piquet. Sometimes we would travel by day, sometimes by night, and occasionally both day and night. The owners of the horses seemed to think that an extra feed of corn was quite equivalent to a rest. In this remote part of the world the horses are made to wear bearing-reins, which the carters tighten as remorselessly as the most orthodox London



FIG. 1.—KOK SU. TIAN SHAN.

coachman. We usually slept at one of the Chinese official rest-houses, which were all very much alike. A large gateway, often having a room over, leads into a courtyard about 80 yards square, with sheds for horses; another gate leads into an inner yard with two or three suites of rooms. Each suite was usually a room in the centre, with a smaller room on either side; the windows were covered with paper, and the furniture consisted of a rickety table and two or three still more decrepit stools, everything half an inch deep in dust. The entire house was made of mud. After a week's hard rain, not a wall, house, or caravanserai would be left standing—they would simply melt away; but rain in this country is almost unknown. Owing to the thick, dusty haze we hardly ever saw either sun or stars, and although we had the high range of the Tian Shan close to the north of us, I can only recall one occasion on which it was visible. We tried by offering rewards to get some old manuscripts; an illustrated book was brought, which our Chinese interpreter pronounced to be three thousand years old. On examining it, I found a picture of a frigate, and another of a man filling his wine-glass from a decanter; so, in spite of its age, I did not buy.

At Aksu a very large proportion of the Turki population had goitre; I did not notice the malady amongst the Chinese. We passed a considerable number of Chinese soldiers on their way to Kashgar; they were straggling along the road in twos and threes, without any pretence of military discipline, and wretchedly armed. Nobody in their senses would dream of pitting them against European troops. Whenever we saw any quantity of these gentlemen approaching, we pulled down the curtains of the cart, as we wished above all things to avoid a row, and they have the reputation of being very bumptious when in overwhelming numbers. On one occasion, seeing an Afghan trader break a chatti over the head of our caravan bashi, I stepped forward to stop the fight. The Afghan declared he had not been paid for something; our men vowed he had stolen their money. On his mouth being prized open with a bit of wood, there was the missing chunk of silver. The people were very inquisitive, examining all our belongings most carefully. A Chinaman wished to know the use of a safety-pin; so I securely pinned the two sleeves of his coat together, and then proceeded to box his ears, much to the delight of the spectators, who repeated the joke to everybody who came afterwards. We passed, on one occasion, a native wearing a heavy iron collar round his neck, to which was attached by a chain a bar of iron about five feet six inches long, and as thick as my ankle; he had to wear it for the rest of his life for stabbing a Chinaman.

On arriving at Kuchar, I tried at once to get a guide to take us to the tombs at Mingui. No one would go; the difficulty consisted in the fact that the man Captain Bower had bribed to show him the road afterwards got two hundred strokes by order of the amban for having

done so. I bearded that worthy in his den, demanded and was promised a guide; it was noised abroad that I had received permission, and then half the town wished to go. I arranged for some men and horses to be ready at daylight, so that, if the amban broke his promise, I should be independent. Next morning no guide from the amban was forthcoming, and we started. We went by a short cut, which proved a couple of hours longer than the ordinary road, and when we arrived at Mingui the promised men were waiting for us, having come the shorter way. The caves are chambers cut out of the sandstone and clay which form the precipitous sides of a valley, through which rushes a rapid river; a great many of the caves are quite inaccessible from below without long ladders, or from above without a rope. Most of those I saw had arched roofs covered all over with endless pictures of Buddha; on one roof I counted twenty-four rows of thirty-six figures in each row. The walls had more Buddhas, and faces of a Chinese type; opposite the doorway was usually a buttress, on which was carved a large figure of Buddha, with nearly always a tunnel round at the back. On a steep rocky promontory there was an opening, entering which we scrambled up by aid of holes for the feet and hands, and found ourselves in a gallery; to the right were a succession of tombs, and to the left an opening in the rock, through which we looked at the river foaming below. I should dearly like to have had a few quiet days' digging with pickaxe and shovel. Evidently somebody else had been of the same opinion, for there were traces of the ground having been disturbed in some of the chambers. Rozahun, who accompanied me out to the cave, said there were plenty of similar ones in Ladakh.

We arrived at Kurla on May 1, the journey of 650 miles from Kaashgar having been rather uninteresting. Wherever there was water there was vegetation, and sometimes cultivation, but there were long stretches of monotonous desert country. We immediately set to work to organize our caravan. With the aid of the aksakal we purchased twenty ponies, which with their pack-saddles, ropes, picketing-pins, etc., averaged £3 apiece, and twenty donkeys, which with their fittings cost £1 2s. apiece. We engaged six men to look after the animals; we took five months' food for the men; we also hired twenty-five or thirty donkeys to go as far as Lob Nor, on which we piled as much grain as they could stagger under; we also hired a few extra donkeys to go with us for a week, to save our supplies of grain.

I experimented here and at Kashgar with the sextant and artificial horizon lent by the Society. Unfortunately, after receiving a few lessons from Mr. Coles, an accident confined me to bed for several weeks, and I was thus prevented from making myself as competent an observer as I could have wished. Nevertheless, I had obtained sufficient knowledge to enable me to make good use of the instruments lent by taking observations for latitude and time. Jolting in the tarantass had ruined the

glass of the artificial horizon, making observations very difficult except on calm evenings. Mrs. Littledale volunteered to note the time by my watch of the sextant observations, and I am afraid it proved to be no small addition to her fatigues, having to stay awake sometimes for hours while I tried under the lee of the tent to catch the stars on windy nights. Finally the prismatic compass succumbed to the accidents of travel, and had to be patched up with silk; therefore I hope allowances will be made, and my first attempt at map-making judged leniently. Making our arrangements with all possible speed, it was May 10 before they were completed. The aksakal, a kind of petty judge, wished to come to Lob Nor with us, and as we hoped to make him useful in getting a guide, we agreed at once. At starting we found that the only men who understood anything about packing were our two Ladakhis. Before engaging any men, I made them thoroughly aware of the fact that they were to walk the whole distance; I told them that if, later on when our stores decreased, we found we had spare animals, then they might ride. After leaving the oasis of Kurla, we crossed some barren country, and the second day reached a sluggish muddy stream, about 30 yards wide and very deep, which eventually joined the Tarim river. Some people from the Lob passed our camp in dug-out canoes. Going down stream, they told us they would reach Abdul in four days; our caravan took sixteen.

On the seventh day we came to where the Chinese are building a new city, 300 yards long and 200 broad. The only name I could hear was Yangi Shahar, new town. Like every other town in that country, it was surrounded with a high wall of mud; they were building it by filling up a wooden framework, which was raised as the mud got hard below. I arranged that Ramazan and the aksakal should go to Chaklik to get a guide, some more Indian corn, and camels or donkeys to carry it for some distance along the Altyn Tagh, while we went direct to Abdal to let the caravan rest. There was good grazing most of the way; the young chi grass was springing up well, and our animals were putting on flesh; but the vegetation is confined to the neighbourhood of the river and a mile or two on either side; beyond was hopeless desert. We had to cross the Tarim twice; our animals swam across, and our baggage was ferried over in canoes. We lashed a couple together side by side, so there was no fear of an upset. As we got nearer Lob Nor the weather became hotter, and at night the temperature did not often go lower than 80°. On May 27, at Kurgan, we caught our first view of the Altyn Tagh. High, desolate, and barren they looked; as the sun rose they faded away. On the following evening a strong gust of wind struck the tent, which was followed by others till there was a furious gale blowing, that lasted all night and the following day. By placing sacks of grain on the tent-pegs, the tent weathered the storm. Nearly all our stores had been ferried across on

the previous afternoon, but it was quite impossible, in the teeth of the gale, to take the remainder of our things over or cross ourselves, though the river was only about 70 yards wide.

We reached Abdal, which is a miserably poor village consisting of four houses and about twenty inhabitants, on May 28. The water of the Tarim here, curiously enough, was very cold, though three days previously it had been warm, and there had been no change in the weather to account for it. When the natives came to pay their respects, they put their hands below their waists, and then bowed in a manner very suggestive of sour apples. Their features were in several instances strangely Irish in type. They told us that the mountains we saw were called Chong Tagh, and that the real Altyn Tagh are far to the south. Ramazan and the aksakal arrived from Chaklik; they had purchased some grain, which came by boat. Neither camels, ponies, nor donkeys were to be procured there; every animal had been hired to carry supplies to some natives who were mining on the other side of the Altyn Tagh, and whose animals had died. The guide they brought, on being cross-questioned, proved a fraud, and only knew the road to Gass; so we sent him back, and relied on an Abdal man who had once been to Saitu. We arranged that twenty of the hired donkeys should go on at the hire of three and a half seers a month apiece, with two men and a boy to look after them.

We left Abdal on June 3, having given presents to everybody who had been of any use to us, and to many who had not. At first all our animals were carrying very heavy loads of Indian corn, but with the numbers we had to feed the daily consumption was large, and we reduced the loads of the weaker animals first. To avoid some of the marshes we retraced our steps a few miles up the Tarim, and then turned south-east along the edge of the marsh. The travelling, in places, was very bad; the earth looked as if it had been steam ploughed, harrowed to break the furrows, and then baked by the sun almost as hard as iron: it wore the shoes of the ponies very much; if they chipped off a piece of earth it rang when it fell, like metal. We camped by the edge of the swamp; the water by the shore was very salt, but by wading in some distance we got some just drinkable. The Kalmuks had marked the way across the desert by forming here and there bundles of reeds into tripods. We saw the Lob Nor swamp stretching away, a green patch, far to the east. At Abdal the natives said the river flows about three days' journey and then sinks into the sand, and that there are no permanent habitations beyond Abdal; there are distinct evidences of the swamp having been at one time much larger than it is at present, and, judging from the number of the roots, there must have been a considerable forest where there is nothing now but arid desert.

The houses of the people of Lob are primitive: a rough framework

is made of logs tied together, against which are placed bundles of reeds standing on end, which are fastened to the logs; the roof is the same, and, as high winds are prevalent, they are frequently laid flat. The Altyn Tagh were very distinct, and did not appear to be one-third the distance away that we knew they really were; their higher summits were covered with fresh snow.

We had now a long waterless stretch to the mountains, about fifty miles as the crow flies. At Astchi bulak there was grass and some water, but too bad even for the donkeys. We marched up a gradual slope of gravel for about ten hours, then stopped to rest and feed our animals. When the moon rose we started again: the night was cool, and we travelled fast, and reached our camp at the Kurgan bulak about noon



FIG. 2.—LOB NOR (AFTER PRJEVALSKY).

the following day. The stream was excessively bitter, but we found a spring, the water of which, though bad, was fit to drink. Shortly before we reached the Kurgan bulak we passed a stream of deliciously cold, muddy water: it was from the melted snow, our guides said; they had never seen any water there before. The sand-grouse had found it out, and were collected near in thousands. Some of the donkey-men before they reached water had been marching for thirty-four hours with only one rest of two hours. We had now attained an altitude of about 6600 feet, and the weather was much cooler. We marched a couple of days up the valley, in the bottom of which springs of bitter water were numerous, and there was plenty of chi grass for our animals; the hills on each side were clay, and devoid of vegetation. There was an old

ruined fort, at the point where we left the road used by the Kalmuks going to Tibet. Our men said, whenever Kalmuks were spoken to about this road they always spit to show how they disliked it. After crossing the pass, a long distance has to be travelled before water is found, and it is customary among the Kalmuks to employ one animal out of every six or eight to carry water for the others. We turned more to the east, still following up the valley, and the grass grew scarce. It was here we first saw the tracks of the wild camel. The country gradually assumed a more Alpine character, and we had several small passes to cross; the rocks were covered with loess, and the coloration of the mountains then became very peculiar,—the lower part was light brown loess, out of which rose cliffs of black rock and, a little further on, very red granite. The contrasts were startling. We were now, on June 10, at an elevation of 10,862 feet, and we had a long march in drenching sleet and rain, and all the men shrivelled up at once; they are not used to it, and the rain made travelling most disagreeable. Owing to the usually dry climate there was deep dust everywhere, which quickly became slippery mud, fatiguing to both man and beast. We were marching parallel to the Altyn Tagh, along its northern slopes; the summits rose 2000 or 3000 feet above us. We had to surmount a succession of ridges and valleys, water and grass being scarce. The first of our horses gave out here—a short-legged thick-set strong animal, but he would not eat grain, and grass was too scanty: we gave him a chance for his life by leaving him beside a spring where there was a little grazing; we felt rather sad next morning, when we marched away and left him to his fate.

I followed down one of the valleys to try for wild camels. The mountains were very savage and grand; the black colour of the rocks gave them a very gloomy aspect: they gradually sink down into the desert, and, finally, little peaks are seen peeping up through the sand. The following day, June 14, we reached Galechan bulak. The Altyn Tagh have mostly got a thin veneer of loess: the tops are bare, but lower down the coating of loess becomes thicker. From the deep ravines formed in the loess by water, one might suppose that the rains are heavy and frequent; but, judging from the channel our scanty morning tub when upset cut in the soil, one realizes that a little water makes a great show. A couple of days later the mountain ahead became impassable, and we had to turn down to the desert and skirt along the base of the hills. Water became very scarce, and there was no grass; there were a few low shrubs, on which our beasts had to do the best they could, and, as they rarely got water oftener than every second day, they lost flesh rapidly, and, owing to the lower elevation, the heat was greater, and their sufferings from thirst were increased. Our guides were most unsatisfactory, and we could not trust them in any way, their palpable object being to wreck the expedition. At one place, having vowed and declared there was no water, Ramazan caught them going secretly to a

spring in the night, the existence of which they had previously denied. I climbed a peak, and with my telescope swept an immense extent of desert; I could see no camels, nor could I see any sign of a range of mountains marked on the Society's new (unpublished) map of Tibet as branching out from the Altyn Taghand running north-east.* But far away to the north, probably 40 or 50 miles, there was a range of sandy hills running nearly east and west. The men stated that the desert route to Saitu, which is only possible in winter, follows along their southern side. Marco Polo, in describing his journey, does not say which of the two routes he followed, but if he chose that by the mountains the country must have dried up enormously since then, for we did not find water in anything like the number of places he did—I think he mentioned twenty-eight. A couple of days later we caught sight of the snowy peaks of the Anembarula Mountains, and we then felt independent of our rascally Lob Nor guides. We were continually being delayed by the straying during the night of some of the animals: the poor beasts used to wander to try and find something to eat; and the men who were supposed to watch them were doubtless curled up in their sheep-skins, and no reward or punishment that we could devise would stop it.

Mrs. Littledale, a couple of men, and myself usually went ahead of the caravan, on the chance of stumbling across game. Seeing the fresh tracks of camels, I with one of the men followed them up, Mrs. Littledale and the other man going to try and find water for their horses, for they had had none since the previous morning. Doing no good with the tracks, we hurried on. Eventually I saw Mrs. Littledale in the distance, waving her handkerchief; I thought she simply meant to tell me that they had found water, so I went on taking bearings with the prismatic compass; finding her still waving, I pulled out my handkerchief, waved an answer, and returned to my compass. I then saw her frantically flourishing a handkerchief in each hand, and I realized that I was urgently required, and my footsore pony had to put his best leg foremost. Mrs. Littledale told me there was a camel on the other side of some rocks, and that the guide had left her half an hour before. On looking over the rocks I saw the camel half a mile away on the plain. I had just begun to crawl towards it when it galloped in our direction; I had a long shot, and mortally wounded it. I had just reloaded when another camel, which up to that time I had not seen, followed its companion's steps, only to meet the same fate. It turned out that the guide had seen the camel, and, wishing to shoot it before I arrived, had made a long round, the wind being then in the wrong direction; just as I came the wind shifted, the camels smelt him, and galloped past me. The men said that one of the camels was thirty-five or forty years old; Mrs. Littledale, who tried to eat some of it, saw no reason to doubt that statement.

* The necessary correction has been made in the map of Tibet, which will be published shortly.—ED. G. J.

Two days after I got a couple more, so one of the objects of the trip was fulfilled.

We had several more days of desert, with little or no water and grass. One afternoon, after the daily march was over, I fancied I saw through my glass a faint greenish patch on the mountain-side, and as our water supply was at a very low ebb, I climbed up to see if I could find a spring; not finding what I sought, I thought, as I was halfway up, I might as well climb the rest, and see what was on the other side. When I reached the summit I found it was the top of the Altyn Tagh. Stretching away to the south was a great desert plain. At the base of the mountains, I should think about 4000 feet below, the sand was dark coloured, further away it became yellow, and I could see the dry bed of a stream where some water had evaporated, leaving a salt deposit. Away to the east, about half a mile, there was a wild yak close to some snow; but I had no rifle, and there was no time to get one before dark. On my way down I found under a rock a patch of snow, where apparently all the feather population came to drink. After quenching my thirst, I carried down to the camp, in my handkerchief, a mass of snow, feathers, and dirt; when melted it did not by any means prove to be an ideal drink, but it was without salt.

On June 24 we were close to the Snow Mountains, and at Nanambal we camped by a considerable stream with good grazing; there was a yurt there, the inhabitants apparently consisting of two men and two women; directly they saw us they jumped on their horses and bolted up the hillside. They returned very gradually; I went forward to try and talk to them, but as I advanced they retreated. Then Mrs. Littledale tried her hand; she thought she would get on better with her own sex, and she used all the blandishments she could think of. The women eventually turned out to be two young men, lamas; what they thought of her I don't know. It took us quite an hour to establish friendly relations; we were particularly civil to the young lamas, as we hoped to enlist them as guides, but at the first opportunity they slipped away. These were the first inhabitants we had met since leaving Lob Nor. I offered heavy bribes to the two Chinamen if they would show me a pass over the mountains, but the answer I received was they did not know any road; it was only some time afterwards that I discovered that our interpreter, who was the greatest coward that ever stood six feet in his stockings, had played us false; he was so thoroughly frightened that his only wish was to lead us to some Chinese town where he could desert. The Lob Nor men refused to come any further, and we took one of the Chinamen, hoping to pick up somebody who would take us across the mountains; but the further east we went the higher they got, and I do not think in that part there was a pass across the range. We had now left the extremely dry country behind us, and were in a more fertile district. We really hoped our water troubles were over, but

after we left the mountains we marched across a broad plain and then down into the yellow sand. We went on and on; the Chinaman persisted we were all right; horses and men began to be played out, and a more hopeless outlook for water could scarcely be imagined, when suddenly, on surmounting a hill of drifting sand, we saw down below us in a valley a vividly green patch of grass and a spring; the water which sank into the gravel at the foot of the mountains reappeared here. We had decided that as we were, owing to the treachery of our interpreter, now so near Saitu, it would be better to go there, procure a guide and a fresh supply of horseshoes, as we had used more than we counted upon, and then strike into the mountains again. The evening lights were beautiful, the brilliant green of the valley contrasting with the different tints of yellow and brown sand and the snow-peaks of the Altyn Tagh; it was the only pretty scenery we had seen since crossing the Tian Shan fifteen weeks before.

The day before reaching Saitu our path for seven or eight miles followed an embankment which was four or five feet high and about ten yards across; where our path branched off, the embankment continued as far as we could see. I never heard that the Great Wall of China extended beyond Suchau, but this certainly much resembled parts of the wall that we afterwards saw, and if it was not the wall I am quite at a loss to say what its use could have been. We invested in some sheep, but we did not own them long, for during the night the wolves made themselves merry at our expense, and a bone here and a bit of skin there was all there was left of them next morning.

On Sunday, July 2, after winding through fields and gardens, we camped on a green meadow just outside the walls of Saitu, and our camp was at once surrounded by Chinese, who were extremely curious to see Mrs. Littledale. My first step was to buy horseshoes, after which we felt quite independent. I then went to call upon the head amban, who commanded the soldiers. He was very civil, but laughed at the idea of there being a road to the mountains; at this time of the year, he said, there was no water, and the horses would all die. He requested us to return in the winter, and he would help us. I then called upon amban No. 2, governor of the town, who stated that the road to the mountain was at this season quite impassable; owing to the melting snow, the rivers were unfordable. He had just heard that some Kalmuks had had their camels swept away and drowned; how did I expect my donkeys to cross? I replied that I had nearly forty, and the loss of two or three would not matter. Suppose your wife was drowned? Here was a question bristling with difficulties, so I turned the subject. No. 3 was less polite, and relations were speedily strained. All were determined that we should go by the main road; they enlarged freely on the danger from robber tribes. Negotiations went on for three days. I announced, and stuck to it, that, guide or no guide, I should start on

the 6th. Things looked very black for our men, who, exhausted with their journey, now in addition were terrified at the tales they heard of the Tonguts, and absolutely refused to go any further. One of the reasons advanced was, that we had given them water out of a cup that our dogs had used. Mrs. Littledale used to carry water especially for our fox-terrier and a Kalmuk dog in an Indiarubber hot-water bag strapped on to her saddle, and they drank out of her cup, and one of the most trying things on the expedition was to have to refuse water to these poor dogs. One day, when the only water any one had left was a small quantity which Mrs. Littledale had in her water-bottle, the caravan bashi, who was terribly exhausted, felt the bottle and asked for a drink; she gave half a cup to each man, and glad enough they were to get it, notwithstanding their Mahomedan tenets. Our two Ladakhis and one Kulja man alone remaining faithful, I told Ramazan that he was to see that every man had a big supper, and then he was to talk to them, expatiating upon the enormous wages they were receiving, and the presents they would get in addition, and how awkward it would be for them if they were left without money or clothes. That, and the threat that the Chinese would certainly imprison them, did the business, and next morning they all came and said they would go. The amban's wife came to see Mrs. Littledale; we made things very pleasant, loading her and her boy with presents, and she announced that the amban would give a guide. On paying off the Chinaman who had brought us to Saitu, I saw there was something wrong. As a matter of policy, I had paid him five times what he was entitled to, so I did not think he could possibly be dissatisfied. On being questioned, he explained that it was the custom, when a big man gave a present, for the receiver to knock his forehead on the ground; but were he to do so, all the people would see and know that he had received something, the amban would hear it, he would lose his money and get into trouble, so he hoped I would forgive him. To be more independent, I was obliged to purchase outright the donkeys I had hitherto been hiring, and to keep their late owners on wages like the other men.

In a humble way we are able to confirm the accuracy of Marco Polo. He mentioned that it was a month's journey from Lob to Saitu. Colonel Yule, in a note, questions the correctness of the time. It took us exactly thirty days to travel the distance. He further said the inhabitants flee into the desert from invading armies, and the wind quickly blows the sand over their tracks. One day I stayed behind to help a donkey out of a swamp, and, although our big caravan was not half an hour ahead, every trace of their track had been obliterated by the wind. But I am afraid somebody must have been imposing on the great traveller when they told him that spirits inhabit the desert, who call travellers by their names, and lure them away to destruction. I regret that we really cannot help him out with that statement, though the wind on the

sand certainly does make peculiar sounds. We left Saitu on July 6, without regret; the heat had been great— 104° to 106° in the tent. After a few miles we left the oasis, and, crossing a strip of desert, we reached another valley, where there was water and grazing. In the north side of this valley, which was composed of a gravelly rock, there were excavated an immense number of Buddhist caves; they extended for nearly half a mile, and there were three or four tiers of them, very similar to Mingui. There were two large Buddhist figures; the foot of one of them, minus his toes, was sixteen feet long. I measured them with a clinometer, and made them to be upwards of 80 feet high.



FIG. 3.—TONGUT GUIDES.

They were cut out of the rock, and where it was faulty the flaws had been filled up with clay. Each figure had a cave to itself, with openings cut high up in the rock, so that light was admitted. Over the head of the taller one, which reached to the top of the rock, there were the ruins of a building like a temple, apparently built to protect the figure from the weather.

Our next march was to the edge of the same gravelly plain that we had crossed about seventy miles further west, when leaving the mountains. Next day we made a long march, and had to camp on the plain without grass or water. Had we, instead of going to Saitu, followed along the base of the mountains, we should have shortened our

march ten days, and saved our animals a lot of wear and tear. A wolf killed a sheep in broad daylight within 50 yards of our camp, and chased another for several minutes, though everybody was shouting and trying to drive it away. I fired three or four fruitless shots at it with a repeating-rifle, but, as they doubled backwards and forwards amongst the boulders, I was afraid of hitting the sheep. We crossed a pass which we thought might be over the Humboldt range, but it proved to be only a spur, which I think it would have been better to have gone round, as we had to climb up and down 3000 feet. From the summit we had a good view of the snow-covered Humboldt range facing



FIG. 4.—YAKS CARRYING WOOL FROM THE KOKO NOR TO HSI-NING.

us. I saw no glacier at this end, but further along almost every valley had a small one. Our guide, a Chinaman, had brought his son, a child of five or six. He was away all night looking for his horse. Our men asked the boy to come and sleep near them; he declined because he had his father's things to look after; so he slept alone, a hundred yards away from the camp. Imagine an English child of that age doing the same! The father afterwards sold the boy to some Kalmuks.

We marched up a valley five to ten miles wide, with the fine snowy Humboldt range on our right; as we went east the mountains got higher. We passed several places where there had been gold-mining; some of the shafts were a good depth, but all were abandoned. We

stopped at a yurt belonging to some lamas, and were offered sour milk; Mrs. Littledale (to avoid hurting their feelings) drank it. The lama took the empty bowl from her, and then the longest, broadest, and reddest tongue I ever saw curled round inside the bowl a couple of times, and it was replaced on the shelf washed, as before. After watching this cleansing process, my wife wished she had not been so polite. Our guide only knew the road to Hsi-ning by the Tsaidam-Gobi, so we stopped a day to negotiate with some Kalmuks for guides. One man looked intelligent when Buhain gol was mentioned, and said it flowed to Koko Nor; but he afterwards denied all knowledge of it. Bribes were tried in vain, and I had actually hold of his horse's rein to seize him and compel him to come, when a man appeared who was willing to go in return for a horse and some money.

To the north the country was composed of barren clay hills of no great elevation, with sandy valleys; but there was to the north-east a rather high snow range, which seemed to start from the Nan-Shan and run north-west. We had been eight days ascending this valley; we crossed a small pass which was only over a spur of the Humboldt. What I saw from the top was quite unexpected. It appeared from the distance as if the Nan-Shan were not connected with the Humboldt at all; between the two there was a broad plain with hardly a perceptible rise, with lakes which apparently formed the watershed; to the east the water would probably run into the Koko Nor, and to the west into the Gobi desert. Nearly due east we saw the Nan-Shan, magnificent snow-peaks, some of them very high; the guide said it would take three days to reach them across a barren country. A few miles after crossing the spur we turned south and crossed the Humboldt by a low easy pass. Ping Dawan being the Chinese name, Captal Dawan the Mongol; height by aneroid, 16,178 feet. On getting to the south side of the Humboldt, we found there was another much higher range of mountains, running parallel with them, as far as I could see, in a north-westerly direction; there was a good deal of snow on them. Some of the peaks were high. One in particular to the south-west, with its cone of snow and large ice-fields, was a conspicuous landmark; it remained in sight towering above its neighbours for several marches. I estimated its height to exceed 20,000 feet. The Tongut name was Amnermurgil. There was another peak a little further away that was also very high. Proceeding in a southerly direction, we crossed the chain by the Yangi Dawan; then over a barren undulating plateau strewn with granite boulders, little lower than the pass itself on which we camped.

When a horse or donkey fell sick, the treatment was to run a large packing-needle through the animal's nose. Our caravan bashi, who suffered from the elevation, forced one right through his own, probably reasoning that what was good for an ass certainly ought to suit himself.

Our next camp was in a broad valley, 14,573 feet, with a small stream which flowed west, in which direction we saw a line of distant snow-peaks coming from the north, probably a continuation of the Hartung-Suisan. We turned east, and, crossing a low divide, commenced to descend. The mountains to the south became higher. We saw quantities of yak—there were between seventy and eighty in one herd; antelopes and kyang in thousands. We were approaching the Tongut country, and our guide wished to return. This we would not hear of. I must say, with the exception of the two Ladakhis, all our men were now in a great fright. On our camp being pitched a few miles from a Tongut encampment, one of the dreaded tribe arrived. Even the greatest cowards laughed when our foeman proved to be a small boy of fourteen. Next day I went to interview the chief.

The tents used by these people are quite different from the felt yurts of the Kirghiz and Mongols. They are made of a rather porous woollen cloth in two pieces, which are loosely laced together, leaving a slit in the roof about a foot wide from end to end, to let out the smoke. The roof being nearly flat, and the sides having a very gradual slope, they cover a great extent of ground, and, not being high, do not catch the wind. I was offered, and declined, tea flavoured with butter and salt. Our Tongut guide dipped his fingers into the rancid butter floating in his bowl of tea, and smeared it over his hands and face. The chief examined me carefully from head to foot, and, having asked my nationality, then said, "The Englishman has wonderful guns, but very bad clothes." Then the guide topic was introduced, and after the usual objections had been overcome by the transfer of some of my property to the headman, two guides were forthcoming. Our old guide declined to leave at once, saying he would go with us till nearly the end of the march; then, by lagging behind, he could slip away unnoticed. For he said, if our new guides knew he was going, they would certainly turn back and rob him. By this arrangement he would be able to pass the large encampment during the night. Our guides did not stay long. They professed to be in fear of their lives, and they departed, leaving us to find our own way. But we were now in a better grazing country, and there was water everywhere, so one of our great anxieties was over. Only those who have experienced it can realize the horror of travelling in a waterless country with treacherous guides. Scarcity of fuel was another though minor source of trouble. We always carried a sack, in which was put as we marched along the smallest piece of wood or dropping that we could find, to make our camp-fire. With the exception of the Kurgan bulak and the neighbourhood of Saitu, we saw no trees between Lob Nor and Koko Nor. The river that we had been descending turned to the south through the mountains, which were here particularly fine and bold. We ascended a valley in an easterly direction, and camped at the foot of a prominent peak, whose altitude by aneroid

and clinometer I made out to be 18,000 feet, and next day crossed the Katin La, about 15,800 feet. It was steep and stony ascending; the descent was in some places soft clay. To the north there appeared to be a rolling, stony plateau; to the south, rocky peaks, some of them vertical enough to suit the tastes of members of the Alpine Club; to the east, the valley of the Buhain gol. As we marched down, the mountains to the south sank rapidly, and about 20 miles from the Katin La there was apparently to the south only rolling grassy hills. Further on the mountains rose and became abrupt and snowy again.

We saw across the Buhain gol some Tonguts galloping about in a great state of excitement. The Mongols profess to be afraid of the Tonguts, and the Tonguts, it now appeared, dreaded the Mongols, whom they supposed us to be. We invited them across to see us. They carried a sword stuck through their belt, and a lance at least 14 feet in length, and most of them a matchlock gun as well. I gave them a practical explanation of the repeating-rifle, omitting to inform them, however, that after firing five shots it was necessary to reload, and they left under the impression that it went on shooting indefinitely. Some days after, about one hundred and twenty similar gentlemen stopped about a mile from our camp, and our Turki men said we were about to be attacked. I held a consultation with Ramazan and Rozahun, and we decided it would be best for them to go to the Tonguts and ask for a guide; it would show them that we knew they were there and were not afraid of them. Each taking a rifle, they interviewed our friends. The repeating-rifle was expounded with such marked effect that when Rozahun proposed to explain the beauties of a revolver, they begged him to put it by. Whatever their original intentions may have been, they were far too great cowards to face us when they saw we were prepared, and they rode away, looking with their long lances very wild and picturesque.

We had now rain regularly every afternoon, and the grazing was luxurious. Our horses began to gain flesh and spirits; one of them actually bucked his load off. Poor beasts! they deserved some good grass after the rough time they had had. They showed their increased strength by marching three geographical miles an hour, in place of two and a half.

A large stream had joined the Buhain gol from the north, and the river was now of considerable size. It took us some time to find a ford, and we crossed to the left bank. Seeing four mounted Tonguts about a mile to our left, I rode towards them; they began to edge away and at last commenced to gallop. Armed with a white umbrella, I started off in hot pursuit. As they fled I saw them working away at their matchlock guns, but apparently could not manage their flint and steels on horseback. My pony was so weak he was soon outpaced, and I gave up the chase.

On August 3, the sixth day after crossing the Katin La, we camped a few miles away from the Koko Nor; we had for some days been very excited to know whether we were right in our calculations as to our position in regard to the lake, and when at last we saw right ahead its blue waters dancing in the sunshine, we knew that our dead reckoning was not much wrong. The north shore of the lake was very flat and looked swampy—there were many antelopes and kyang feeding; the south shore was bounded by mountains, but not of any great altitude. Fifteen to twenty miles south-east, in the lake, I saw an island; to the north-west the horizon was rolling grassy hills; on the north-east stood the Nan-Shan with patches of snow. We marched for a couple of



FIG. 5.—BRIDGE NEAR HSI-NING.

days along the shore of the lake. The third day we pitched our tents near a large Tongut encampment; thousands of sheep and yaks were feeding on the hills. At the door of almost every tent was a spear stuck in the ground, and standing like a flagstaff; I tried to buy a spear, but nobody would sell. They were now kind enough to offer us a guide to Hsi-ning, but we respectfully declined. Next morning our five sheep were missing; thinking they had joined one of the flocks near, we started, leaving a couple of men behind to bring them on. They overtook us in the evening, and said the sheep had been stolen and were not to be found. Our two Ladakhis, who had the greatest contempt for the Tonguts, were most anxious to start back at once; they said that if our own sheep were not forthcoming, they

would take fifty sheep to replace them, and, if the headman objected, they would bring him along too. I have not the least doubt they would have done so had I allowed them to go. Among the sheep was one that we were extremely sorry to lose; he had followed the caravan all the way from Kurla; he used to sleep by the kitchen fire, and was the pet of the camp.

We reached the busy, prosperous-looking town of Hsi-ning on August 9, four days from Koko Nor. A few miles from the town we had the pleasure to meet a Mr. Obrucheff, the Russian geologist to the Potanin expedition; he had come from Suchau by a route to the south of the south Koko Nor mountains and the lake itself.

Some Tonguts had told us that an old lama lived alone on the island in Koko Nor, and that in winter numbers of people crossed the ice to see him; others had told Mr. Obrucheff there were three hundred; Prjevalsky reports eleven. So much for the dependence to be placed on information obtained in this country.

Soon after we arrived, Mr. Hunter, a Scotch missionary, visited us; he helped us in many ways.

Two marches from Hsi-ning the road to Lan-chau bifurcates. The left-hand one, a cart-road, takes ten days; and the right, a rough mule-track along the Hoang-ho, only seven: we chose the latter. In crossing a ferry, one of the horses carrying our precious burden of wild camel skins got frightened and went overboard; but the men held on to the load, and fortunately saved it going into the river with the horse. We passed a number of water-wheels, some of them 60 feet high; they lift the water from the river to irrigate the land, principally growing poppy. In this loess-covered country water has a disastrous effect on the roads. It is of no unfrequent occurrence to see a small hole in the road; on looking down, you find the ground you are standing on is a mere shell, and the cavern beneath of considerable depth.

We had made up our minds that we would if possible get a raft and float down the Hoang-ho; so directly we arrived at Lan-chau I called upon Mr. Redfern, an English missionary. He told me that rafts did go down, but no European had been, and he did not recommend Mrs. Littledale to try it. This was the very last argument that would divert my wife from our intended route; and by next day he had arranged a raft to take us to Ning-hsia. Our craven-hearted interpreter here announced that nothing would induce him to go any further, and Lan-chau was ransacked in vain for another. One of our Turki caravan men, who spoke a few words of Chinese, agreed to come; but he spoke so little, he added much to our difficulties.

For a journey like ours, when four or five months' food for man and beast has to be carried, and where the water troubles are so great, donkeys are far preferable to ponies; mules would probably have done better than either, but we could not buy any at Kurla. Out of our

twenty ponies, though twelve actually reached Lan-chau, only four or five would ever be much good again; while out of our forty-one donkeys, about thirty of the thirty-four which survived would only require a fortnight's rest and good food to put them to rights. Our horses ordinarily carried 3 maunds = 290 lbs., and were given 4 lbs. of grain a day; and we had a man to look after each four horses; the donkeys carried 2 maunds and had 2 lbs. of grain, and one man easily managed ten or twelve. Horses walked about half a mile an hour quicker, forded streams better, and were pleasanter to ride, but there their advantages ended. We handed over our horses and donkeys to our men, as they had on the whole done well, the Kulja man for having stood



FIG. 6.—WATER WHEEL ON THE HOANG-HO.

by us in the Saitu revolt taking the lion's share, and they started back to Kurla immediately by the high-road.

Our raft was about 50 feet by 18; it had three sweeps at each end, with which the crew of twelve men were able to give it a slow crab-like motion. We pitched our tent, and with a floor of planks made ourselves comfortable. One of the raft-men had bought some baskets of peaches as a speculation; they were rather in our way, but we took toll, and it gave the headman a stake in the safety of the raft, so he was more likely to be careful.

On the Han river there is an organized system of wrecking. A gang of men will tow a boat halfway up a rapid, then the head of the gang says unless he gets so much extra the men won't pull any more; if the

owner refuses, they let go the tow-rope and the boat is smashed on the rocks, and then the rascals save as much of the cargo as they can, for as salvers they are legally entitled to half.

The missionaries came to see us off. It is impossible to speak otherwise than in the highest praise of the zeal and devotion of these men, who are spending their lives in an endeavour to Christianize the almost hopeless heathen Chinaman.

The rapid current whisked us off, and Lan-chau was quickly lost sight of. We floated nearly all day through a gorge, and went down a small rapid—we had heard there was one—and prematurely congratulating ourselves that it was past, we tied up for the night. We started at daylight, and soon the gorge became narrow, the raft dashing down at an alarming pace; the sides of the gorge were nearly vertical. The river every few minutes made sharp turns, boiling and surging, and at the bends the water would be heaped up against the rocks, higher than my head as I stood on the raft, and then flow away in a succession of whirlpools. I thought if the river was going to be like this all the way there was not much chance of the raft keeping intact, for we had bumped once heavily, fortunately not in the most rapid part, but sufficiently so to break some of the logs and to knock the raft all askew. What did not exactly increase our confidence, was the discovery that each man had an inflated sheepskin handy. At one place I don't think the river was more than twenty yards wide. Fortunately, after a couple of hours the gorge came to an end, and the river widened out and went at a more sober pace. Here half our crew put all their worldly goods into their skin bags, which they re-inflated, and then paddled themselves ashore. They had, it turned out, only been engaged for the dangerous part. In spite of all their efforts, the raft had on several occasions spun round in a decidedly awkward manner. In the gorge there were, of course, no habitations, but below there were scattered villages.

The ferry-boat of the country was made like a sheep-hurdle, under which were fastened about nine inflated skins; the ferryman paddled it like a coracle, and the passengers sat behind. As we got lower the river separated into several channels, and then our troubles began. Owing to the unwieldiness of the raft, we were not always able to take the most promising channel, and we constantly stuck fast. The raftmen used to tie six or eight of their longest and biggest logs together, making a thick boom nearly as long as the raft; one end was tied close to the raft, the other had a very strong rope, which kept the boom at right angles. In the strongest current there was a great strain, and off the raft used generally to come; but sometimes the water was so shallow that we had to pull the whole raft to pieces, and float it down log by log over the obstruction, and rebuild it below. We passed some flat-bottomed boats; the owners were very anxious to take us down to

Bautu. We declined, as we thought we should get a better choice of boats lower down; but it was a great mistake, and anybody descending the river ought to engage the first available boat after passing down the gorge; no boats ever come through the gorge, for even if they got safely down they could never return. The river, as we descended, flowed through so many channels that none were very deep, and the raft exhausted our patience, for no sooner had we rebuilt it at the foot of some shallow and started, than it would stick fast again, and there was every prospect of our taking a month to reach Ning-hsia. Our raft-men had all one morning been taking logs off our raft and making a smaller, they said, to tow us off. They then put their peaches on to the smaller one "to lighten the big one," immediately cutting the rope; and away they went, leaving us on the remains of the raft with only three men. Fortunately, I soon after arranged with the owner of a scow piled up with wool that happened to pass, that they should take us and our baggage to Ning-hsia. It was a fortunate thing for the absconding men that our boat never overtook the little raft, for assuredly, had we done so, their fruit should have gone into the river. From our elevated position on the top of the wool we had a capital view of the country, and we constantly saw the Great Wall of China, twisting and turning like a great snake. It was not usually a very magnificent affair, being built of stones where they were plentiful, otherwise of sun-dried brick and mud. We arrived on August 28 at Ning-hsia, or rather at the landing-place, for the town itself was several miles away from the river. The only boats available were a couple of scows laden with grain. They agreed to take us and our baggage to Bautu in nine days for twenty-two taels; after we had paid our money, some Chinamen came on board and said the boat could not start till the boatmen paid them some money. I suspected a swindle, so told them the boat would start in ten minutes; if they could not arrange in that time I would give them a passage to Bautu, and they could see the mandarin there. They became very abusive, so they were summarily ejected; then four or five of them held on to the painter, and I had the greatest difficulty in restraining our two Ladakhis, who were eager for a fight, from using unnecessarily strong measures. We had not gone far when both our boats grounded, and remained fast several hours. A boat-load of soldiers arrived with our old antagonists; they did not come to our boat, but we saw a violent altercation going on in the other. The boatmen finally told them that if they did not go they would fling them into the water, soldiers and all. It was impossible to pitch the tent on board, it caught the wind too much, but I arranged a small awning, and we used to camp on shore at night. There were very few inhabitants along the river-side; here and there a village, but the greater part of the way the desert comes pretty close to the river, and the hills from a distance look very barren. The river when we first saw it was a deep

red colour, but it now assumed a dirty grey look ; it was generally about a quarter of a mile wide, rather shallow, and the banks covered with bushes and willows, and beyond nothing but drifting yellow sand. One of our boatmen complained of his eyes, so we gave him a couple of pills.

A Chinaman was overheard asking another why we gave two pills ; the reply was, "He has two eyes ; do you think he only wants one cured ?"

Between Ning-hsia and Bautu there is a considerable traffic. Scows loaded with wool or grain drift down to Bautu ; they are then towed by their crew of five men upstream again, taking two to three months on the round trip. As we approached the place where the Hoang-ho commences to bend to the east, we saw more frequently sheep and cattle, especially on the left bank. On nearing Bautu, the mountains which had been distant on the west and north now ran close to the river, and there was a small lamaserai on each side of the river.

We arrived on September 12 at the small walled Chinese town of Bautu, having taken twenty-five days to drift down from Lan-chau. We hired five carts to take us to Kwei-hwa-cheng for 35,000 cash. The price was not as ruinous as the high figures would imply, the equivalent of a seer or tael (1 tael = about 4s.) being about 1400 cash. The carts were like dog-kennels on wheels, being about 2½ feet wide, 3½ long, and 3½ high, drawn by a pair of mules harnessed tandem ; the driver sits in front with his legs dangling over the shaft, as near the centre of the cart as the good nature of the passenger allows.

We passed through a country abounding in ruined towns and villages, not one-fifth of the houses in some of them being inhabited. The ground was frequently terraced right to the summit of the hills, but only the most fertile plots are now cultivated. Such is the result of the disastrous Mohammedan rebellion of 1861, which caused the destruction of nine-tenths of the population, and from which the country, after a lapse of so many years, is only just beginning to recover.

By promising rewards we reached Kwei-hwa-cheng on the third day. We were most hospitably received by Dr. Stewart, a medical missionary. In describing the difficulties of the Chinese language to beginners, he told me, among other things, that the words for chicken and wife closely resembled each other. Once when prescribing for a sick Chinaman he found he had told him to cut his wife's throat and make broth of her. Another missionary ordered his servant to go to the bazaar and buy a chicken ; the man was gone nearly all day, and returned saying that good-looking women were awfully scarce just then, and he would have to pay thirty taels for a young one.

In this town there were a colony of Swedish girls living alone ; they had been sent out to China through the instrumentality of an American. These poor ladies had been exposed to many insults on their way up-country, and to daily ribald remarks in the streets at Kwei-hwa-cheng.

and one shudders to think what may be their fate. It is difficult to speak temperately of a society or individual that, in the name of religion, lightly takes the responsibility of sending these women out wholesale to a country like China, and when there, leaves them practically without supervision or protection and with most inadequate means. It will scarcely be credited that, though they usually go about in pairs, a girl hardly speaking a word of the language will sometimes be sent alone with a Chinaman several days' journey in a cart to visit some town where there is no European. Altogether, I don't think Mrs. Littledale or I have ever felt more sad than the day we left those kind, enthusiastic, open-hearted Swedes.

We travelled by day in our carts over a thinly inhabited and sparsely cultivated country, pitching our tent at night if there did not happen to be a clean inn. After going four days, we had to change the axletrees of our carts, the roads from here to Peking being in many places too narrow for the broad-gauge carts in use further west; and besides, the ruts were so deep it would have been impossible to travel unless the wheels fitted them. The inhabitants of the country became more numerous, and, as "foreign devils" were no novelty, we suffered no annoyance, except ludicrously extravagant bills used to be presented for our night's accommodation.

On September 27 we passed through the Great Wall by a rather mean gateway. The wall looked very picturesque, winding up and down the hillsides in apparently rather an aimless manner, and sending out a branch wall here and there without any apparent reason; it was made of mud, and faced with either brick or stone, and had a crenulated parapet. Although there was only room on the top for two carts to drive abreast, in place of the six I read about in the days of my youth, it was on the whole rather imposing. Down the Nankau pass and over atrocious roads we jolted for three days. Shortly before reaching Peking we passed three large antiquated-looking castles; they were built after the model of Tibetan strongholds by the Emperor Chien Lung, when meditating a campaign against Tibet, so that his soldiers might see the kind of fortresses they would have to attack, and practice scaling the walls. Another tradition has it that they were erected by the emperor to commemorate a successful (?) Tibetan campaign. One of our carts sank to its axletrees in indescribable filth, and stuck fast for a couple of hours. The whole traffic of Peking by that gateway was stopped in consequence; there were at least a hundred carts delayed, and yet not one of their men would help our cart, and so clear a way for themselves.

Our arrival at a comfortable little hotel in Peking may be considered the end of our journey; the rest was plain sailing. We paid our plucky Turki interpreter in rouble notes, which he sewed into the lining of his coat; and he started alone on his long journey of four months back to Kurla. Ramazan and Rozahun accompanied us to

Hong-Kong, where we saw them on board a direct steamer to Calcutta, from which place they would return through Kashmir to Ladakh.

Should we ever wander into inner Asia again, the day we secure the services of those two good little fellows the difficulties in front of us will be already half overcome.

Before the reading of the paper, the PRESIDENT said : We have the pleasure this evening to welcome back to England Mr. Littledale, whose interesting paper after crossing the Pamir tablelands will be remembered with pleasure by most of us, for it was actually read very little more than a year ago.

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

The PRESIDENT : Mr. Littledale's interesting paper suggests many topics of reflection and discussion and inquiry, but the central point of all is, perhaps, the wild camel. I hope Sir William Flower will kindly give the meeting some opinion respecting the animal he has seen from the collection of Mr. Littledale.

Sir WILLIAM H. FLOWER : I am in the habit of dividing travellers who go into remote regions of the world into three classes—those who slay the animals of the countries they pass through and leave them where they were killed ; those who bring home their trophies and carry them off to distant and perhaps inaccessible parts of the country where they may happen to reside, to hang them up in their halls, where in process of time moth, dust, and decay destroy them ; and those who recollect that there is in London, in the Cromwell Road, an institution where such trophies as are of scientific interest will be preserved for the benefit of all who are capable of deriving any advantage from them. I am happy to say Mr. Littledale is one of the third class, and that zoological science has very much benefited, not only by his last adventurous journey, but other equally remarkable and adventurous journeys which he, accompanied by his brave and heroic wife, has undertaken. One of his earlier expeditions enabled the museum to exhibit, for the first time in Europe, specimens of the largest and finest of all the sheep tribe—that which was seen years ago by Marco Polo, and which, when rediscovered recently, was named after him the *Ovis poli*. A beautiful group of these animals is now mounted in the mammalia gallery of the Natural History Museum. From another expedition he brought home from the almost inaccessible mountains of the Caucasus specimens of that interesting animal, the bison, which in former times ranged over the whole of Europe and our own islands, allied in many aspects to the bison of North America. It has become extinct in the old world except in two regions—a forest in Lithuania, where a small herd has been preserved by the Emperors of Russia, from which one specimen was sent many years ago by the Emperor Nicholas to the Zoological Gardens, and is now stuffed in the Natural History Museum ; the second locality is this region of the Caucasus, where Mr. Littledale shot a bull and a cow, now exhibited in the museum. On this last expedition, of which we have just heard such an interesting account, beside some smaller though hardly less interesting animals, he succeeded in bringing home the wild camel. As we all know, there are two forms of the domestic camel—the one, with two humps, found in Central Asia, Persia, and the south of Russia ; and the one-humped species, or dromedary, found in India, Arabia, and throughout a considerable part of Africa. Wild camels, until recent times, had been quite unknown, and the origin of the domestic camel was, as is the origin of many of our domestic animals, involved in mystery. The history of the camel, as has been revealed by recent geological explorations, is a very curious one. Though now living in Africa and Asia, we have not at present found any fossil remains of camels in early formations in the old world, but most

unexpectedly, during a survey that began about twenty-five years ago, remarkable fossiliferous deposits were found in pliocene, miocene, and even going back to eocene times in the western part of North America, and there was discovered the original home of the camel, and the American paleontologists have traced it from a primitive generalized form of the group to which the existing camel belongs by a succession of minute changes; but, curiously enough, it became entirely extinct in the region where it seems to have been originally developed. Some, however, emigrated to South America, remaining there in the form of the lama, vicuna, and alpaca found in the Andes of South America and Patagonia; and the other branch appears to have crossed that bridge of land which once extended across the North Pacific, and spread over the regions of the old world indicated just now. Unfortunately, it is impossible to say whether these camels which run wild without owners in the western parts of the great desert of Gobi, discovered by the celebrated Russian traveller, Prjevalsky, and afterwards by Mr. Littledale, are really wild, that is, descended from camels which have never at any time been domesticated. About a year and a half ago a skin was exhibited at the Zoological Society by Mr. Blanford, brought home by Major Cumberland, which was the first evidence of the wild camel brought to this country; but Mr. Littledale is the first to bring home complete specimens, not only skins, but also skeletons, which give the full characteristics of the animal, and which will soon be ready for exhibition in the Natural History Museum. It belongs to the two-humped species, as may be supposed, as the tame camels of Central Asia are two-humped; but the humps are poorly developed—in fact, in the specimens at the museum, scarcely developed at all. In all probability the primitive camels had no humps, as the lamas of the present day have no humps, and the great humps developed in our domestic camels are the result of domestication, cultivation, and selection, and also depending for their size upon the condition of the animal, developed by good feeding. These wild camels were certainly in very poor condition, and, being also just changing their coats, have a rather shabby appearance compared with some of the domestic animals we may have seen in their fine winter coats; nevertheless, they are most interesting animals, and we are all very much indebted to Mr. Littledale's energy, endurance, and courage in going so far in search of them and bringing them safely back to our national museum. I think the other specimens Mr. Littledale brought home I had better leave Dr. Günther to mention, as he has most carefully examined them all, and probably will tell us something interesting about them.

Dr. GÜNTHER: I can hardly add anything to Sir Wm. Flower's remarks. The other animals which Mr. Littledale has collected consist of species which are of great interest to zoologists, but which do not demand the same attention that so remarkable an animal as the wild camel does. I followed the course of Mr. Littledale's expedition with some anxiety, he having mentioned at the outset that he meant to come home through China, and I therefore thought there was but little prospect of seeing specimens of the wild camel. The wild camel was discovered by Prjevalsky some fifteen years ago; he succeeded in bringing five specimens to the St. Petersburg Museum, and I humbly hoped that a specimen of so interesting an animal might be obtained for the British collection, but the authorities of the Russian museum seemed to be anxious to keep them all. The animals Mr. Littledale brought home are in very good condition, particularly the skeleton. There is not the least reason to doubt that the camels, whether tame originally or not, have multiplied in a wild state, and are now perfectly adapted to life in wild nature. It is singular that within a recent period we have become acquainted with a similar instance; I allude to the dromedaries in the south of Spain. It is reported that some years ago dromedaries that had been used as beasts of burden were turned adrift

and had multiplied; and I heard only yesterday that the Comte de Paris, who takes special care of them, has now a herd of forty or fifty individuals of this one-humped camel in a perfectly wild state, existing without the assistance of man. There is only one other remark I have to make. Mr. Littledale has now obtained so many spoils that there is only one other left for him to gather, and I hope Mr. and Mrs. Littledale will have retained energy and health enough to accomplish this feat too, and, that is, to obtain specimens of the wild horse which is still roaming over the plains of Central Asia.

General WALKER: It is so late that I will only point out that the hand-map prepared for general use this evening is divided into two parts: the lower contains the journey of Mr. Littledale from Batum to China, but the upper part contains what is really of very great geographical value, the journey from Lob Nor to Saitu, and from Saitu to Koko Nor. The lines over which he has travelled in this portion of his adventurous journey are perfectly new; no European ever travelled over them before, at least, since the time of Marco Polo. I think it very remarkable that a journey of this nature should have been accomplished by a gentleman travelling with his wife; it is the most remarkable feat for a lady to have accomplished that I ever heard of. Mr. Littledale has given an exceedingly modest account of it all, but really, when one comes to think it over, it is all the more astonishing that any lady should have performed a journey over such a difficult and dangerous line of country. Saitu is a point reached by a number of Europeans: Prjevalsky coming from the north; Messrs. Carey and Dalgleish from India; the Indian explorer A-K (Krishna), who gained great credit for his adventurous explorations in Tibet; and Count Széchenyi, the Austrian traveller, coming from China. Mr. Littledale has travelled from Lob Nor to Saitu as no European has done before since the time of Marco Polo, and then from Saitu to Koko Nor, which, I believe, is wholly new ground. I think he deserves every honour that the Society can pay him, and I only regret that Mrs. Littledale is not here this evening in order to receive the recognition which, I am sure, she would receive from every one here present.

Mr. DELMAR MORGAN said that, besides the zoological facts brought to our notice by Mr. Littledale, he had done much to elucidate the geography of an almost unexplored region. His route lay along the northern foot of the Kuen Luen, a system of mountains the very existence of which was unknown before Alexander von Humboldt's time. It was at the suggestion of this learned geographer that the British Government sent the Brothers Schlagintweit in 1856 to explore its western extremity, and the late Sir R. Murchison had said of these travellers that they were "the only geographers to visit these localities and sustain what Humboldt had affirmed, that his Kuen Luen presents all the characters, relations, and attributes of an independent chain." More recently Baron von Richthofen had ascertained the continuity of the system through upwards of forty degrees of longitude into China. The late Gen. Prjevalsky had visited central parts of the Kuen Luen, but it was reserved for Mr. Littledale to fill in a gap left by that eminent traveller between Lob Nor and Sha-chau. This was the route along which passed the Chinese silk trade, and Marco Polo had been the last European traveller to describe it. Within historical times the region in question had been very different to its present condition. Three hundred and sixty of its flourishing cities are said to have been buried beneath the drift sand. Mr. Littledale mentioned a range of mountains to the north-east of Sha-chau. M. Potanin, in crossing this part of the Gobi, also met with chains of mountains in about the same parallel, and saw some snowy peaks. He called these ranges "Gobi Altai," taking them to be south-easterly ramifications of the Altai system, which apparently extends to the borders of China.

“Gobi,” according to this Russian traveller, is not a desert in the sense that the Sahara is a desert; and the word “Gobi” is applied locally to raised plains, not arid tracts. There were other points suggested by Mr. Littledale’s interesting paper, but at that late hour of the evening it would be impossible to discuss them.

The PRESIDENT: There are several interesting points on which it is too late to dwell with reference to the paper of Mr. Littledale. I think, however, that there is just time for me to express regret that he should cast a doubt upon the statements of Marco Polo, that spirits whisper the names of travellers as they pass through the deserts, and hear other travellers passing by them who are inviaible. At all events, it is a well-known fact that in many deserts drums and fifes are heard, and tattoos are beaten in the early morning. Mr. Littledale acknowledges that he has heard sounds like drums. Lieut. Wood went out of his way to hear this music, and Sir F. Goldsmid has experienced it also. I have heard similar sounds in the deserts of Peru, such as may have appeared to Marco Polo to be the whispering of his own name. If I remember rightly, Sir Henry Yule collected a good many instances of such sounds being heard in the deserts of Asia, which are extremely interesting. We have not had time to discuss the loess caves where the statues have been carved, and the figures on the roofs, which, I have no doubt, merit very careful investigation. One other thing I should like to refer to of not so pleasant a character, and that is the reckless way in which missionaries seem to have sent a number of respectable young women into the centre of China, and to have left them alone with very meagre resources. It is, I think, a most disgraceful story, and I trust Mr. Littledale will take care to have it brought strongly before the notice of the Swedish Government. I think you will be glad to hear that the fox-terrier arrived safely in England again, but very thirsty, because it drank nothing from Peking to London. We all regret that through illness Mrs. Littledale has been unable to be present with us this evening, but I am sure you will unite with me in offering our most hearty and cordial congratulations to Mr. and Mrs. Littledale on having accomplished this wonderful journey, and in returning our very grateful thanks for so interesting a paper.

MR. LITTEDALE’S MAP FROM LOB NOR TO KOKO NOR.—The starting-point on this map is Abdal, to which the same position is given as that assigned to it on the Society’s map of Tibet. It has been constructed from a compass route survey by Mr. Littledale, checked by astronomical observations. The distances travelled were most carefully estimated by pacing at intervals for a fixed distance beside the caravan and observing the time occupied, by which the speed at which the caravan was travelling was arrived at. Mr. Littledale carried a watch which kept a steady rate throughout his journey, and he was thus able to fix his longitude by frequent observations with a sextant of the sun and stars for time. Observations of *Polaris* were taken for latitude every evening when the day’s march was over, and the work was plotted and inked in on the map every night. A large number of aneroid readings were taken for the determination of heights, as well as compass bearings to all prominent objects within sight of the route followed.

MAP OF THE HOANG-HO.—The starting-point on this map was Lan-chau, the position of which is that assigned to it by Prjevalsky and Rockhill. Compass bearings were taken of the course of the river, and prominent objects in sight from the aft on which they journeyed down the river. Every evening sextant observations of *Polaris* were taken on the river-bank for latitude, and numerous aneroid readings were recorded.

THE RIVER NAPO.

By CHARLES DOLBY TYLER.

BUT little has been heard of the river Napo since the year 1551, when Orellana descended this now historic stream; and no steps have been taken towards colonizing the fruitful country through which it flows, if we except the policy of a former dictator of Ecuador, who banished his political enemies thither, in the hope that they would, sooner or later, fall victims to savage or beast.

It was, perhaps, the air of grim mystery which enveloped it that induced me, when at Iquitos, near its mouth, to undertake a journey up this river, and it is the result of my observations during that trip, combined with the experience acquired from a three years' residence in the Amazonian region, which I propose to deal with in the present paper.

The journey from Iquitos to the delta of the Napo, and thence to the Curaray, a tributary on its right bank, was made in fourteen days in a steam-launch drawing four feet of water. From the Curaray to the village of Napo, a distance of about 340 miles, I travelled in a canoe: time occupied, forty-two days. Thence to Quito proved a toilsome journey afoot, through trackless forests and over high mountain ranges, that lasted ten days. Altogether I spent nearly three months in getting from Iquitos to Quito, distributed as already stated, with the exception of a few days spent at rubber stations *en route*, and a fortnight at the Jesuit Mission at Archidona, on the termination of my canoe voyage, owing to the absence of catechized Indians to carry my *impedimenta* forward.

For all practical purposes, and to facilitate a description of this river, it may be divided at the junction of the river Coca, and treated as two distinct streams, the Upper and the Lower Napo. The line of demarcation at Coca is so apparent as not to escape the notice of even the most superficial observer. The bed of the river here ceases to be of sand, and above Coca it is entirely rocky; the river, that up to this point has a fall of about 0·873 foot per mile, suddenly acquires a stronger current in a fall of 7·4 feet. The low flat country is here left behind, and with it the luxuriant vegetation characteristic of the Amazon basin. Slight elevations occur that gradually increase in height as one approaches the eastern spurs of the Cordillera; and the temperature falls several degrees in as many miles after entering the upper stream.

The *embouchure* of the Napo is divided into three channels, the central one being the largest and most navigable. It is 1100 yards wide, and has an average depth of three fathoms. The first, or eastern outlet, is extremely narrow, and too shallow to admit of any craft larger than a canoe. The third channel is about 300 yards across, but is also

shallow, and its greatest depth never exceeds a fathom and a half. The whole of the delta is low, but this is more noticeable about the third outlet, where the wide low-lying banks present the appearance of marshland. The island of Destacamento, formed by the main and western channels, abounds in pebbles, and it is said that gold has been obtained from it, but I was unable to establish the authenticity of this statement. The fact that polished quartz pebbles are found thereon, as also in the bed of a streamlet at the rear of Iquitos, is remarkable, as in all the country round, within a radius of fifty or more miles, not a stone of any description is obtainable.

During the whole of its course, the Lower Napo is an extremely sluggish river, whereas the upper stream is remarkably swift. The following altitudes taken by me, the approximate distances from one point to another, together with the width of the river, will fully explain this:—

Altitude at mouth of the Napo	...	...	...	391'	above sea-level.
" " " of the Curaray	...	...	...	507'	"
" " " of the Coca	...	...	...	784'	"
" " the village of Napo	...	...	...	1450'	"
Distance from mouth of the Napo to the junction of the Curaray				200	miles.
" " " of the Curaray to the junction of the Coca				250	"
" " " of the Coca to the village of Napo	...	...	...	90	"
Width of main channel at the mouth of the Napo	...	...	...	1100	yards.
" opposite the Curaray	...	...	...	800	"
" " the Coca	...	...	...	450	"
" " the village of Napo	...	...	...	40	"

The whole of the course of the Lower Napo is navigable for steamers drawing but little water. As yet, no steamer or launch has essayed to pass above the Curaray, and ordinary propelling vessels could not go up much further except at the imminent risk of being laid high and dry by a sudden fall in the river.

The depth of the channel is very variable, owing to the alternate rise and fall of the river and the shifting nature of its sandy bottom. An average of two fathoms may be taken between the mouth of the Napo and the Curaray, and from a half to one fathom on approaching the Coca. The only class of steamer that could navigate this river successfully would be a flat-bottomed stern-wheeler, provided with log-guards, and drawing not over thirty inches when laden. The supply of fuel is practically inexhaustible, the entire length of the Lower Napo being studded with groves of *Capirona* or Mulatto wood, *Palo Remo*, and other resinous trees that are suitable even in a green state for fuel. At Puca Urcu, some 250 miles from the mouth, there exists a deposit of bituminous substance, not unlike coal, which could be utilized for generating steam.

The average temperature on the Lower Napo is 82° Fahr., and the variation throughout the year is very slight, except during the equinoxes,

when the thermometer not infrequently registers 64° . On the Upper Napo, however, a marked variation is noticeable—the mean temperature during the dry season, from June to November, being 75° Fahr., and in the wet or wintry season, 78° . At Archidona the average descends to 72° in summer. During the whole of my three years' residence on the Amazon the thermometer rarely went above 90° , and never five degrees beyond, whereas during the dry season it stood frequently at 76° .

Owing to the numerous lagoons that line the course of the river, and to the swampy nature of its banks, malarial fever, rheumatism, and dysentery are prevalent; but experience tends to show that when a clearing is made in the forest, the use of light flannel underwear adopted, and a regular and frugal diet observed, these dangers may be minimized. The natives are subject to two kinds of cutaneous disease, which appear to be constitutional. One is a bluish discoloration of the skin, and the other a white blotch where the *cutis* has, apparently, lost its pigment. Where the origin of these diseases lies it is difficult to discover, but the simple Indian will assure you that the former comes from eating tapir, and the latter from an undue consumption of white cayman.

As a field for colonization, the Napo valley, from the junction of the Curaray to the village of Napo, leaves little to be desired; but the Upper Napo, for obvious reasons, would be preferable for an Anglo-Saxon immigration. Meanwhile, and until a good road were made to connect Napo or Archidona with Quito, communication could be adopted with the main Amazon by means of the steam-launch already described, and there is no doubt that a scheme for colonizing this region, if carried into effect, would prove successful. Individual efforts, however, cannot be too strongly condemned; the influx of colonists should be wholesale. Native labour cannot be relied upon. The *yumbos*, or semi-civilized Indians, which are met with on the upper part of the river, are a lazy, treacherous set, and do next to nothing beyond providing their *cuis* with the needful means of subsistence; while the savages on the Lower Napo are quite untractable, and have, moreover, acquired such a wholesome horror of the Viracucho, or white man, and his rifle, that they flee at the sight of him.

The various tribes of Indians that inhabit the Napo region differ but slightly from one another in their manners, customs, and belief, and in describing the Zaparo tribe at length, I shall have given a fair illustration of the generality of them.

The Zaparo tribe, which inhabits the country that lies to east and west of the rivers Pastassa and Napo, and from about $0^{\circ} 40'$ S. Lat. on the north, to $2^{\circ} 20'$ S. Lat., close to the Curaray, on the south (an area of about 12,000 square miles), is made up of numerous subdivisions or families, among the principal of which are the Ahuishiris, Andoas, Curarayes, Matagenes, Mautas, Meguanes, Nuganus, Nushinus, Rotunus, Shiripunos, Sinchictus, Supinus, Tiputinis, and Yasunis. Though an

integrate body when threatened from without, they live in a state of continual feud among themselves.

They lead a semi-nomad life, and are not always to be found at their settlements, as they follow in the wake of the animals they chase when these migrate eastward or westward in search of ripening fruit. They cannot be said to live in villages, for the temporary beautiful rustic sheds they erect, which are open on all sides, and contain no other furniture than a couple of palm-fibre hammocks slung crosswise within, serve them only a few months at furthest, until game becomes scarce, when they strike camp and press forward. The Curarayes, Yasunis, and Tiputinis are, however, exceptions to the general rule, for they seldom quit their villages, and lead an agricultural life. Beyond hammock-plaiting and the weaving of fishing-nets, the Zaparo knows of no industry whatever.

In general appearance these Indians somewhat resemble the Chinese. They are below medium height, fairly well developed, and very hardy. As in the Chinese, there is the rounded face, small obliquely set eyes, and prominent cheekbones; the nose and lips are rather thick, the former being slightly flattened. They are beardless, and usually wear a shock of unkempt hair, which is somewhat finer in the gentler sex. The women have, on the whole, a very pleasant cast of countenance, and are beautifully formed. They enjoy a great amount of freedom, which is only just, seeing that they do all the work—hunting excepted, which alone is the duty of the men.

The only covering worn by both male and female alike is a long shirt of bark fibre in a single piece, called a *llanchama*. To obtain this, they fell a moderate-sized tree, and baste it with clubs until the outer bark is broken off, and the interior fibrous envelope becomes detached from the wood. This inner bark, when removed, is partially closed at one end, two armholes are cut in at the sides, and it is then sun-dried preparatory to being ornamented with fret and circle designs in red, without which it would not be considered serviceable.

Their weapons are the *macana*, or two-edged sword, and the spear, which they manage dexterously. I had the pleasure of witnessing a spear-play between two parties, consisting of about a score of warriors on either side. They aimed deliberately at one another in rapid succession, and caught the flying weapons of their adversaries as they approached. Sometimes one brave, more expert than the rest, would catch three or four, and, whilst hurling them back again, catch another. In spearing fish they are remarkably expert, seldom failing to transfix the finny prey at a first cast. The *macana* is made either of *chonta* (palm wood) or *huacapu* (*lignum vitæ*), and is a most unwieldy weapon. It is usually about five inches broad at the point, and tapers down towards the handle; it varies in length from thirty inches to three feet. The blade is also painted with a red design in fret, as are the gourds,

and in some instances the savages themselves, especially when on the war-path. There is a smaller reproduction of this weapon, measuring from eighteen to twenty-four inches in length, termed facetiously the *Itumu-aishna*, or wife-corrector, which, as its name implies, is destined to quell domestic broils.

The men are very shy and silent before strangers, but, curious to say, the women—many of whom are really beautiful, and well calculated to excite the jealousy of their companions—are quite the reverse; jealousy is a dead letter to the Zaparo. In their connubial relations they are exceedingly irregular, and in the course of a season the head of a family will change, discard, rob, or buy twenty different spouses, many of the old ones coming back to him in the course of time. Each male is allowed to keep by him as many wives as he can conveniently maintain by the chase.

Each clan or division of the tribe is ruled by a chief, who is generally respected, and on occasion obeyed. He is never selected by the community, but falls naturally into place through a continually asserted superiority coupled with feats of daring. Besides the chief, there is yet another authority whose influence is illimitable: this is the *shimamu*, or medicine-man—the oracle of the clan, whose word is never disputed, even by the chief himself. He it is who averts the evil influence of sorcery and witchcraft; and yet, when so required, can exercise either with impunity. He alone has safe access to the *Munyu*, or evil spirit, and, clad in tapir-hide, impersonates this demon when vengeance is exacted; only through his intercession can the wrath of *Munyu* be averted. It is the medicine-man who habitually drinks the divining *ayahuasca*, and, like the Pythoness of old, in his delirious trance converses with both good and evil spirits, unravels the mysterious future, reads the destiny of his tribe, and receives the commands of the Spirit of Life. Many of the adults also partake of *ayahuasca*, this practice in some instances degenerating into a vice. The beverage is a decoction of a certain species of liana, and is equally as narcotic, though less baneful in effect, as opium. When under its influence, the savage becomes simply unmanageable. He first commences to talk of birds and flowers, and every gay-coloured and beautiful thing imaginable, and, in this primary stage, is exceedingly amorous. Soon, however, this gives way to fearful delirium, when the patient becomes dangerous, and, unless forcibly restrained, would run amuck of every living being that crosses his path. This attack is followed by complete prostration, which ends in deep sleep. Owing to the powerful effects of this potion, none but male adults are allowed to partake of it. The first *ayahuasca* bout is quite an event in the career of a Zaparo warrior, and celebrated with feasting accordingly.

The Zaparo, in common with the majority of Indians in this region, believes in a dual existence—the good spirit, or “Spirit of Life,” and

the *Munyiu*, or "Spirit of Evil:" among the northern clans the latter is designated *Zamaro*. According to their belief, if such it can be called, the Good one can, but seldom does, overcome the Evil Spirit. The latter is credited with carrying off any one he meets alone in the depths of the forest, to devour them in his lair. This I consider a neat explanation of the unaccounted-for disappearance of many who, single-handed, fall easy victims to the panther, jaguar, or boa constrictor.

They also believe in metempsychosis. As a reward for valour, the spirit of the departed one passes into the body of some ferocious jaguar or other beast of prey, and, by way of punishment, that of the coward takes up its abode in the form of some noxious or hideous reptile.

They are indisputably a practical people, so far as the preservation of their race is concerned. The aged and sickly, the fool and the helpless orphan babe, are, after a hurried consultation with the *shimansu*, ridded of their burden of life by a blow from a *macana*—usually the nearest relative undertaking this humanitarian task. Sometimes the living is interred with the dead. Theirs is an excellent rendering of "the survival of the fittest."

They consume a great quantity of game and fruit, but few cereals or tubers. The *Guayusa* or Napo tea is their favourite beverage. This is the dried leaf of a small laurel shrub, somewhat resembling the coca plant (*Erythroxylon coca*), which they also consume. During my trip I laid in quite a stock of *Guayusa*, and found it to be an excellent substitute for tea, being, if anything, slightly more aromatic. It is said they drink it of a morning by way of emetic, to rid the stomach of any surplus indigested food, but I cannot endorse the assertion. In my own case it proved an excellent sedative. The coca leaves, which they masticate, are very sustaining, and are only called into demand when they have long journeys to perform, or when their stock of *masato* (fermented yuca) is exhausted. They also distil the juice of boiled plantains by means of a primitive clay still, and obtain a nauseous, unwholesome class of rum, of which, however, they consume very small quantities. The *masato*, to which I have referred, is simply the masticated and fermented root of the yuca (*Jatropha manihot*). It is requisite that the root undergo the process of mastication, this being performed by the unmarried women, otherwise it would not ferment, and, fermenting, it loses any quality that may have been imparted to it during the process. The yuca thus treated becomes a pulpy mass, which is preserved for three or four days in earthen jars, when it becomes fit for use. A handful is worked between the fingers in a bowl of water, which becomes milky, and the fibrous parts are thrown away. It is very refreshing, though rather heady, and, in taste, bears a strong resemblance to sour milk. The *guineo* plantain, and several species of palm fruit, are treated in a similar manner, so that the Indian has a wide choice in the matter of refreshments.

When dealing with the subject of dress, I omitted to mention the charms of stringed monkey-teeth and iguana-skin bracelets affected by the gentler sex. The latter charm, which is considered the more potent, consists of thin sections of iguana tail-hide, which are slipped over the wrist when fresh and contract on drying.

The only other tribe which merits special mention, principally on account of physique, is the Coto, or Orejon, that inhabits the left bank of the Lower Napo, near its mouth. They are low in stature, and thick-set. Their physiognomy is strikingly repulsive, as they have a very broad face, square jaw, prominent cheekbones, and the thick lips and flat nose that characterize the Congo African, surmounted by long coarse black hair, beneath which is hidden a low, retreating forehead. But the most noticeable feature about them is, perhaps, the distended ear-lobe. At a very tender age they pierce the ear with a small piece of sharpened wood, which they allow to remain therein, exchanging it each day for one of larger dimensions, until the hole thus formed will admit of a large circular piece of cabbage wood, which is ornamented with a black spot in the centre. A pair I measured were slightly over four inches in diameter, and the ear-bands that encircled them resembled a carpenter's pencil. It is from this peculiarity they derive the Spanish appellation of "Orejones," or Big-ears; and it is the custom of besmearing their nude bodies with achiote, which gives them a striking resemblance to the red howler, that has earned for them the name of "Coto."

Being unable to gather any information regarding them from the traders on the main Amazon, I decided to visit one of their villages when ascending the Napo, and was fortunately assisted in this by a breakdown of the steamer's engine when almost opposite their territory.

I arrived at the village at dawn, but found only a few females and children playing around, the male population being absent, evidently upon a hunting-expedition—which, by the way, last for several days at a time. The village comprised some twenty huts, differing slightly from the usual style of Indian architecture, inasmuch as they were closed in on every side. On examination, these walls were found to be merely a continuation of the roof thatch of *yarina*, or ivory-nut leaves. There were no doors to these primitive edifices, and entry was made by lifting a loose piece of thatch. In one hut were two newly made mounds. At the head of each a spear was stuck into the earth, and on either side a stone hatchet partly embedded in the soil, and a bowl of mildewed masato. Doubtless they were graves.

In another were several *chambira* (palm fibre) hammocks, spears, stone hatchets, earthen pots, gourds, and a quantity of short lengths of cane containing poison. The stone hatchets, of which I saw a large number, are of two sizes: the larger weighing about four pounds each, and having a thirty-inch haft; and the smaller having a twelve-inch haft, and weighing one pound. These relics of the Stone Age are certainly

most unwieldy instruments, yet they manage to fell the largest trees with them, and scoop out fair-sized canoes. Where the stones come from is a mystery.

The canes containing the poison were suspended by threes from the roof. This poison, when fresh, is equally as good as that prepared by the Ticunas, but becomes innocuous after eight or ten weeks. In this substance the Indian dips the point of his arrow or spear, and inevitable death ensues from a wound inflicted by the weapon thus anointed. It is remarkable that, while causing death, this poison in no way taints the flesh of game killed through its agency, which may be eaten with impunity.

The Lower Napo abounds in fish and aquatic mammals, whereas the upper stream contains a very limited number of species. Below Coca, nearly every kind of fish found in other Amazon streams is to be met with. Those which are in principal demand are the *pirarucu* or *paiche*, the Amazonian cod, which attains to an enormous size, and rivals the huge pink *delphinus* which is so common on this river. The *paiche*, when salted and sun-dried, forms a staple article of consumption amongst the rubber-collectors and others in these regions. When broiled it is not unlike its marine counterpart, but, when otherwise prepared, has a disagreeable, rancid flavour. Next in importance comes the *gamitana*, not unlike a huge trout in appearance, ranging from two to four feet in length. This fish is found chiefly in the numerous lagoons that connect with the main river.

The manatee is much sought after by the natives, and the river tortoise or turtle, of which there are two varieties, yields them an abundant supply of meat and oil.

Just above the Aguarico I caught, among other small fish, three freshwater soles (*Pleuronectes lingula*), which attracted my attention, as they were the only specimens I had seen in the Amazons.

Alligators are plentiful near the mouth, but gradually disappear as one ascends, their place being taken by a beautiful large grey otter about four feet long, and bearing an exquisite fur. The fish met with on the Upper Napo comprise a number of *siluridæ*, and several varieties of the carp family. One known as the *boca-chica* (small mouth), about the size of a mackerel, is much esteemed by the Indians, who catch and dry them by thousands.

The forests throughout the Napo country abound in game, such as tapir, capybara, peccary, venison, etc., and the wild turkey, curassows, widgeon, duck, teal, and partridge.

The plants at present under cultivation are the plantain, of which there are numerous varieties, the sugar-cane, maize, mandioc, cocoa, coffee, cotton, pistachio nut, and rice. The mandioc, or yuca (*Jatropha manihot*), is to the native as bread, or rather wheat, to the European. From its tuberous root they prepare what is known as *farinha*, which

bears a striking resemblance to African *kous-kous*. To prepare it they carefully peel and cut the root into small cubes, which are placed in water and allowed to remain there from eight to ten days, the liquid being occasionally changed. At the expiration of this period, dissolution will have taken place, and the whole reduced to a mass of pulp. The pulp is taken out and kneaded in fresh water, by which means the poisonous principle is extracted. It is then sun-dried, rubbed between the hands, when it assumes an irregular granular appearance, and finally baked in a conical clay oven. When fresh, *farinha* is very palatable, but becomes musty after a short while, and infested with weevils.

At the northern angle, formed by the junction of the Curaray, there are immense plantations of wild white cocoa (*Theobroma cacao*), the fruit of which is much sought after by the monkey tribe. This plant, which is of well-known commercial value, yields a nib scarcely inferior to what is known on the market as *arriba*, and can be easily cultivated.

It would fill a volume to give even the most meagre description of the vegetable wealth of this feracious region; an enumeration of its cabinet woods would mean a large-sized catalogue, and the same may be said of the medicinal plants. There is one point that bears upon the subject which I would wish to make clear, and that is the distinction between the *guadua* and the water-tree.

The *guadua* is essentially a huge bamboo that attains a height of about 120 feet. It is seen frequently on the upper part of the Lower Napo, bending gracefully over the water, and at a distance presents the appearance of a weeping willow.

The *cetico*, or water-tree, is a variety of the *bombax*, or silk-cotton tree, and yields timber almost like light cabbage-wood, as buoyant as cork. This tree lines the entire length of the Lower Napo, and on its tall grey stem the maximum rise of the river is clearly defined. Its leaves are very large, palmate, and silky, and the greater part of the trunk is branchless. Before the collection of rubber became of such paramount importance, the natives dealt with the traders almost exclusively in wax, which they obtained from the hollows in this tree, where it was stored by a certain species of ant.

In concluding this paper, I must mention that gold in illimitable quantities exists in the bed of the Upper Napo. The Indians extract small quantities by washing the sand, but their primitive method of extracting the precious metal gives only the barest results. On many occasions I have taken up loose boulders, and found it adhering to their lower surface, and in handfuls of sand taken at certain points it is distinctly visible to the naked eye.

THE MANCHESTER SHIP CANAL.

By H. YULE OLDHAM, M.A.

MANCHESTER, the great industrial centre of Lancashire, is removed by a distance of 30 miles from the sea, a geographical fact which the difficulty and cost of transport over the intervening land has long impressed on the minds of its citizens.

Frequent and strenuous have been the efforts to provide easier communication by artificial means. In 1776 the Duke of Bridgewater's celebrated canal was opened, and it was between Manchester and Liverpool that in 1829 the earliest steam railway was constructed. Since this date several other lines of railway have been added between the same two towns, but the cost of carriage, instead of decreasing, has been enhanced, while the margin of profit in trade has, by the keenness of commercial competition, been steadily reduced. Within recent years the necessity of some new effort to lower the expense of transport was felt to be imperative. It was remembered that by the construction of the Bridgewater Canal the cost of carriage to the sea had been diminished by one-half, and so, with the intention of effecting a similar reduction, a new canal was projected.

A natural water connection between Manchester and the sea has always existed, the Irwell, which flows through the city, being one of the main tributaries of the Mersey, at the mouth of whose estuary lies Liverpool. As long ago as 1720 an Act for rendering these rivers navigable was passed by Parliament, and steps were taken which rendered them for many years an important line of communication. More than once in this century have proposals been made for the further development of this natural waterway, and more than fifty years ago was Manchester dreamt of as a port for ocean-going vessels. Nothing, however, of a definite nature was undertaken, and latterly the contamination of the enormous population, which has grown up on the banks of the Irwell, had reduced the character of the stream to little more than that of an open sewer, to which no less emphatic an epithet than inky could be applied.

Within the last few years, however, a great change has been effected, and the dream at length realized. The foul and shallow stream has been replaced by a splendid waterway stretching to the sea, wider and no less deep than the Suez Canal, and the largest ocean vessels can sail up to and discharge their cargoes on the quays of Manchester, now a duly constituted port of the United Kingdom.

Brindley, the famous engineer of the Bridgewater Canal, when asked what he considered the object of rivers, is reported to have replied, "To feed cauals, of course." The engineer of the new waterway between Manchester and the sea has expanded this idea by converting a river

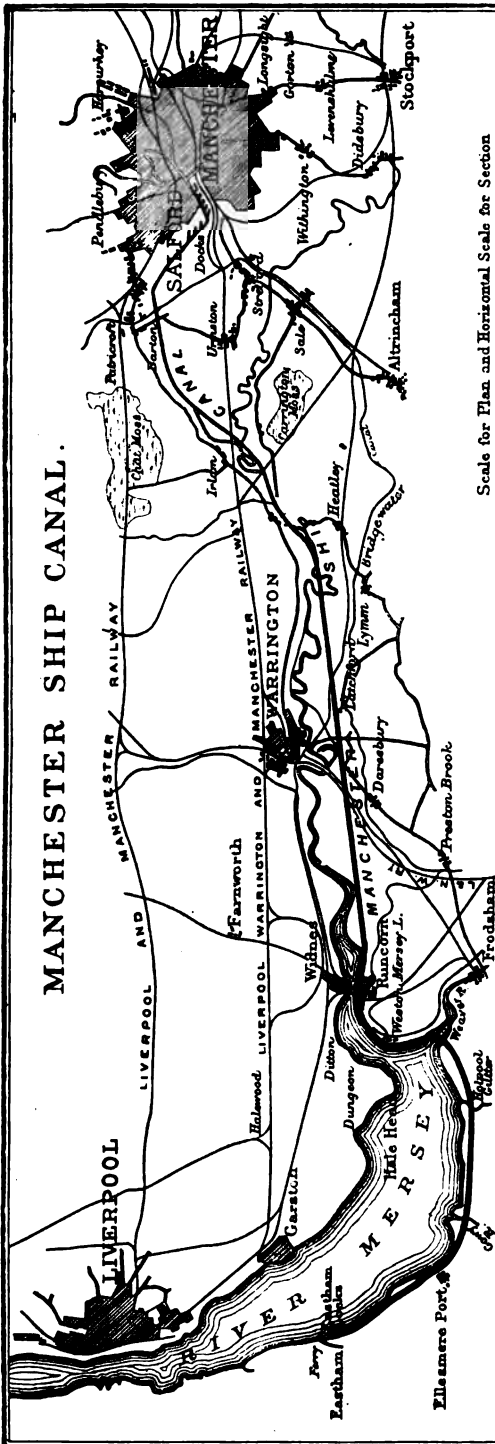
bodily into a canal. The Manchester Ship Canal is essentially the lower portions of the rivers Irwell and Mersey straightened, deepened, widened, and controlled; in fact, the river system has become so modified that, instead of the Irwell being a tributary of the Mersey, these two streams might now almost more aptly be described as the principal feeders of the Ship Canal. One obvious reason for adopting, as far as possible, the actual course of the existing streams lay in the great difficulty and cost of obtaining any other route through so densely populated a district as that which had to be traversed.

Largely owing to the persistent advocacy of Mr. George Hicks, the first practical step towards the construction of the canal was taken in June, 1882, when, at a meeting convened by the late Mr. Daniel Adamson at his house near Manchester, a provisional committee was formed. In December of the same year the first Bill was deposited in Parliament.

At the outset there had been two schemes in the field, one proposed by Mr. Hamilton Fulton for a level, lockless, and therefore tidal channel; the other, that of Mr. E. Leader Williams for a canal with three locks. As there is a difference of 60 feet between Manchester and Liverpool, the former plan would have involved enormous excavations in construction, and after completion the constant expense of lowering and raising all goods to and from the deep basin in Manchester in which the ships would have lain. The latter plan was therefore, subject to modifications, adopted.

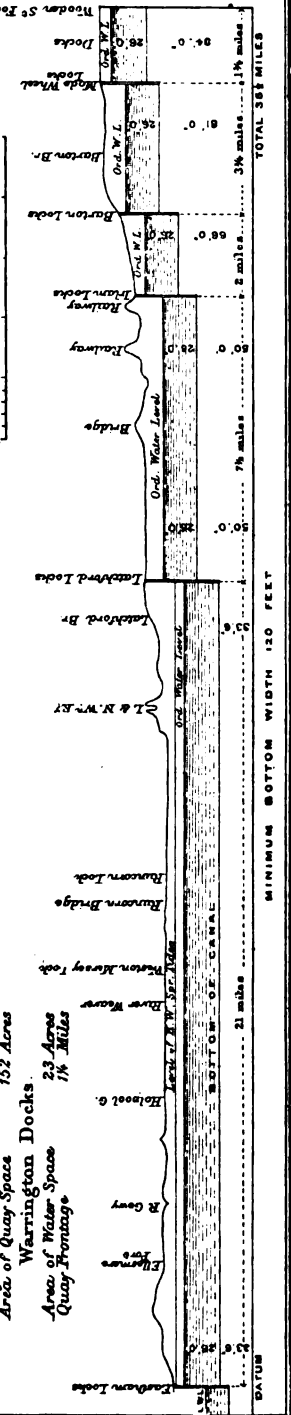
The next two years were spent in a fierce fight for Parliamentary sanction. Opposition, as was natural, came chiefly from the existing Bridgewater Canal, the railway companies, and the Mersey Docks and Harbour Board representing the interests of Liverpool. The two former voiced the natural alarm of existing carrying companies at the prospect of a new competitor, but the latter brought forward the more serious contention that the construction of the proposed canal would lead to the silting up of their harbour. A glance at the map will explain the contention. The Mersey at its mouth widens into a large estuary 27 square miles in extent, communicating with the sea by a narrow channel some half-mile wide, on the edge of which lies Liverpool. At each turn of the tide a large volume of water, owing to the great size of the estuary, rushes through this channel and thus scours it by natural means. According to the original scheme, the canal was to have been brought down the middle of the estuary from Runcorn by means of training walls and a dredged channel, but it was objected that this would lead to a silting up of the sides of the estuary and consequent alteration of those natural conditions, which assist in keeping the channel at Liverpool clear. With no little ingenuity, the promoters of the canal overcame this objection by altering their original plan so as to bring the canal along the edge, and not down the middle. This will explain the apparently unnecessary detour round the Cheshire shore from Runcorn

MANCHESTER SHIP CANAL.



Manchester and Salford Docks.
 Area of Water Space 114 Acres
 Length of Quays 5 1/2 Miles
 Area of Quay Space 152 Acres
Warrington Docks.
 Area of Water Space 23 Acres
 Quay Frontage 1 1/4 Miles

LONGITUDINAL SECTION



Scale for Plan and Horizontal Scale for Section



to Eastham. All opposition from the Bridgewater Navigation Company was subsequently removed by the purchase of the latter's undertaking; but in the mean time the Ship Canal Company's Bill passed both Houses of Parliament, and received the royal assent in August, 1885.

Some two and a half years had been spent in obtaining Parliamentary powers, and now two years were needed to raise the requisite capital, the necessary sum being completed only one day within the limit of time prescribed by the Act.

All preliminary difficulties having been overcome, the first sod was cut by Lord Egerton of Tatton, chairman of the Company, on November 11, 1887.

Five and a half years had been spent in obtaining the means and power to construct the canal, six more were destined to elapse in its execution. After the works had been in hand two years, a severe loss was suffered in the death of the contractor, Mr. T. A. Walker, a man of great ability; then heavy floods occurred which caused large damage, and the deeper the cuttings were carried the greater became the expense of carrying on the works.

Early in 1891 it was found that the original capital of £8,000,000 would not suffice for the completion of the canal, and the undertaking was in danger of collapsing from lack of funds. The Manchester Corporation, however, came forward and provided a loan of £3,000,000, which was subsequently increased to £5,000,000, and with this help, and that of a sum exceeding £2,000,000 already raised on mortgage debentures, the canal was finished by the close of 1893. Before this some of the lower portion, being ready, was thrown open to traffic as far as Ellesmere Port, in July, 1891. A year later Saltport was established at the mouth of the Weaver; on November 25, 1893, the canal was filled from end to end; and on January 1 of this year it was finally opened for through traffic to Manchester.

In all, therefore, eleven and a half years elapsed between the first meeting at Mr. Adamson's house and the completion of the canal, six being the actual time consumed in its construction. No less than eleven Acts of Parliament have been required, and the original capital has been almost doubled. Up to the middle of last year about £9,000,000 had been spent on the construction of the works, including plant and engineering expenses, £1,000,000 in interest on capital, and, among other items, more than £150,000 in Parliamentary expenses alone. The Bridgewater Canals Undertaking cost one and three-quarter millions, and the original purchase of land (4520 acres) rather more than a million pounds. Of this land, however, there is a surplus available of 2500 acres, which no doubt will have an increasing value, as they lie along the banks of the canal.

The total length of the canal measures 35½ miles, and falls naturally into two main divisions—a lower reach of 21 miles, which is to a certain

extent tidal, from the entrance at Eastham to the locks at Latchford; and an upper portion of $14\frac{1}{2}$ miles, subdivided by three locks into four smaller sections.

The rise in the upper portion is $60\frac{1}{2}$ feet above the ordinary water-level of the lower reach. As regards this latter section, the condition of affairs will be best understood by reference to the accompanying table of tide levels, which are calculated from the Datum of the old Dock Sill at Liverpool.

				ft.	ins.	
Average high water equinoctial spring tides *	...	...	...	21	1	above datum.
Mean high water	...	...	...	15	6	" "
Ordinary canal level	...	...	...	14	2	" "
Mean tide level	...	...	...	4	9	" "
Mean low water	...	...	...	5	$6\frac{1}{2}$	below "
Lowest low water equinoctial spring tides	...	...	...	10	4	" "

It will be seen that the ordinary water-level in the tidal portion of the canal is $9\frac{1}{2}$ feet above the mean tide level, and this would represent the rise at the entrance locks at Eastham for a ship approaching at mean tide, but at high tide the level of the water outside is apparently more than a foot above that of the canal. This is, however, not actually the case, for three immense tidal openings, each 200 yards long, at Ellesmere Port, Weaver Mouth, and Runcorn, admit the water to the canal whenever it rises outside to a height above the ordinary water-level within, thus equalizing the levels, and preventing the somewhat slender barrier, which in parts separates this portion from the estuary, from being crushed in by the pressure of a high tide.

Owing to this arrangement there should be no lack of water in the lower section of the canal, as at every mean high tide the sea will more than supply any deficiency. Accordingly, streams entering this section are treated in a different fashion from those which flow into the portion above Latchford. There, where a scarcity of water may be felt, all streams, from the Mersey down to the smallest brook, are suffered to discharge their waters into the canal; but in the lower section they are either, when small like the Gowy, siphoned through iron tubes under the bed of the canal into the estuary beyond, or, when large like the Weaver, provided with a long series of sluices for the discharge of surplus water through the bank opposite the point of entry.

In width the canal varies slightly at the surface-level, but its navigability is best indicated by the minimum width at bottom, which is 120 feet, while that of the Suez Canal is only 72 feet. In point of depth these two canals are similar, the minimum in each case being 26 feet; but the lock sills of the Ship Canal have been made 2 feet

* These figures, as well as the others used in this article, are taken from the official publications of the Manchester Ship Canal, kindly supplied by the General Manager, Mr. Marshall Stevens.

deeper, so that, if necessary, the depth throughout could be increased to 28 feet.

The locks are five in number, without counting those at the sides admitting other canals, and, with the exception of the entrance ones at Eastham, which are slightly larger, consist of a large lock capable of holding any but the very largest vessels now afloat, and a smaller one side by side; but, as the canal is really a modified river, each set of locks is flanked by a series of sluices to regulate the discharge of flood-water. At the Mode Wheel locks, for example, the last of the series, there are two locks, one 600 feet by 65 feet, the other 350 feet by 45 feet, for the smaller craft, and four sluices each 30 feet wide.

One of the chief difficulties which beset the construction of the canal lay in the number of established routes crossing its line, since a waterway for masted ships requires a clear headway of considerable height. Ordinary roads could be managed by means of swing-bridges, and no less than seven have thus been dealt with. But the railways, of which five cross the canal, required fixed bridges. To deal with the line which crosses the Mersey on a high viaduct below Runcorn was found to be impracticable, so this, which unfortunately is only 75 feet above the ordinary water-level of the canal, decided the height of the rest. In each of the other cases a viaduct at a similar height and with long approaches was constructed near the existing lines, so that the traffic was never interfered with, but simply diverted on to the new lines when ready. Two ordinary roads having been similarly dealt with, there are six high-level bridges 75 feet above water-level, in addition to the old Runcorn viaduct, crossing the canal.

Two other obstacles presented difficulties of a more novel character. The one was the Vyrnwy aqueduct bringing Liverpool's new water-supply from the Welsh hills, the other the old Bridgewater Canal. The former has been treated like the river Gowy, and taken through a tunnel under the bed of the canal; the latter, however, was less easy to deal with, and in its treatment represents one of the most brilliant engineering feats of the whole undertaking. To carry the old across the new canal, a swing-bridge has been built, which is pivoted on an island in the centre of the latter. When a ship has to pass, watertight gates are closed at each end of the bridge, and a complete section of the canal swings round and back again without a drop of water being lost.

Some idea of the magnitude of the work done in constructing this remarkable canal may be gained from the fact that 51,000,000 cubic yards of soil and rock were excavated in the task, more than 16,000 men and boys and 100 steam-excavators being employed, and 10,000 tons of coal per month consumed when the work was in full swing.

As an engineering triumph the canal is remarkable; how far it may prove a commercial success remains to be seen. Certainly it has cost a large sum of money, greatly in excess of the original estimates, but so also

did the Suez Canal. All the work done is of an extraordinarily massive and substantial character; the dock space at the terminus is immense, over 100 acres in extent, with $5\frac{1}{2}$ miles of quays, which are a model of good workmanship and wise provision for possible requirements in the future. The largest lock can be cleared in eight minutes, and the bridges swing open on the approach of a vessel, causing no delay, so that Manchester can easily be reached in six hours from Liverpool.

Manchester is now a port of the United Kingdom; is it destined to become a leading one? In point of population, there is no reason why it should not. Within a radius of twelve miles round Manchester there is a population twice as great as that in a similar area round Liverpool, and it has been calculated that in the districts which are nearer to the Ship Canal than to any other ocean steamship port there is a population of no less than $7\frac{1}{2}$ millions. Liverpool, which has increased a hundred-fold in less than two centuries, is one of the most remarkable products of Lancashire; it will be interesting to see how far its prosperity is affected by the establishment of a new port nearer those industrial centres which have so greatly helped to make it what it is.

There are, however, two drawbacks likely to militate against the success of the new venture at the outset, if not longer. One is the lowness of the bridges, which only allows a headway of 75 feet above the ordinary water-level, and therefore necessitates the lowering of topmasts in the case of many vessels—an operation which a sailor describes as often being as bad as drawing a tooth. The other is with regard to the water itself. The Mersey and its tributaries are not steady streams. Coming from the rainy side of the hills, with a comparatively short course to the sea, they are apt in winter to sweep down in furious floods carrying quantities of silt. But perhaps their summer mood will be even more difficult to deal with. Any one who has seen the Irwell or Mersey in a dry season, creeping along a black shadow of itself, cannot help wondering where the water will be found to float the hoped-for fleets. A great undertaking, however, is almost complete for supplying Manchester with water from Thirlmere, in the Lake District. In times of need some of this enormous supply might be used, and the curious spectacle seen of ships floated from Manchester to the sea with water partly brought from Cumberland. Anyhow, energy and fertility of resource are qualities not altogether lacking in Lancashire, and the canal is not likely to prove a failure from want of them, whatever difficulties it may have to contend with.

It is noteworthy that the first railway was tried between Manchester and Liverpool; how many imitators will the new experiment produce?

A NOTE ON THE GEOGRAPHY OF FRANZ JOSEF LAND.

By ARTHUR MONTEFIORE, F.G.S.

THE selection of Franz Josef Land as the immediate objective of Mr. Frederick G. Jackson's expedition and the route for his advance in a northerly direction offers so high a probability of reward, that one can scarcely fail to be glad that it is the English expedition which has decided on what appears to afford the surest approach to a fertile field of geographical discovery. It will be remembered that in the *Geographical Journal* for April, 1893, Mr. Jackson pointed out briefly the main advantages of this route, and those members of this Society who have made Arctic geography a special study will not fail to recognize their particular merits. In the discussions which have arisen from time to time at the meetings of the R.G.S., our leading Arctic authorities have dwelt on the great importance of Franz Josef Land as a route to the more immediate vicinity of the North Pole, but it will suffice if I quote, as an example of "expert" opinion, one sentence from the concluding passages of Admiral Markham's 'Life of Sir John Franklin' (London, 1891). "In order to carry this (Polar exploration) out to a successful issue, our attention and our energies should be directed towards the little known Franz Josef Land, for it is in this direction that the greatest prospect, almost amounting to a certainty, of success will be obtained." That is the opinion of an Arctic explorer of great and successful experience, deliberately expressed, and supported by arguments with which students of Arctic geography are familiar, and with which they can scarcely fail to agree.

Now that Mr. Jackson will this summer lead an expedition to Franz Josef Land—a scientific expedition fully and without stint equipped at the cost of Mr. Alfred C. Harmsworth, an Arctic enthusiast and a Fellow of our Society—one naturally turns from the contemplation of the *Fram*, now lying, as we believe, in the strict embrace of oceanic ice, and from the interesting attempt which Peary is making to establish the insularity of Greenland. For after a lapse of many years, our own countrymen are taking up the Arctic work in which this country has achieved such great things—not merely in the generations immediately behind us, but during the whole period of Arctic exploration. With the splendid work which the loss of Franklin called out we are all familiar; but how many of us can recount the full tale of the Arctic expeditions which sailed from England before the present reign? It is a long list, for they are sixty, save two; and, although none attained its object, each added something to its own and its country's credit.

The immediate interest, then, which surrounds the little-known Franz Josef Land may make this brief note on its geography useful for reference. I have collected the facts almost entirely from the journal of Payer, who led the only expedition which has penetrated the country;

but the *résumé* of the journal of Mr. B. Leigh Smith, who twice visited and once wintered on the southern coast of Franz Josef Land, is useful as recording several minor discoveries in the south-west, as well as affording valuable information as to the character of the winter climate. This *résumé* appeared in the *Proceedings* of the Royal Geographical Society, vol. iii. pp. 129-145, and vol. v. pp. 204-220. It is to Payer, however, that we must turn for information on the geography of the interior, the geology and zoology of the country, the conditions of travel, the northward development of the land, and the prospects of geographical discovery in the higher latitudes.

Franz Josef Land was discovered by the Austro-Hungarian expedition on August 30, 1873. The *Tegetthoff*, which had been slowly drifting, fast locked in the ice, since August 20, 1872, was then in $79^{\circ} 43'$ N. lat. and $59^{\circ} 33'$ E. long. Weyprecht and Payer loyally named the new land after their sovereign, and the high bluff they had first seen Cape Tegetthoff. It was not until November 1, however, that the party landed on Wilczek Island, their ship having then drifted to $79^{\circ} 51'$ N. lat. and $58^{\circ} 56'$ E. long. Three hasty visits to this island—insufficient even to determine its configuration—were all that could be done before winter prevented further work. This was the second winter which the ship had passed, locked in the ice. The return of the sun on February 24 found the preparations for a sledge journey well advanced, and on March 10, a party of seven men and three dogs, with Payer in command, left the *Tegetthoff* for a reconnaissance in the neighbouring islands. This terminated on the 19th. On March 26, Payer, with a similar number of men and dogs, again left the ship; on April 1 he reached Austria Sound, and, travelling on its frozen surface, he successively attained Cape Tyrol (April 4), Rawlinson Sound (April 8), Cape Brorok, $81^{\circ} 45'$ N. lat. (April 11), and finally Cape Fligely, $82^{\circ} 5'$ N. lat. (April 12). Returning the same day southwards, he regained the ship on April 23, a remarkable sledging record. A third journey—this time to the westward—was begun on April 29, and concluded on May 3, the most westerly point reached being the south-east coast of McClintock Island, $56^{\circ} 25'$ E. long. It is to the second of these journeys that we are wholly indebted for the geography of the interior.

As far as a country whose eastern and western limits are unknown can be described in conventional terms, Franz Josef Land may be regarded as a large insular mass with a chain of small islands lying along its southern coast, the most considerable of which, taken from east to west, are Salm, Hall, M'Clintock, Hooker, Northbrook, and Bruce Islands. The most southern point of the mainland is Cape Grant, $80^{\circ} 5'$ N. lat., but portions of the island chain extend south of the 80° parallel. Westward exploration by the Austrians ceased a little west of 57° E. long., but Mr. Leigh Smith, by actual navigation, extended this to $44^{\circ} 45'$ (west of Cape Neale), and saw the land stretching

away, cape beyond cape, to about 42° E. long. On the east nothing is known beyond 62° E. long., so we may say that the known parts of Franz Josef Land stretch across 20° of longitude (on a mean latitude of $80^{\circ} 30'$ N.). The most northerly point yet reached is Cape Fligely ($82^{\circ} 5'$ N. lat.) and Petermann Land was observed in about $83^{\circ} 10'$ N. lat. The land itself is cleft asunder, almost due north and south, by that dominating feature of its known interior—Austria Sound. On the west lies Zichy Land, separated from the island chain by Markham Sound, a south-westerly prolongation of Austria Sound; and on the east there rises Wilczek Land, with its great Dove glacier 60 miles wide. On the parallel of 81° N. lat., Austria Sound is at its narrowest, and between this point and $81^{\circ} 40'$ it spreads out both east and west, forming two wide-mouthed bays, and opening up several deep fiords. At $81^{\circ} 40'$, the latitude of the southern extremity of Prince Rudolf's Land, the sound forks, the branch running north-east being called Rawlinson Sound, and that trending north-west preserving the original name. Prince Rudolf's Land is the most northerly portion of the Franz Josef Land group which has been visited. It lies, on the 82° parallel, between $57^{\circ} 50'$ and $60^{\circ} 15'$ E. long., these being the longitudes of Capes Germania and Rath, respectively its most westerly and easterly points in this latitude. After attempting in vain to ascend Rawlinson Sound, Payer turned back, and, advancing along the west coast of Prince Rudolf's Land, reached Cape Fligely, $82^{\circ} 5'$ N. lat., the most northerly point yet attained in this direction. The weather was fortunately clear, and he saw, some 60 or 70 miles due north of him, the mountains of another land, which he called Petermann Land; and away to the westward, stretching in a north-easterly direction from 82° N. to $82^{\circ} 25'$ N., the distant but yet distinct outlines of King Oscar Land. Between Cape Fligely and this land there stretched a wide expanse of open water, and beyond the water a close formation of old ice; north, too, of Cape Fligely lay open water (but "of no great extent") and ice. The connection of Petermann Land with Wilczek Land or Prince Rudolf's Land was not determined, but a protruding cape about $82^{\circ} 20'$ N., which received the name of Cape Sherard Osborn, undoubtedly was part of Prince Rudolf's Land. Although it is possible that Petermann Land is divided from Wilczek Land by Rawlinson Sound, it is more probably a continuation of it.

Austria Sound stretches a surface of ice from Wilczek Land to Zichy Land, but it is not a wholly unbroken one. In 1874, at any rate, a wide expanse of water lay at its southern extremity immediately north of Hall Island. Again, there are at least ten islands of noteworthy extent rising out of the sound, Wiener Neustadt, just south of 81° , and Rainer, $81^{\circ} 20'$, being the most considerable. The ice of Austria Sound is on the whole smooth and level, but from time to time long narrow barriers of hummocky ice occur, and the whole of the known extent of Rawlinson Sound is extremely rough, and this rough ice protrudes

thence into Austria Sound, narrowing down to its southernmost limit at Andrée Island $82^{\circ} 25'$. Still, the whole length of Austria Sound, from $80^{\circ} 40'$ to $81^{\circ} 50'$, may be traversed on what is practically level and easy ice. It is worth noting that the great portion of the ice was not of more than one year's growth. This, of course, leads one to hope that in the month of September the Sound would be navigable.

Bold and intensely boreal are the coast-lines presented by Franz Josef Land east and west of Austria Sound. From mountains, conical but not volcanic, vast glaciers descend to the sound. All is snow and ice, and wherever rock surfaces are exposed they are covered with a thick layer of ice, the colour of the rock being indistinguishable. Even the most precipitous cliffs, and the vertical basaltic columns which continually crop out, tier upon tier, are (at least in April) encrusted so thickly with ice that Payer could find no word more apt for them than "crystallized." (This may be partly owing to the high degree of humidity.) The formation being basaltic, we are not surprised that Franz Josef Land present no continuous mountain chain—that we should find, rather, isolated groups of the plateaux, cones, and table-topped hills characteristic of the formation. Payer compared the mountain forms of Franz Josef Land to those of Western Greenland, and contrasted them with those of East Greenland, parts of Spitzbergen, and Novaya Zemlya. The average height to which the mountains attain is 2000–3000 feet, but in the south-west this rises to about 5000 feet. If we advance northward along Austria Sound, and confine our attention to its eastern shores, the Wullersdorf mountains (3000 feet) would form the chief feature of the southern end; north of these there spreads a wide glacier until the rock eminences of Capes Heller and Selmarda are reached. Immediately north of these rise the mountains of La Roncière Peninsula, extending from 81° to $81^{\circ} 10' N.$, and lying roughly parallel to the southern limit of the great Dove glacier. This glacier is at least 60 geographical miles wide, C. Buda Pest, $82^{\circ} N.$, which protrudes into Rawlinson Sound, marking the most northerly known limit. Still going north, we come to Prince Rudolf's Land, which has an elevation of about 3000 feet. The whole of the south-east side explored is occupied by a great glacier, the Middendorf glacier, having a sea wall several hundred feet in height; but on the west side the precipitous cliffs and capes expose rock surfaces. Returning from Cape Fligely by the western shores of Austria Sound, similar rock eminences and precipitous table-topped cliffs alternate with glaciers, but the former are far more continuous than on the east, while there is no great glacier like the Dove or the Middendorf. As might be expected, the coast-line is more developed, and the fiords deeper and more frequent.

The geology of Franz Josef Land promises to be of great interest. Speaking briefly, one may say that, as far as is now known, it is similar

to that of Spitzbergen. The Dolerite, which is so familiar to the traveller in that group as well as in Greenland, is the dominant formation of Franz Josef Land. The lowest rocks found are of the Oxford Clay; above them are cretaceous rocks (with fossil conifers); and above these the flow of Dolerite. It is probable, I think, that in the extreme north of the Franz Josef Land group, the carboniferous rocks which dip and are lost in Novaya Zemlya will reappear. Though imprudent, it is almost safe to predict that the geological formation of the immediate region of the Pole will prove to be carboniferous.

There has not as yet been a good opportunity for examining the flora of Franz Josef Land, but it may be described as representative of an Alpine zone about 1000 feet higher than that which is typified by Spitzbergen or Novaya Zemlya. Patches of tiny flowering plants occur, and Mr. Grant (of Mr. Leigh Smith's expedition) was able to supplement—near Eira Harbour—the list given by Payer (vol. ii. p. 88). For Mr. Grant's list, reference should be made to *Proceedings R.G.S.*, vol. iii. p. 134. Prominent in the lists are, as we might expect, several saxifrages and the familiar *Ranunculus nivalis* and *Papaver nudicaule*. A summer in Franz Josef Land will doubtless cause several additions to be made.

The fauna of Franz Josef Land presents great encouragement to the explorer. Even in mid-winter bears are plentiful, while in the less severe seasons they occur in great numbers, almost appearing to live and move gregariously. Mr. Leigh Smith's summer visit and the winter which he subsequently spent on Cape Flora (Northbrook Island) most clearly corroborated this very important point—that animal life abounds during the genial season, and that bear and walrus are hardly less plentiful in the winter (thirty-four bears and twenty-four walrus having been shot in the winter, the remarkable openness of water throughout that season chiefly accounting for this). Birds are very numerous, Mr. Leigh Smith noticing their first appearance, flying north, as early as February 8. So far no reindeer or ptarmigan have been found, but there is a slightly misleading statement in the report of the *Eira's* second voyage (*Proceedings R.G.S.*, vol. v. p. 210), viz. that hares were not found by the Austrians. It is true that Payer, in his rapid journey up and down Austria Sound in the month of April, did not meet with any hares, but he distinctly states that he found traces of them.

The winter temperature of Franz Josef Land—as far, at any rate, as its southern coasts are concerned—affords evidence of some ameliorating influence. The occasional rise of temperature to a high degree, though significant, is not of such importance as the fact of the high average means. The *Tegetthoff* wintered in 79° 51' N. lat. (not 79° 43', *vide Proc. R.G.S.*, vol. v. p. 209), and the Leigh Smith party about five miles more northerly, but nearly 100 miles further west. On the *Tegetthoff*, the means of November, December, January, February, March, and April were

respectively, -15.72° , -19.93° , -12.1° , -19.36° , -9.53° , and $+5.72^{\circ}$ F.; while on Cape Flora we have recorded for November, -1.25° ; December, $+4.79^{\circ}$; January, -25.7° ; February, -26.7° ; March, -1.4° ; and April, -1.24° F. Just as there were exceptionally high temperatures, so there were low temperatures. In January, February, March, with the Leigh Smith party, there were records of -43° F. (below which the thermometer did not register); and the Austrians, for the same months, recorded minimums of -50.5° , -47.8° , -51.0° F. The prevailing winter winds are from the east-north-east. The summer fogs are frequent, and there is a slight precipitation of rain. The low-lying clouds and fogs, though depressing and troublesome, have a silver lining, for they retard the escape of the land's heat.

It is to take up the fascinating exploration of Franz Josef Land where it was laid down; to advance northward up Austria Sound towards and, I hope, *beyond* Petermann Land; to discover the relations of land masses and seas yet to be surveyed; and to investigate the geology, zoology, and botany of that unknown region, that Mr. Frederick Jackson and Mr. Alfred Harmsworth are devoting—the one his energies, the other his wealth, and both their patriotic enthusiasm, in the expedition with which their names are connected.

RECENT AFRICAN LITERATURE.

By E. G. RAVENSTEIN.

BEGINNING our survey of recent African literature with South Africa, we may fairly give the precedence to Mr. Selous' recent work,* which deals with that redoubtable hunter's explorations and pioneer-labours since 1881. That a work written by Mr. Selous should abound in hunting-stories is only what might be expected. It is not, however, merely a book written for the gratification of sportsmen, for it presents very ample information on the country, its resources, inhabitants, and recent history, in which Mr. Selous played so conspicuous and commendable a part. Information coming from so experienced a traveller, of whose thorough knowledge and good faith there can be no doubt, should be received with confidence. When speculating on the builders of Zimbabwe, Mr. Selous accepts the hypothesis that they came from Southern Arabia, but denies absolutely that they were possessed of a high degree of civilization. On the contrary, they were a "rude" people, not even possessed of written characters, and to describe the remains of their buildings as "ruined cities" appears to him to be a gross exaggeration. This is true, no doubt. At the same time it is possible that

* 'Travels and Adventures in South-East Africa,' by Fred. Courtney Selous. London (Rowland, Ward & Co.), 1893.

these ruins may not be of Arabian origin at all. When first discovered or heard of, more than three hundred years ago, they were identified with Solomon's Ophir or Sophira. There was a famous emporium of that name in the Gulf of Cambay, the inhabitants of which were no strangers to Phallic worship, and it is quite possible that ships from India were carried by the monsoons to the coast of south-eastern Africa. Even settlers from the Malay Archipelago may have found their way to this part of the world, just as they found their way to Madagascar.

Further excavations at Zimbabwe have been made since Mr. Bent's visit by Sir John C. Willoughby, who has published a little book on the subject, illustrated by very instructive plans.*

Dr. James Johnston's bulky and well-illustrated volume † may be read with some profit by those credulous souls who labour under the mistake that all parts of Africa are equally well adapted for European settlement, and that the accounts furnished by missionaries may be implicitly trusted. The author, a Scotchman long resident in Jamaica, landed at Benguela on May 18, 1891. He travelled by way of Bihe to the Barotse valley, traversed Bechuana and Mashona Lands; then crossed the Zambezi, paid a flying visit to Lake Nyasa, and finally, on October 10, 1892, reached Chinde. He travelled as a "friend" of missions, and was accompanied by a few Jamaica negroes, whose services he thought might be utilized in the Christianization of Africa; but probably never have missionaries been spoken of in more contemptuous terms by their bitterest enemy. The officials of the South African Company and H.M. Commissioners in Nyasaland fare no better, and altogether the "reality" as revealed to us by the author does not prognosticate a happy and prosperous future for that large section of Africa which he saw in the course of what, after all, was but a flying visit. However, even a pessimist may do some good, and some of the "facts" stated deserve attention. That Dr. Johnson himself takes a more hopeful view of the future than might seem to be warranted if we generalized merely from the statements made in various parts of his volume, is proved by his concluding chapter, "A Retrospect."

Among other books dealing with South Africa, a foremost place must be accorded to Mr. John Noble's 'Official Handbook,' ‡ which appears as a second edition of the gaily-coloured 'Handbook to the Colonial Exhibition.' It is a very treasury of information, containing contributions from a large number of specialists, and dealing with the

* 'A Narrative of Further Excavations at Zimbabya,' by Major Sir J. C. Willoughby. London (G. Philip & Son), 1893. Compare *Geographical Journal*, 1893, II. p. 440.

† 'Reality versus Romance in South Central Africa,' by Jas. Johnston, M.D. London (Hodder and Stoughton), 1893.

‡ 'Illustrated Official Handbook of the Cape and South Africa,' edited by John Noble. Cape Town (Juta), 1893.

country and its resources, the native tribes, and the history not only of Cape Colony, but also of all other British territories in South Africa, as far as the Zambezi. The very full monograph on 'Diamonds and Gold in South Africa,' which Mr. Th. Reunert contributed to this Handbook, has been published separately, with numerous additions,* together with sections of the Diamond Fields, a geological map of the Transvaal, and ample mineral statistics.

Mr. H. Anderson Bryden's 'Gun and Camera in Southern Africa' † is essentially a book for sportsmen and pioneers. The author, in the course of a year, wandered over Bechuanaland, the Kalahari, and the Ngami country, and confirms the rapid extinction of all big game. The quagga is to be met with no longer; the elephant, giraffe, and hippopotamus are becoming very scarce. Incidentally, the author supplies information of immediate practical importance. His sketch of Khama, the Bamangwato chief, will be read with interest, and those desirous of learning more about that remarkable African may be referred to Mrs. Wyndham Knight-Bruce's little book. ‡

A very valuable contribution to our knowledge of Zulu arts and industries has been made by Mr. Hendrik P. N. Müller, whose collection has been figured in a sumptuously printed work of 271 plates.§ The collector himself has furnished some ethnographic notes on the tribes among whom these interesting objects were gathered, supplying at the same time the music for native songs which may be heard on the Zambezi, whilst M. J. F. Snellemann gives a concise description of each plate.

Of a more popular type are two little books by ladies—the one, by Mrs. Barkly, || deals with life on the frontier of Basutoland, where the authoress stayed in 1877-1881; whilst the other, by Lady Blennerhasset, ¶ introduces us to some of the mining centres of South Africa. Lady Blennerhasset went out as a hospital nurse, accompanied by Miss Lucy Sleeman. She visited Kimberley and Johannesburg, and subsequently paid a flying visit to Massikessi, Umtali, and Mtasi. Unusual frankness is displayed in writing about the Europeans met with.

(Crossing the Zambezi, we meet with Mr. D. J. Rankin, one of the

* 'Diamonds and Gold in South Africa,' by Theodore Reunert. London (Stanford), 1893.

† London (Stanford), 1893.

‡ 'The Story of an African Chief, being the Life of Khama.' London (Kegan Paul), 1893.

§ 'Industries des Cafres du Sud-est de l'Afrique.' Collection recueillie sur les lieux par H. P. N. Müller. Description des objets représentés par J. F. Snellemann. Leiden (Brice), 1894.

|| 'Among Boers and Basutos,' by Mrs. Barkly. London (Remington), 1893.

¶ 'Adventures in Mashonaland,' by two Hospital Nurses. London (Macmillan), 1893.

early pioneers of Nyasaland,* and best known as the "discoverer" of the Chinde mouth as a practicable waterway. His work deals somewhat disjointedly with explorations carried on between 1883 and 1891, the results of which have already been published in the *Scottish Geographical Magazine* or elsewhere. The author speaks hopefully of the future of Nyasaland, notwithstanding the difficulties presented by the labour problem.

Captain Lugard's bulky volumes quite naturally link British South Africa with East Africa, for their author did valiant duty in the defence of Karonga, on Lake Nyasa, before he undertook the expedition to Uganda, with which his name is more especially associated. The geographical results of Captain Lugard's expedition have already been fully dealt with in a paper read before the Society (see *Proceedings R.G.S.*, 1892, p. 817).† His work, however, enters very largely into questions which are not strictly geographical, and all those who take an interest in the present condition and future development of our "East African Empire" will find in it a mass of information of a useful and practical nature. That the affairs of Uganda, and more especially Captain Lugard's strange relations with the missionaries, should occupy a large space, is only what might have been expected. We believe that none will rise from a careful perusal of this portion of his work without arriving at a strong conviction that Captain Lugard's conduct of the mission entrusted to him was marked by honesty of purpose and judiciousness of action.

The questions of slavery and slave-trade, commercial possibilities and the labour problem, the methods of transport—the author recommends the employment of camels—and the future government of the vast territories which have recently been incorporated with the British Empire, are dealt with at large, and should be read in the light of Sir Gerald Portal's report recently published. A praiseworthy feature of the work consists in the large number of maps which illustrate it.

If any further proof were wanted that a thorough scientific training best qualifies a man for exploring an unknown country, it would be furnished by the publication of Dr. Stuhlmann's book.‡ It is not often that a work of such high merit and varied interest is brought to the notice of the student of African geography. No department of knowledge at all bearing upon geography seems to have been unfamiliar to the German explorer, and hence his descriptions of scenery, vegetation, the fauna and the inhabitants are instinct with life and historic truth.

* 'The Zambesi Basin and Nyassaland,' by Daniel J. Rankin. Edinburgh and London (Blackwood), 1893.

† 'The Rise of our East African Empire,' by Captain F. D. Lugard. Edinburgh (Blackwood), 1893.

‡ 'Mit Emin-Pascha ins Herz von Afrika,' von Dr. Franz Stuhlmann. Berlin (Reimer) 1894.

Dr. Stuhlmann was not content to supply a map, based upon numerous observations for latitude; he also sent home valuable geological and botanical collections. These latter are to be described in separate works, and the bulky volume now before us merely contains the narrative of his travels.

Dr. Stuhlmann, after a preliminary exploration of Usambara, in 1888, joined Emin Pasha at Bagamoyo, in April, 1890. Marching through Mpwapwa and Ugogo—where game appears to have become plentiful, since a limitation has been put upon the importation of firearms and ammunition—the expedition reached Tabora on July 29, and soon afterwards hoisted the German flag there. It then marched northward to the Victoria Nyanza, reaching Bukoba, where a now flourishing station was established, on November 15. After a flying visit to Uganda, in January, 1891, Emin Pasha and Dr. Stuhlmann started for the north-west.* They crossed Karagwe and Ankoli; passed close to the Mfumbiro volcano; skirted the western shore of the Albert Edward and the snow-clad Ruwenzori; and ultimately reached the plateau to the west of the Albert Nyanza, where the Sudanese were encamped. There can be no doubt that Emin, anxious to wind up his African career by a notable exploit, intended to push on to Lake Chad and Bornu; but the dense forests, the want of food, and the outbreak of small-pox frustrated this plan. Dr. Stuhlmann was ordered to return to Bukoba, where he arrived on February 15, 1892; whilst Emin, ever hopeful, remained behind, only to perish miserably when almost within sight of the Congo.

One of the most attractive features of Dr. Stuhlmann's book consists in his discriminating descriptions of the numerous tribes with whom he came into contact, and whose supposed migrations he indicates in a small map. Dr. Stuhlmann saw much of the so-called Pygmies. He looks upon them as the remnant of a primeval race, which at one time occupied the whole of tropical Africa and southern Asia. They have lost their original language, and have been encroached upon by surrounding tribes, even within the dense forests to which they retired, until they are met with only in scattered remnants. No trace of degeneracy is to be found among them, for they are well-proportioned and certainly not rachitic.

The author deals fully with economical questions. At present only slaves and ivory reach the coast from the interior, and as ivory is not likely to hold out much longer a substitute for it must be found, unless trade with the interior is to stop altogether. Dr. Stuhlmann recommends a thorough scientific inquiry into the resources of the country, the establishment of experimental agricultural stations, and the breaking-in of African elephants as beasts of burthen.

The maps—by Dr. R. Kiepert—and illustrations which accompany

* See *Proceedings R.G.S.*, 1892, p. 540, with map.

this splendid work of travels are excellent. No book would better deserve the honours of a translation.

That distinction has quite recently been gained by Lieut. von Höhnel's account of Count Samuel Teleki's remarkable journey through Masailand,* which culminated in the discovery of lakes Rudolf and Stefanie. Things move so quickly in Africa that an expedition which terminated more than four years ago may almost be looked upon as ancient history. Lieut. von Höhnel's book, however, is new to the majority of English readers; it deals with regions which, for the most part, have not since been visited, and which, moreover, lie for the greater part within the British sphere. The large maps and numerous illustrations of the original are all given, as also the scientific appendices.

Two works dealing with British East Africa deserve to be placed on record. The first of these is a 'Handbook of British East Africa,' prepared by Capt. H. Foster, R.E., and published for the Intelligence Department of the War Office. The compiler gives a concise account of the physical and political geography of the country, its ethnology, products, and trade, and supplies, in addition to this, a good deal of information likely to be of use to travellers. There are a few useful maps.

The second work † was undertaken at the express desire of the late Sir William Mackinnon (whose portrait forms a welcome frontispiece), and presents us with a carefully compiled history of the formation and the work of the Imperial British East Africa Company. The author, Mr. McDermott, is assistant secretary of the company, and must naturally be assumed to have written from the point of view of his directors. We are bound to state, however, that Mr. McDermott has done his best to show no bias, and that if occasionally he does indulge in strong condemnatory language—as in the case of Dr. Peters's expedition—he does so not without good cause.

The recent history and downfall of the empire founded in the Katanga copper country by Msidi, an adventurer from Ugalaganza, may profitably be studied in Mr. Moloney's popular account of the expedition led by the late Captain Stairs, ‡ and in Mr. Arnot's 'Bihe and Garenganze.' § Mr. Arnot, as might be expected, devotes much space to the history of the mission of which he is the founder, and which has now stations in Bihe, at Nana Kandundu's on the upper Zambezi, and in Msidi's old empire. Incidentally, however, we are furnished with much geographical and ethnographical information, and more

* 'Discovery of Lakes Rudolf and Stefanie,' by Lieut. L. von Höhnel, translated by Nancy Bell. London (Longmans), 1894.

† 'British East Africa or Ibea,' by P. L. McDermott. London (Chapman and Hall), 1893.

‡ 'With Captain Stairs to Katanga.' London (Sampson Low), 1893.

§ 'Bihe and Garenganze,' by F. S. Arnot. London (Hawkins), 1893.

especially on the route which connects Benguela with Katanga Land. Mr. Swan, who took the Congo route during his recent visit to Europe, is decidedly of opinion that the Benguela road deserves the preference, as "it costs nearly as much to take a load from the coast to Stanley Pool, as from Benguela to Garenganze.* Even were the railway finished, it would not be worth our while to attempt to reach Garenganze this way."

M. Dybowski's narrative carries us into another section of the Congo state. The author was charged with ascertaining the fate of Crampel's expedition, and to punish the evil-doers. In this he succeeded. Starting from Loango, he crossed to Stanley Pool; then ascended the Congo and the Ubangi to Bembe, and finally pushed northward through a country rendered difficult through heavy rains until he reached the upper Shari, when want of provisions compelled him to retrace his steps. The interest of his narrative centres in his account of the tribes whom he encountered when passing from the French into what may appropriately be called the "Mohammedan sphere." He sharply urges the "organization" of the peaceable and industrious heathen tribes, so as to enable them to successfully resist the raiding-parties who enter their country from the north in search of slaves and ivory.

M. Dybowski mentions various products of the Congo basin, which might be exported if the facilities for transportation were greater than they are at present. It is obvious that ivory cannot last for ever. An examination like that carried on by M. F. Martin during a recent journey up to Stanley Falls should therefore be welcomed. Mr. Martin, an experienced Sumatra tobacco-planter, undertook his expedition on behalf of a Belgian syndicate. He reports that between Bolobo and Bangala there is land sufficient for growing tobacco of a superior quality, but that no financial success can be looked for until the difficulties of transportation, of native labour, and of a supply of food for the labourers shall have been overcome.†

The ethnography of the tribes—Danakil, Somal, and Galla—who occupy the eastern horn of Africa, is dealt with in an exhaustive manner by Dr. Paulitschke, of whose work the first volume has recently been published.‡ The author's description is based upon personal observations during a visit to Harar, and a thorough study of all existing sources of information. In the volume now before us, he deals with the physical geography of the country, the geographical distribution of the tribes, and their migrations, and their "material culture." There are 25 plates of excellent illustrations, and a large ethnographical map.

* 'La Route du Tchad,' par J. Dybowski. Paris (Firmin Didot), 1893.

† 'Afrikanische Reiseskizzen,' von Fried. Martin. Munich (Lindauer), 1894.

‡ 'Ethnographie Nordost-Afrikas. Die materielle Cultur der Danakil, Galla, und Somal,' von P. Paulitschke. Berlin (Reimer), 1893.

A second volume will deal with the "mental culture" of these interesting Hamitic tribes.

The interest of Mr. Bent's book on Abyssinia is archæological and historical rather than geographical. Accompanied by his adventurous wife, Mr. Bent in the course of four months succeeded in taking impressions from a number of highly interesting Himyanitic and Ethiopian inscriptions.* More it was impossible to do, owing to the disturbed state of the country, which necessitated a precipitous retreat. At Axum Mr. Bent succeeded in obtaining perfect squeezes of four inscriptions previously only imperfectly known to us through Salt, Rüppell, and d'Abbadie; at Yeha, a site of ruins to the north-east of Adowa, he obtained small Sabæan inscriptions, dating back, according to Professor D. H. Müller, to the seventh or eighth century before Christ, and proving the place to have been known as Awa; and on the Kohaito Plateau, to the south of Halai, he examined the ruins of what he supposes to have been the ancient Koloe. He very plausibly suggests that a huge reservoir at that place represents Ptolemy's lake Coloe, which is usually identified with lake Tsana.

THE SPELLING OF EGYPTIAN NAMES.†

By LIEUT.-COLONEL J. C. DALTON, R.A.

We have received a copy of the rules, as above, which have been prepared in the War Office at Cairo, and issued to the Egyptian army in the form of a pamphlet, which is prefaced by a memorandum dated March 1, 1894, and signed by Colonel H. M. L. Rundle, R.A., Adjutant-General. This memorandum states that, "in order to reduce the confusion existing with regard to the transliteration into English of native names of places and persons, and to ensure an uniform system of orthography in the various sections of the ministry of war, the following rules and a tentative index have been drawn out. These rules will be taken into use and carefully adhered to in all official documents, orders, maps, reports, etc., from this date."

We must congratulate the Egyptian War Office, and all those who recognize and advocate the necessity of having a uniform system for the orthography of native names, upon the important step thus taken in Egypt. There is no doubt that much confusion has existed owing to the diversity, or rather the absence, of systems for spelling native names which has hitherto obtained in that country, due mainly to the fact that until comparatively recently there has been a jumble of

* 'The Sacred City of the Ethiopians,' by J. T. Bent. London (Longmans), 1893.

† 'Rules of Orthography for Native Names of Persons and Places.' Cairo War Office Printing Press, 1894.

French, English, and other spelling which was most perplexing and undesirable.

It is very satisfactory to the Royal Geographical Society to find that the compiler of the rules just adopted in Egypt has accepted, practically in their entirety, the system initiated by that Society so far back as 1878, and elaborated in 1885. This system has for several years been in use by the Hydrographic Department of the Admiralty in their charts, etc., and by the Intelligence Division of the British War Office in all their maps, and no doubt this fact has served to familiarize the Egyptian nation, and the army in particular, with the system of orthography which has now been made law.

The very few points of difference between the rules we are now reviewing and those from which they are taken are trifling, and chiefly consist in the elimination from the latter of certain letters and sounds which do not exist in the Arabic language, such as the *c* and the *ch*. But the Egyptian rules also omit the *sh*, and this we cannot account for, as the sound is so common in Arabic. We notice also a few of what are probably only printer's errors, such as the remarks with reference to the letters *J* and *K*. As regards the former we presume that for *ds* we should read *dj*, as the latter is a rendering of *j*, which is not unfrequently met with on maps, e.g. *Djebel* instead of *Jebel*. Under *K*, the Egyptian rule lays down that the English *k* should *never* be put for the hard *c*. Probably the word *never* should here be read as *always*. The examples to the different rules have very wisely been culled mainly from local names; they are carefully chosen, and serve their purpose admirably.

But what is perhaps the most valuable part of the pamphlet is the tentative index, which contains a large number of Egyptian names, given in the Arabic character with their English transliteration. Nothing could have been devised which could better prove the utility and value of the rules than this index, and in Col. Rundle's memorandum he directs that "any queries as to the correct transliteration of words not included in the tentative index should be addressed to the Director of Military Intelligence." By this means an authoritative transliteration of all Egyptian native names will henceforth be laid down, and no other fancy rendering will be considered official.

When we add that the Director of Military Intelligence is Major F. R. Wingate, D.S.O., R.A., who is not only an accomplished Arabic scholar, but an author of no mean repute and a recognized authority on Egyptian matters, we feel sure that the difficult task of making a liberal and at the same time a simple transliteration of Egyptian names could not have been entrusted into better hands.

What seems to us a most important feature of the case is that the compiler of the rules which have been adopted for Egypt has not allowed himself to be led away by the temptation to further elaborate

them, so as to meet the special conditions of the language immediately concerned to a greater extent than can be done by a set of rules which are made for *general utility*. We are quite aware that there are certain sounds which, to the perfectly trained ear of the Arabic scholar, cannot be rendered in an altogether satisfactory way by any system which is intended to apply to more than one language. But if every linguistic expert were to insist upon a system which would meet his particular case only, uniformity and simplicity would go to the wall, and confusion would be worse confounded.

As is well known, the United States Government have adopted the rules as drawn up by the Royal Geographical Society, and have made them law, and if other countries which have to deal with native names (and amongst these the British Colonies occupy a prominent position) will only tackle this knotty problem in as frank and liberal a spirit as the U.S.A. and Egypt have done, those who have at heart a uniform system of orthography for such names may well cherish the hope that they are at last beginning to see light where all not so long since was very dark.

A DECADE OF PROGRESS IN INDIA.*

By C. E. D. BLACK.

It was a happy idea which led the President, as far back as 1872, to remodel the statutory annual statement exhibiting the moral and material progress of India. Up to that date the reports had consisted of little beyond a brief and too often a bare record of the year's work. But Mr. Markham recognized the fact that for English readers some previous history of the various branches of Indian administration was required, to say nothing of the glaring need of literary research and skill in the utilization of materials. The result was a Blue Book which for general interest and importance was altogether a new departure in official literature. The India Office, recognizing in like measure the advantage of issuing at intervals statements of this character, embracing a rather wider field of treatment, took the opportunity in 1883, ten years after the appearance of Mr. Markham's report, to commission Mr. J. S. Cotton to prepare a similar statement for the preceding decade. The present volume, which is the third of the decennial series, is from the pen of Mr. J. A. Baines, c.s.i., of the Bombay Civil Service, whose interesting monograph on the Census of India was lately reviewed in our columns.

The author has done justice to the varied and extended scope of his present work. He has followed the general lines of Mr. Cotton's report,

* The Third Decennial Report, exhibiting the moral and material progress and condition of India during 1891-92 and the nine preceding years. Eyre and Spottiswoode, 1894.

but has added chapters on the Army and Indian Marine, Vital Statistics, Sanitation, and Surveys, while a concluding summary is given of the factors involved in the general condition of the masses and their relative development and importance at the present day. These additional sections, all of which are essential in so many-sided a review of an empire's progress, will give an idea of the care with which Mr. Baines has endeavoured to supply the deficiencies of the preceding volume. On the other hand, the excellent series of statistical and general maps, prepared by Mr. Trelawney Saunders to accompany Mr. Cotton's statement, is conspicuous by its absence. The present Decennial Statement, like the recent Census Report, has no maps at all—an omission which certainly impairs the value of both works for reference. Considering the exceptional facilities for turning out maps of every description and scale possessed by the Surveyor-General's Department at Calcutta, the lack of these valuable media of illustration and instruction suggests more than a passing remark. The author's geographical review of the Indian Empire and its numerous scattered dependencies is, however, all that could be wished. Here Mr. Baines supplies a lucid and concise account of the history and chief characteristics of each province in turn—an account which will form a useful standard work for future reference. The descriptions of Aden, the Persian Gulf, Baghdad, the Somali protectorate, etc., and the exact nature of their relations to the Indian Empire, are also clear and interesting, and considering the process of expansion here visible and the rapidity with which these outlying localities are coming to the forefront of everyday politics, this section is specially valuable. From an economic point of view, most attention will be probably concentrated on the concluding chapter. We cannot afford space to record here even the principal conclusions arrived at respecting the general condition of the multifarious races of India, but some salient points may be noticed. The author does not deny the existence of "habitually starving millions," but, taking the country as a whole, there is plenty of food for all its inhabitants, though hitherto the difficulty of supplying the deficiencies of one locality with the surplus of others has been only partially overcome. Fortunately, the old days when grain was selling at famine prices in one district, and actually rotting on the ground in another, are gone. Registered meteorological observations indicate that, as a rule, two-thirds of India are affected each year, either favourably or prejudicially, in a manner different from the other third. There is no record of a universal failure of crops, any more than of a general harvest above the average. With regard to the land and its burthens, the Government assessment is known to be light throughout India, but it would have been interesting had the author made some effort to show how Indian taxation compares with that of other countries. But the indirect evidences of the progressive prosperity of

the people are too clear to be mistaken, and Mr. Baines deserves credit for the convincing manner in which he has marshalled his array of statistical facts pointing to this vital conclusion. We wish that he had supplied more liberal references so as to enable readers to look up the actual sources of information on which his most interesting volume is based.

JOURNEYS IN MONTENEGRO.*

By Dr. KURT HASSERT.

IN 1891 and 1892 Dr. Kurt Hassert made two journeys in Montenegro of five and three months' duration respectively. To travel through the Black Mountains of Montenegro can hardly be regarded as a pleasure trip, as the roads are in a very bad condition, and not seldom absolutely unfit for travelling with beasts of burden. Comfort is, therefore, in many cases altogether excluded; for weeks the clothing cannot be changed, and the traveller is obliged to spend the nights without a bed and exposed to the tortures of innumerable insects. Food is of the most primitive kind. Coarse maize-bread, potatoes, honey, cheese, and milk are the principal food-stuffs; fish and meat (mostly mutton) and poultry are but rarely obtainable. The Montenegrins are very hospitable people, who share whatever they have got with the stranger; but, owing to their extreme poverty, they expect a money present in return. Life and property are quite safe in Montenegro, with the exception of the Albanian frontier and the Turkish territory, which are rendered unsafe by Arnaut robbers, who frequently lie in ambuscade and treacherously shoot down their victims.

The Black Mountains form part of the Dinaric Alps, the gigantic walls of which, crowned by steep crests, slope very abruptly to the Adriatic. East of these districts the mountain ranges are followed by a plateau which slopes down to the lake of Scutari, and is divided into two parts by the broad Zeta valley and the Duga passes. The highest point of this plain has an elevation of not more than 260 feet above sea-level. Its soil is very fertile, and capable of unlimited cultivation. This district is of importance, as the shortest and most convenient route from Albania to the Herzegovina. Strategically, it is the weakest point of the principality. It was used in 1862 by Omar Pasha as a basis for his operations, and if the Turks had at that time constructed a fortified road, Montenegro would have been divided into two parts, and its independence made very questionable, as the western districts of the country are infertile tracts of land. A similar plan of campaign was adopted by the Turks in the war of 1876 to 1878, viz. by advancing from north and south to concentrate their forces in the Zeta valley. The alleged invincibility of the Montenegrins is therefore unsupported by facts. Their individual bravery is acknowledged by everybody, but their independence is chiefly due to the inaccessible and desert mountain ranges of western Montenegro, which render it impossible for an invading force to remain there long enough to subjugate the country.

The physical features of the two parts of the principality differ considerably, from one another. The western portion consists of the Crna Gora proper. The other division, which is called Brda, consists, in its eastern parts, of a slate forma-

* Paper read at the Berlin Geographical Society, February 2, 1894.

tion, the mountains forming pronounced and well-developed chains and ranges; it has extensive primeval forests, rivers of considerable importance, and large tracts of land which are characterized by the loveliness of their scenery. With the exception of the fertile plains near the Lake of Scutari, the western parts of Montenegro present totally different physical features. Their surface consists of a monotonous limestone plateau almost without water and vegetation, and occasionally exhibiting the very worst Karst features. Speaking from a general geographical point of view, the country has to be divided into three parts, distinguished from one another by their different physical features, viz. the Karst mountains, the slate formation, and the plains together with the coast belt.

The traveller who quickly passes through the country may find the Karst picturesque and very interesting. But the eye soon gets tired of the monotonous and desert mountains, where the oppressive heat of the day is followed by the coldness of the night, and where hardly any water is found, the possession of the few existing wells and springs—which are famous in the poetry of the surrounding tribes—being the cause of much dispute and bloodshed. The Nikvsic basin (of only 19 square miles' area) is the only spot where water is plentiful. The courses of almost all rivers which flow into it are partly subterranean. They finally join the Zeta, but also this river disappears in an underground gorge, coming again to the surface on the opposite side of a broad mountain, whence the river—which is now of considerable size—continues to flow at the surface. Besides the half-burnt grass, which only in springtime grows somewhat more abundantly, the Karst is characterized by a vegetation of low bushes, the mountains being but rarely studded with single trees. In former times the Karst mountains were covered with beautiful forests of beeches and conifers, which have, however, almost entirely disappeared. Near the frontier the Turks felled the trees in order to protect themselves against the attacks of their troublesome neighbours, and the Montenegrins themselves destroyed the forests in the most senseless way, and rainfall and wind completed the work of destruction by carrying off the loose humus. Thus these once fertile territories were transformed into the dreary desert of to-day. Not more than 200 years ago the Sinyavina Planina was covered with large forests, and had numerous permanent settlements. At the present day it is a desert without any forests and inhabitants. Its large plains are almost without grass and bushes, and can only be used as poor pastures during the spring months. Thus the Karst of to-day must be described as a stony and inhospitable desert, the oases of which are represented by a number of basins and valleys which are mostly fertile and well cultivated. But besides these features, some of the mountains and valleys of the Karst are not without grand and picturesque scenery. These are, however, almost entirely unknown, owing to the fact that they are situated in a country which belongs to the wildest regions of Europe, and which is avoided by travellers on account of its alleged insecurity. Cañons like those of the Colorado are met with, being great obstacles to the progress of civilization, but at the same time forming good natural boundaries, like the gorge of the Lower Tara between Montenegro and the Sanjak Novi Bazar.

It is unintelligible why the Berlin Congress did not select the gorge of Cijevna, which is not less than 3900 feet deep, as the boundary between the Montenegrins and their deadly enemies, the Albanians—a mistake the consequences of which are incessant feuds at the frontier, which runs about a mile to the west of the river. Also the most recent Albanian riots, of 1893, were due to this fact. The traveller feels relieved when, after having passed these districts, he enters East Montenegro. Instead of the monotonous triassic and cretaceous limestones, sandstone rocks and mica schists make their appearance, frequently interrupted by diabasic rocks. The lovely mountains and valleys are covered with humus, water is plentiful, and a

luxuriant grass vegetation, as well as vastly extending forests of beeches, oaks, and conifers, characterize the country. Numerous farms and dairies are met with on the plateaux, and villages are frequent in the valleys, where the climate is mild. Only the highest summits of the steep mountains are devoid of vegetation, thus adding to the loveliness of the lower ranges the wild grandeur of a high and bold mountain region. These territories, which until quite recently were almost unknown to geographers, are inhabited by a healthy and robust race. The plains round the Lake of Scutari and the coast belt bear witness to the activity of the population. The districts surrounding this lake are the most fertile parts of Montenegro, producing cereals in large quantities. It is, however, a great drawback that, owing to the yearly inundations, the flat eastern banks of the lake are covered with swamps and morasses, which make the district very unhealthy, producing malignant fevers. The lake, which is the largest of the Balkan peninsula, covers an area of 135 square miles, and is one of the most picturesque lakes of Europe. It abounds with fish. Immediately on its western termination rise the coast mountains of Rumiya, and its eastern portion is bounded by an extensive plain. This latter part of the lake is so shallow that its maximum depth, according to Dr. Hassert, is not more than 23 feet. It is evident that the lake owes its existence to permanent inundations of the lowest portion of the plain. The narrow outflow of the lake, the Boyana, is partially obstructed, and the consequence is that the lake gradually becomes deeper and larger, and fertile tracts of land and villages which existed but a few centuries ago are now covered by the lake. Not less than three times the rising floods rendered it necessary to change the site of the town of Scutari, either in part or completely; and when the level of the lake is at its highest, the depth of the water near the bazaar of the town is not less than 10 feet. A correction of the Boyana river would render this impossible, and at the same time open the lake to European commerce. But, unfortunately, most of the wishes and hopes which the traveller may have with regard to the development of the country seem to have a very remote chance. The country round the lake is densely peopled, the fields yield two crops per annum, and fine old olive groves surround the towns of Scutari, Antivari, and Dulcigno. The most important districts of the principality are connected by a number of good waggon-roads, and the nine post-offices which Montenegro possesses are connected by telegraph with one another.

THE HYDROGRAPHY OF THE ÆGEAN AND THE DARDANELLES.

THE fourth and last expedition of the Austro-Hungarian ship *Pola*, during the summer of 1893, was chiefly occupied with researches in the Ægean Sea. Professor J. Luksch, of Fiume, to whom the charge of the hydrographical work was entrusted, has published a preliminary report, and we are indebted to our correspondent, Dr. Peucker, for the following summary of his results.

Further soundings confirm the result that the basin of the Ægean is comparatively shallow, the greatest depth not exceeding 1230 fathoms. Between the islands separating it from the Mediterranean basin, the depth is extremely uniform, but even in the deepest channel—between Crete and Caxo further to the east—it does not attain 440 fathoms, and the two basins may therefore be regarded as entirely separate. In the Ægean basin a series of more or less extensive submarine valleys, separated from each other by islands or submerged barriers, form a striking feature; the deepest of these, starting to the north of the eastern extremity of

Crete, includes the sounding of 1230 fathoms already mentioned, the exact position of which is $35^{\circ} 36' 30''$ N. lat., $26^{\circ} 15' 40''$ E. long. This valley extends westward and gives a depth of 710 fathoms east of the island of Cerigo. Another depression farther to the north gives a maximum depth of less than 550 fathoms. The broad region northwards and eastwards of this and between the coast of Asia Minor and the Cyclades is almost everywhere shallow (maximum 417 fathoms), while the most northerly part of the Ægean sinks again to 710 fathoms, being deepest on the western side. The complexity of the physical features of these parts demanded more frequent soundings than were necessary in the Mediterranean—observations being required at intervals of 10 to 20 miles, instead of 30 to 60 miles. In addition to these, a new sounding of 2114 fathoms in the Karaman Sea east of Rhodes may be noticed, as affording, along with others in its neighbourhood, a completed view of the relief of the Levant. It seems in the highest degree unlikely that greater depths will be discovered in this region, and the longer axis of the depressed area is shown to run in a north-west to south-east direction from Rhodes to the mouth of the Nile. As appears from a tracing of a chart given in the report, the line of 3000 metres (1640 fathoms) encloses an area only 60 miles long and 40 miles broad.

Professor Luksch's observations of temperature and salinity lead him to the general result that the warmth of the intermediate layers of water diminishes from south to north, as also does the salinity. The highest temperature, associated with the greatest salinity, was met with off the south-west coast of Asia Minor, where the water retained all the characteristics of the Mediterranean. From Samos northward to the Dardanelles, there was marked cooling of the water and lowering of salinity, but in the extreme north temperature again increased somewhat; and on the Greek coast similar variations occurred. In the intermediate region between the two coasts rather lower temperatures were observed than in the south-eastern and south-western corners of the sea. Special attention was directed to the study of the currents in the extremely irregular channel joining the Ægean with the Black Sea, and although observations were for the most part made by indirect methods, Professor Luksch is of opinion that sufficient material has been collected for the construction of a reliable current-chart of the Ægean. Direct measurements were possible only in the Dardanelles, and there the results of Captain Wharton's researches on the current from the Black Sea—the existence of which has been known since 1681—were confirmed. Near mid-channel the speed of the current was found to vary from $1\frac{1}{2}$ to $3\frac{1}{2}$ miles an hour, chiefly under the influence of wind. The rapid decrease of speed below the surface, found by Wharton, was not, however, again recognized. Wharton's observations showed that a surface velocity of 3 miles an hour was reduced to half a mile an hour at a depth of 5 fathoms, and Luksch obtained practically the same speeds at the surface and at $5\frac{1}{2}$ fathoms. The temperature of the water in the Dardanelles was found to increase slightly from the south end towards the middle, the salinity at the same time diminishing; but the water was fresher than in any part of the whole Mediterranean region, corresponding more to the waters of the Baltic off the coast of Schleswig.

The transparency of the waters of the Ægean—in relation to intensity of sunlight, sea disturbance, etc.—was investigated by means of photographic plates and white metal discs. With a ten minutes' exposure the former were acted upon at a maximum depth of 330 fathoms, and the latter remained visible when 27 fathoms below the surface; these observations were made off the south-west coast of Morea. The transparency is not so great as in the Mediterranean, where the discs were sometimes seen nearly 30 fathoms below the surface. Experiments showed that the effect of cloud or thin fog in diminishing transparency was much less than that of a slight sea disturbance, especially when short and broken and not

of the nature of a swell. The colour of the sea-surface was for the most part intense blue, two or three per cent. of yellow, according to Forel's scale; only in the northern part near Mount Athos and in the Dardanelles did the scale-proportion of yellow rise above five per cent.

THE MONTHLY RECORD.

EUROPE.

Scylla and Charybdis.—Amongst the many natural phenomena which have in these days lost much of their terror, but little of their charm of historical interest, are the famous tidal whirlpools at the entrance to the Strait of Messina. Recent revisions of the Italian charts finally prove them to be insignificant, although doubtless at certain seasons they were a source of real danger to the small ships of ancient times. The currents of the Strait of Messina, however, offer many curious peculiarities, and the "remarks" appended to the chart just mentioned (No. 47, May, 1892; notes translated in *Annalen der Hydrographie*, 1893, p. 505) illustrate some anomalies in the behaviour of tidal streams in a manner likely to throw light on many cases where the conditions are more complex. The latest surveys have cleared up a number of doubtful points not settled at the time of publication of the 'Mediterranean Pilot,' and corrected some errors in the work of the German surveyor, Keller. In a recent number of *Globus* (Bd. lxx., No. 11, p. 176), Dr. Gerhard Schott gives an excellent summary of present knowledge of this subject, with charts showing the surface circulation during ebb and flood tides. The cause of the relatively strong current—which attains a maximum speed of $5\frac{1}{2}$ miles an hour—is almost solely the configuration of the coast-line and of the sea-bottom. High water occurs in the Ionian Sea at the time of low water in the Tyrrhenian, and conversely, but with the feeble tides of the Mediterranean the maximum range at Messina does not exceed $10\frac{1}{2}$ inches to 1 foot. The flood stream, which runs northwards through the strait, begins in the upper and narrower portion about two hours after the moon crosses the meridian of Faro, at Messina two hours later, and two hours later still it is running through the whole channel. The ebb current, entering the narrow opening between Scylla and Punta Peloro, tends to cross and recross from side to side of the strait, at least as far down as Reggio. Where the irregularities of the coast-line form a bay sweeping back from the main channel—as between Faro and Messina on the Sicilian side, and Catona and Reggio on the Calabrian—back currents, locally termed *Bastardi*, are found, extending from the shore outwards for over half a mile. These currents always run in the opposite direction to the tidal streams, and are obviously extremely useful to navigators; they show very clearly on a small scale the influence of certain forms of coast-line upon the arrangement of tidal currents, an effect very often so disguised as to be scarcely recognizable, as for example in the English Channel. The whirlpools of Scylla and Charybdis are probably whirls set up at the interfaces between the *Bastardi* and the tidal streams. But, unlike the Corryvreckan, they are by no means easy to locate.

The Lake of Zell in Salzburg.—A bathymetrical survey of this lake was carried out in 1892 by Dr. W. Schjerner, whose report has lately appeared (*Zeitschrift Berlin Geogr. Soc.*, 1893, No. 3). The lake occurs in the central of the three depressions by which the chain of the Salzburg Alps is broken, which, unlike those to the east and west (traversed by the Salzach and Saalach), is drained in opposite directions, though with a very slight parting ridge, the lake occurring on

the southern slope, and discharging to the Salzach. The slope, however, is so slight that, until artificially regulated, the water of the Salzach at times flowed back into the lake and even threatened to surmount the water-parting towards the Saalach. The lake, which is roughly $2\frac{1}{2}$ miles long by 1 broad at its widest part, is contracted at the centre by the deltas of the principal feeders, which enter at the sides, though the main contours are still unaffected. The shores are flat at the ends, but descend steeply at the sides. The deepest part is nearly central, and reaches 228 feet, less than previously supposed, but a considerable depth when regard is paid to the flat nature of the valley north and south. Tables are given showing the percentage of area occupied by the successive zones of depth, the angle of slope at each stage, etc. The mean depth is calculated at 121 feet. A connection probably exists between the formation of the lake and that of the defile of the Salzach to the east, which seems quite recent. According to a theory of Brückner's, the ancient Salzach glacier flowed through the opening at Zell to the Saalach, but sent an arm eastwards which excavated the defile just mentioned. At the melting of the glacier, the former course being blocked by the end moraine, the Salzach made use of the new channel, its lateral deposits damming back the lake at its southern end.

Early Nomenclature of the Bernese Alps.—The history of the nomenclature of the Bernese Alps is the subject of a paper in the *Jahrbuch* of the Swiss Alpine Club, by A. Wäber, who traces the progress made in fixing the names of the various summits down to the end of last century. The process was slow and gradual, especially with regard to the central snowy peaks. Maps were wanting, and the inhabitants as a rule troubled themselves little about parts of the chain beyond the limits of pasturage. Many of the names of "Alps," or pasturing grounds, however, became attributed also to the peaks which dominated them. The nomenclature of the earliest maps (at the end of the fifteenth century) was extremely scanty. The first to add much to it were Schöpf (1577-8) and Rebmann (1592-1604). Then after a century's standstill it was again enriched by the works of Scheuchzer (1712-16) and Bodmer (1701-10), and fifty years later by the publication of the "Eisgelbirge" of Gruner, which contains a vast amount of material, though without very much sifting. The interest aroused in the Alps at the end of last century brought about a further increase of knowledge, towards which Studer in particular contributed by his series of panoramas. It was, of course, long before the nomenclature became definitely established, and, strange to say, the uncertainty lasted longest in the case of the finest group, that of the Jungfrau, Mönch, and Eiger, although the first and last names had been applied as at present by Schöpf (1577), who surpassed many of his successors in exactitude. The Mönch, which was first so called by Studer in 1790, had often gone by the names "Inner Eiger," "Eigers Scheeberg," etc. A table is given showing the dates at which the present names of the principal summits were first applied. The Wetterhorn is among those already named by Schöpf.

The Geography of Norway.—At the last meeting of the Norwegian Geographical Society, Dr. Hans Reusch, the well-known geologist, read an important paper on "A New Feature in the Geography of Norway." The sloping of the entire country towards the coast, said Dr. Reusch, does not continue right out to sea, but spreads outwards along the low-lying, almost level part, for which he proposed the general name of "the strand-flat." Those who have visited Bergen will have noticed the lowland on which the town stands, and which surrounds it. The lowland flats of the Karm and Bömmel Islands will also be remembered by voyagers along the coast. All this forms part of the "strand-flat." This flat was, it must be assumed, formed in earlier geological times by the level of the sea being higher than at present. The corroding forces destroyed the land

down to the "flat." This "strand-flat" is an uneven one, and, by its being partly washed by the sea, the enormously long Skjeergaard or chain of skerries along the coast has been formed. On the "strand-flat" are situated the towns of Stavanger, Bergen, Tromsø, etc., and hundreds of thousands dwell upon it. It must, therefore, be considered an important feature in the geography of Norway.

ASIA.

The Syr Daria.—Mr. Sven Hedin, the Swedish traveller at present exploring in Central Asia, has sent the result of his observations on the Syr Daria to the Berlin Geographical Society (see *Verhandlungen*, vol. xxi. p. 150). The ancient Jaxartes is now called the Syr Daria from the point, 1150 miles from Lake Aral, where it is formed by the union of the Narin and the Kara Daria. The Narin rises in the mountains south of Lake Issik-kul (at 12,000 feet), and flows down the steep valley at the north of the Tian Shan, passes through a narrow gorge at Fort Narin (7100), and 200 miles below it turns from a westerly to a south-westerly direction, and changes its slope from 21 to 17 feet per mile. Middendorff called it a dirty, troubled, chocolate-coloured stream; but at the beginning of February Sven Hedin saw a clear, light-green stream, carrying plenty of drift ice. Just before the junction of the Narin and the Kara the former was over 167 feet broad, 6 feet deep, and flowed with a surface speed of $3\frac{1}{2}$ feet per second; while the latter was nearly 260 feet broad, about 5 feet deep, and had a speed of practically 4 feet per second. So at that season the Kara, with nearly 4700 cubic feet per second, has a greater volume than the Narin, with about 3100 cubic feet per second. This probably happens for one or two months, when the more northerly Narin, with a northern exposure, is frozen; and the Kara, which comes down its steeper slope (21 feet per mile for the last 90 miles) from the southern slopes of the Ferghana mountains, is fed by melted snow. Its colour was a dirty grey, and its temperature on February 2 was 38° Fahr., whereas that of the Narin was only $32\cdot2^{\circ}$. Later in the season the Narin probably has the same dirty colour, and becomes the larger stream. It is said to rise from 10 to 12 feet in five days, and to sink just as rapidly. About 4 miles below the junction the waters of the Kara have not quite mixed with those of the Narin, for a clear current 50 feet wide, with a temperature of 34° Fahr., was found near the right bank, and at the left bank (590 feet from right) the temperature was $36\cdot1^{\circ}$; the drift ice, however, floated down the middle of the stream. At the ferry on the road between Khokand and Chust, about 55 miles further down, the width of the river is 640 feet, its depth 5 feet 3 inches, its speed $2\frac{1}{2}$ feet per second, and the volume 7840 cubic feet per second, almost the same as the sum of those of the Narin and the Kara. The colour was dirty grey, the temperature $35\cdot4^{\circ}$, and all the ice had melted; so the Kara water prevails, as the air-temperature at this season was below 32° . At Khojend (108 miles down) the river was clear, and carried drift ice, and had cooled to $32\cdot9^{\circ}$. Its breadth here was 430 feet, depth nearly 13 feet, speed $2\frac{1}{2}$ feet per second, and volume nearly 12,900 cubic feet per second, while Pettraff gives the minimum volume between 9900 and 12,850. The mark for summer depth on the bridge at Khojend was $14\frac{1}{2}$ feet above the water-level on January 27, 1894. The fall of the Syr was in some places as much as 3 feet per mile, but after passing through a gorge near Khojend, it descends only between 8 and 9 inches per mile for the remaining 990 miles to Lake Aral. At Kasalinsk on November 28, 1893, Sven Hedin found the Syr Daria grey-yellow, 1066 feet broad, 8 feet deep, moving $2\frac{1}{2}$ feet per second, which gives a volume of nearly 20,000 cubic feet per second, provided the mean surface speed is assumed to equal average speed of the river. In spring and summer the river is undoubtedly larger in the upper reaches. Much water is used for irrigation purposes, especially for the

rich rice-fields, so that the Syr Daria has been called the Nile of Turkistan. The river also overflows its banks, wide marshes occurring between Khokand and Margilan, and in the lower part of the course temporary morasses and lagoons are very common on the right bank, especially between Kasalinsk and the mouth and east of Perovsk, where the reedy Bokali Kopa is an area of nearly 2000 square miles under water. Much water sinks into the sands in summer, and much is evaporated, so that the volume reaching Lake Aral at that season is probably no greater than in winter. The river never freezes between Ferghana and Khojend, but below that it has usually a solid ice sheet for over a month at Chinaz, for nearly three months at Perovsk, and at Kasalinsk, from the mean of twenty years' observation, it is frozen from December 4 to April 4 each year. Romanovitch has made tables giving dates of freezing and thawing on the Syr Daria and the Amu Daria, and shows that the line of similar dates of freezing runs north-east south-west, whereas that for thawing runs east and west.

Events in Baluchistan.—From the report of the Baluchistan Agency for 1892-3, we learn that the British occupation of Mekran has been withdrawn. With regard to surveys, 3789 square miles on the half-inch scale in the Las Beyla country, and 820 square miles in the Gorral and Zhob valleys, were completed last year; a cadastral settlement survey is in progress in Queltar and Pishin, and a native surveyor is at work reconnoitring north and north-west of Kharan, and with the object of finally leaving no unsurveyed country between the Mekran coast and the Helmund river.

South-East Borneo.—Compared with the other Dutch possessions in the Eastern Archipelago, Borneo has hitherto remained very much in the background, and is still to a great extent a *terra incognita*. An account of the south-east residency, contributed to *Petermann's Mitteilungen* (1894, p. 27) by mining engineer G. Schneiders, is therefore welcome as a summary of the present economic condition of the country, and its prospects of future development. The most important feature in this part of Borneo is the river Barito, the largest in the whole island, and, like other rivers of tropical islands, possessing a volume out of all proportion to its length, which, however, amounts to over 500 miles. It forms the best highway into the interior, which is commanded by the town of Banjarmasin, the capital of the residency, though this does not, as sometimes supposed, lie immediately on the main stream, but a short distance up its tributary, the Martapura. The whole neighbourhood is a swampy level, in great part covered at high tide, which necessitates the artificial raising of the streets, and the building of the houses on piles. This situation affords security against attack, while the constant washing away of impurities renders it comparatively healthy. Out of a total population of 25,000, the foreign section includes 1600 Chinese, 300 Arabs, and 200 Europeans, the last, however, including those with a mixture of Malay blood. Germans are comparatively numerous, but are apt to lose their distinctive nationality. On the lower Barito, the pile-built huts of Malay fishermen at wide intervals are almost the only signs of habitation, but on its tributary the Negara matters improve, and here accordingly Dutch enterprise is mainly concentrated. A military road from Banjarmasin joins the principal posts in this direction. The range of hills which bounds the basin of the Barito eastwards, and runs down to the south-east corner of the island, contains great mineral riches, including gold, platinum, diamonds, etc.; but the regulations, which make it difficult for any but Dutch settlers or other naturalized Europeans to obtain grants of land, are an obstacle to their development, as is also the want of easy access to the coast and the interior. Some German, English, and French miners are, however, at work. Without better communications and properly regulated methods of collection,

gutta-percha, camphor, iron-wood, etc., cannot become paying exports. In spite of the suitability of the soil for rice-cultivation, enough is not always grown for home consumption. Pepper and tobacco receive more attention, and tea and coffee would probably do well. With the present restrictions on the immigration of Chinese, recourse must be had to Japanese or Madurese labourers, the natives showing slight aptitude for work. The stages by which the Dutch extend their influence into the interior, and gradually reduce the native chiefs to the position of feudatories, are traced by the writer, who draws the general conclusion that the island presents few difficulties in the way of colonization.

AFRICA.

The Congo-Portuguese Frontier.—The new frontier between the Congo State and Portuguese territories from the Kwango to the Kasai, the delimitation of which on the spot by a joint commission on the lines of the agreement of May, 1891, was ratified at Brussels in March last, is shown by a map in the *Mouvement géographique*, 1894, No. 8. There are some minor deviations from the provisional line which followed the eighth parallel from the Kwango to the Kwilu, the latter river to the seventh parallel, and this to the Kasai. These are made either to follow the course of streams, or, apparently, to pass to one side or another of important villages. Between the parallels above mentioned, some minor streams serve as the boundary instead of the Kwilu, and thus the abrupt angles of the original line are avoided. As in other recent agreements, it takes no account of existing tribal relations, for while the main part of Lunda west of the Kasai falls to the Portuguese, the northern tributary districts, such as that of Muata Kumbana, visited by a member of Wismann's expedition in 1884, are assigned to the Congo State. As the boundary on the whole takes much the same direction as the route of that expedition, the surveys of the commission (on which the Rev. G. Grenfell represented the Congo State) did not deal with any great extent of new country, though the rivers Wamba, Kwilu, Loanque, etc., were crossed somewhat further to the north. According to Mr. Grenfell's report, the development of the country will require the *razzias* of the Kioks to be stopped; it may then furnish a good supply of cattle. The details which he gives as to the occurrence of the *Elais* and *Raphia* palms, and the flora and fauna generally, agree with Wismann's account.

The Lubudi River, South-East Congo Basin.—Details respecting the exploration of this river, one of the chief tributaries of the West Lualaba, by the Belgian expedition, led, after the death of M. Bia, by Lieut. Franqui (cf. *Geographical Journal*, i. p. 449), appear in the *Mouvement géographique*, 1894, No. 8. Several tributaries of the Lubudi were crossed by Cameron, who was not, however, as stated by M. Franqui, the first to mention it, for, as well as the Lufupa, another tributary of the West Lualaba, it appears (under the name Lububuri or Luburi) in the itinerary of the "Pombeiros" (1806). Of late years it was crossed by Mr. Arnot in 1885, and by Le Marinel in 1891. Although much smaller than the Lualaba at the junction, it has possibly, according to Lieut. Franqui, a much longer course; for, having followed the latter river from its source, he has proved that it cannot be the stream crossed by Capello and Ivens in S. lat. 13°, which, however, may very likely be the Lubudi. This stream is wide but shallow, with a rapid current, and receives some important tributaries. Except the islands and immediate banks, the country through which it flows is the usual tree-savannah, and is fairly fertile and well-peopled. On the right bank is the important tribe of the Lubende, who so far have been little touched by foreign influence. Caoutchouc is the only important article of commerce produced in their country. To the west are the Baluba-Lukéla, and above them the Samba, belonging to the Lunda family.

Algiers as a Coaling-Station.—Algiers is rapidly becoming an important coaling-station for vessels going to and returning from the East. Formerly ships used to stop at Gibraltar and Malta, but Algiers has been found a much more convenient stopping-place, as it divides the distance better between Port Said and the United Kingdom, and is free from the unusually strict quarantine regulations frequently enforced at our own Mediterranean ports. Sir Lambert Playfair, our Consul-General, submits a statement in his recent report on Algiers showing that, while in 1886 the number of British vessels that called for coal was only 85, in 1890 the total had risen to 263, and last year to 1118. He adds that the number is increasing every day.

Machin and the Discovery of Madeira.—Mr. Batalha Reis points out to us that “the story of Machin had been rejected long before Brito Rebello by Rodriguez de Azevedo in 1873, ‘Saudades de Terra pelo Dr. G. Fruchoso’ (pp. 348–424).” The document referring to Machico was discovered by Brito Rebello, who acted on a hint given him by his friend Ernesto do Canto. Galvãd, in the original Portuguese, calls the adventurer Machim, whilst in Hakluyt’s version he is called Macham. Of course, the discovery of the document referred to cannot be said to have finally settled this controverted question.

AMERICA.

The Highest Summit in North America.—“It is curious to know,” says the Washington Letter in the last *Bulletin* of the American Geographical Society, “that the highest mountains on the continent of North America, so far as is now known, were discovered by browsing around in a table of logarithms.” This quaintly worded statement is made with reference to the announcement by Dr. Mendenhall, that the discussion of the horizontal and vertical angles, taken by Mr. McGrath’s party in Yakutat Bay and other parts of the neighbourhood of Mount St. Elias, shows that that peak is not the only lofty summit, nor the loftiest on the shores of Alaska. A group of three snow-summits, probably belonging to one mountain, had been observed by several explorers, and Mr. Russell gave them the name of Mount Logan after the founder of the Canadian Geological Survey. It is this mountain which has now been found to be the loftiest of the group, the elevation assigned being 19,500 feet. Mount St. Elias, after undergoing many vicissitudes as to its height, has probably been at last definitely fixed at 18,000 feet; and Mount Orizaba, in Mexico, the only loftier summit hitherto known in North America, probably does not exceed 18,300 feet. The full discussion of this question will be looked forward to with much interest.

Exploration in Northern Bolivia.*—When Mr. Chandless reached his furthest point on the river Aquiry, or Acre, the chief tributary of the Purus, he was at no great distance from the river Madre de Dios, one of the chief tributaries of the Beni. This was in 1865. Mr. Chandless took twenty observations for latitude on the Aquiry, and observed two occultations. His surveys of the Purus and Aquiry are admirable pieces of geographical work. Since his time many india-rubber collectors have penetrated into these wilds, and have established stations. One of these india-rubber workers is a Bolivian named Victor Mercier, who settled on the Madre de Dios, and in 1887 undertook to traverse the previously unknown country between the Madre de Dios and the Aquiry. The journey, chiefly through dense forest, occupied him from the 9th to the 30th of August. He encountered friendly Indians of the Pacahuara and Guarayo tribes, and reported the country to

* *Diario de una expedición del Madre de Dios al Acre por Victor Mercier, escrito dedicado al Doctor Antonio Quijarro (La Paz, 1894).*

be very beautiful, in some places open glades alternating with belts of forest. Some thriving indiarubber stations were found on the banks of the Aquiry. The narrative of this important journey across the unknown country between the Madre de Dios and the Aquiry, made in 1887, was not printed until the present year, when it appeared in a small pamphlet issued at La Paz, in Bolivia, and dedicated to Dr. Antonio Quijarro, himself an explorer of the eastern forests.

Condition of British Honduras.—The following notes on the present condition of British Honduras are taken from Mr. E. B. Sweet Escott's Report on the Blue Book of the Colony for the year 1892 (Colonial Report, Annual, No. 94). According to the census of April, 1891, the population was 31,471, 16,268 males and 15,203 females. The total white population amounted to 400. The estimated area of the colony is 4,839,408 acres, of which only 45,000 acres are returned as being under cultivation. The estimated extent of forest yielding mahogany and logwood is 3,065,000 acres. The principal products of the colony, in addition to mahogany and logwood, are sugar, bananas, rum, Indian corn, coffee, rice, and coconuts. According to observations taken at the station at Belize, which are not well summarized in the Report, the maximum of air-temperature was 90° in June, July, and September, whilst the minimum was 60° in January. January, November, and December were the three coolest months in the year, though the air-temperature (presumably the maximum) recorded was 84°, 86°, and 85° in these months respectively. The average maximum temperature for the twelve months was 87·7°, and the average minimum temperature 67·1°. The total rainfall for the year was 72·64 inches, and rain fell on 119 days. The lowest rainfall was in April, and the greatest rainfall was in October, with a total of 17·72 inches. There are no railways, canals, telegraphs, or telephones in the colony, and the roads so called consist almost entirely of paths cut into the forests. The rivers and sea are now the principal highways of communication.

The North-West of the Argentine Republic.—At the meeting of the *Société de Géographie* of Paris on March 16, Dr. Meyners d'Estrey communicated a short account of a recent expedition sent out by the Argentine Government to study the geography, geology, and archæology of the provinces of Catamarca, Salta, and Tucuman. Dr. Moreno, director of the La Plata museum, was leader, and he was accompanied by Messrs. Lange, Rooco (topography), Hauthal (geology), H. Ten Kate (archæology), and two assistants. The topography and cartography of these regions are still imperfect, as Brakebusch's map, which is probably the best, leaves much to be desired. Mr. Lange is preparing a map of Catamarca from the results of the new expedition. Except on the eastern mountain slopes, part of Tucuman, and the Lerma valley, luxuriant tropical vegetation was not seen, and most of the country is an arid desert, becoming more so the further north-west the explorers penetrated. Formerly the land was probably much more fertile, but, except in a few places where grapes and peaches grew, the cactus replaced the fields of maize, the pueblos were in ruins, and a miserable, lazy, and ignorant population of half-breeds and Indians replaced the old civilized race. Dr. Ten Kate made many excavations in old buildings and cemeteries, and also purchased many objects of archæological interest. The earthenware is of all shapes and sizes, and often richly ornamented. He has also articles in stone, arms, tools, ornaments and fetiches in copper, bone, and shell, as well as numerous skeletons, most of which are in earthenware pots. It appears that the indigenous people, now completely vanished, had workshops, and knew how to manipulate metals, and to weave; they cultivated the soil, and kept great herds of llamas, sheep, and goats.

POLAR REGIONS.

The Norwegians in the Antarctic.—The *Jason* (Captain Larsen), *Hestha*, and *Castor* returned to Port Stanley, Falkland Islands, on March 16 (?) from their second trip to the Graham's Land Seas. They have made a successful sealing voyage, over 16,000 seals being captured. Captain Larsen obtained half the total catch. The weather is reported to have been very cold. Unfortunately, three men have been drowned owing to the capsizing of a boat. The *Antarctic*, of Tonsberg, arrived at Melbourne on February 27. She called at Las Palmas, Tristan D'Achuma, and Kerguelen. At Kerguelen the vessel ran into Greenland Harbour and visited Royal Sound, where a colony of 59 persons was found, consisting of Europeans, Chinese, and Indians; 1600 hare were obtained, but no fur seals. She will visit Newcastle and Sydney, and sail south in November for the Antarctic ice.

AUSTRALASIA AND PACIFIC ISLANDS.

Discoveries of Relics at the Abrolhos Islands.—The secretary of the Hakluyt Society has recently received a letter from Messrs. Broadhurst, Macneil & Co., who have for some years been settled on Houtman's Abrolhos, in which, after referring to the late Mr. R. H. Major's volume on 'Early Voyages to Terra Australis,' published by that Society in 1859, they say, "Latterly, our operations being carried on in the southern part of the group, where the *Batavia* in 1629, and the *Zeeuyk* in 1727, were lost, we have found a good many relics. Since the beginning of the year, upwards of sixty coins, beginning with Philip IV. of Spain (1633) and ending with a large silver coin of the city of Utrecht, Holland (1726), have been found on Gun Island. Some gun-locks with 'Zeeland-Cameer' on them, cannon-balls, pistol-bullets, wine-glasses, weights, clay pipes, a large number of rosary beads, and numerous other articles—wine-bottles, etc.—have also been found on the same island." It will be remembered that similar relics were found in 1840 by a party of Englishmen who visited the group, and the Gun Island referred to received its name from one of the articles then recovered.

German New Guinea.—Additions continue to be made by the officers of the German New Guinea Company to the knowledge of the lands within the German sphere (*Nachrichten über K. Wilhelms Land, etc.*, 1893, pp. 42, *seq.*). Herr Kärnbach reports on a cruise in the *Ysabel* along the north coast of New Guinea in May of last year, during which the Le Maire (or Schouten) Islands were also visited. These are volcanic, mostly densely wooded, partly with coconut palms, with which Lesson Island in particular is almost covered. The coast westward from Dallmann Harbour was found to be much more thickly peopled than the shores of Huon Gulf, the houses of the numerous villages being built on piles. Among them were some resembling temples, like those of Humboldt Bay. Coconut and Nipa palms were observed, and canoes of large size resembling the *sampangs* of Java. The *Ysabel* also touched at the low-lying Tiger Island, over 80 miles from New Guinea, which is almost covered with coconut palms. This was apparently the first time a ship had put in at the island, which is further east than it is placed on the charts, and seems identical with Matty Island. The inhabitants, who are of a totally different type from the Papuans of the mainland, some showing the light colour of the Malays, were unacquainted with iron or tobacco. During the cruise a great number of articles of ethnological interest, as well as copra, were received by barter. Later on the German part of the Solomon Islands was visited by Herr Schmiele in the *Ysabel*, with a view to studying their suitability for settlement, both the eastern and western shores of the principal islands being examined. In the case of Ysabel Island and the southern half of Choiseul, the great obstacle is the great steepness of the shores, which leaves little ground suitable for cultivation.

The former also is very sparsely populated. Villages are placed on almost inaccessible heights and surrounded by walls, as a protection from the head-hunters from the southern islands. The ascent to the Wesleyan mission-station at the south end of the island was a matter of some difficulty. Bougainville, on the contrary, possesses large stretches of level and cultivable land. Tortoise, ivory-nuts, and trepang are the principal products of the islands, the supply of copra being small. On the return voyage the southern coast of Neu Pommern (formerly New Britain) was examined, some good anchorages being found. Here, too, the shores are as a rule steep; a fine river, navigable for boats, was, however, found, and ascended for a few miles, the banks being high, and the air fresh and healthy. Inquiries made at Herbertshöhe of natives of the Tasman and Lord Howe groups present among the workers there, proved the report that those islanders are unacquainted with the use of fire, to be incorrect.

Trigonometrical Survey of Mount Kosciusko and Neighbourhood.—Mr. Joseph Brooks, F.R.A.S., of the New South Wales Trigonometrical Survey, made a journey to Mount Kosciusko in March, 1892, for the purpose of extending the survey from that station in a southerly direction, and he has now forwarded to the Society some interesting notes on the subject, accompanied by a sketch-map, and a series of photographs. Mr. Brooks, who, in addition to the ordinary members of the staff, was accompanied by his wife, two daughters, and son, gives a detailed account of his journey from Spencer's homestead on the Snowy river to his observing station on Mount Kosciusko. The country traversed, as might be expected, was extremely rough, and on one occasion the waggon in which his family were travelling was overturned, and one of his daughters narrowly escaped being killed; but, after overcoming all difficulties, he reached the camping-ground about $1\frac{1}{2}$ mile to the north-east of Kosciusko Trigonometrical Station, and erected the portable observatory. The instruments used were an eighteen-inch altazimuth instrument, a six-inch theodolite, and three chronometers. A good deal of difficulty was met with in observing the angles on account of the foggy and misty weather, which much delayed the work, but on April 3 the last angles were measured, and the next day the observatory and instruments were brought down off the mountain to the camp. The importance of Mr. Brooks' work is that it has completed the chain of triangles between the Melbourne and Sydney Observatories, thus forming a base from which future surveys may be extended. From observations made by Mr. Brooks, Mount Kosciusko was found to be 7336 feet above sea-level, and Mueller's Peak 7268 feet. For many years Mueller's Peak was considered to be the highest point of the Snowy Mountains, but it is now proved to be 68 feet lower than Mount Kosciusko, the height of which was determined by observations taken from three different stations. The latitude and longitude of Mount Kosciusko were found to be $36^{\circ} 27' 26''\cdot 3$ S., and $148^{\circ} 15' 56''\cdot 6$ E., and were computed geodetically depending on Cooma astronomical station, which had been previously fixed by 333 observations for latitude and 254 for time. While camped at Kosciusko, a minor triangulation of points on the surrounding ranges was made, and the results are shown on the map which has been forwarded, and which, when compared with Townsend's survey of 1846, shows a close agreement, the distance between the two peaks being almost identical. Some of the photographs taken by Mr. Brooks during his journey show that the country about Kosciusko is tame and somewhat uninteresting. It consists of broken granite and quartz ridges, partially covered with grass and low stunted heath, and intersected by swamps through which flow many small streams. About a quarter of a mile to the east of Kosciusko there is an outcrop of slate which reappears on the main range about three-quarters of a mile east of the Victorian Trigonometrical Station.

During the time that Mr. Brooks was encamped, he visited Mueller's Peak, and found there a bottle and two or three tins containing visiting-cards, scraps of paper, and addressed envelopes, showing how large a number of people had visited the peak under the impression that it was the highest point on the Snowy Mountains, or Australian Alps.

Fur-Seals in the Southern Seas.—Mr. F. R. Chapman, in a communication to *The Canadian Record of Science*, made at the request of Dr. George Dawson, furnishes some interesting data regarding the virtual extinction of the fur-seal, once so plentiful on the coasts of New Zealand and Tasmania. It is doubtful, however, how far the figures of sealing catches quoted by early writers referred to the true fur-seal. The earliest reports of the existence of these seals were made by Captain Cook in 1770, and again in 1773. It is certain that the Maoris used seals for food, and were in the habit of making annual hunting-expeditions to Cape Saunders shortly after the breeding season. Sealers were the first European traders to New Zealand; they were followed by whalers, who were succeeded by flax traders, and they finally gave place to the colonists. In 1846, explorers sent by the New Zealand Company found a few seals at Cape Foulwind; but it is difficult now to determine the northern limit of the seal, but they seem to have been rare in the North Island. They were very plentiful in Bass Strait (lat. 38°), where one of the early sealers likens the scene to "a crowded farmyard," and Bass himself "had to fight his way up the cliffs against the seals." During the first years of its settlement, Tasmania was a resort of sealers, who slaughtered without regard to sex or season. Pollock, one of the most reliable authorities in the early days of New Zealand, writes that before 1825, seals were so abundant on the southern coasts that many shore parties secured 100,000 skins in a season; a lucrative business it must have been, for skins were selling at a guinea apiece in London. At the present time on the southern coasts a seal is only seen once in ten years or so, although in the sounds of Western Otago there are a few inaccessible rocks where seals still breed. Far richer than the mainland, however, were the outlying islands to the south. The Snares group, 63 miles south of Stewart Island, once swarmed with seals, but they have long ago been exterminated, as the group of islands was very small. The Auckland Islands, much cut up by inlets, with numerous sea-caves and precipitous cliffs affording ideal "rookeries," were crowded with seals when discovered, and even in 1885 they were by no means extinct. Campbell Island has recently yielded very few seals; but Macquarrie Island, which is outside the jurisdiction of New Zealand, was once the most remarkable sealing-ground in the southern hemisphere. Its discovery was kept secret, and probably the entry of a large cargo of skins from Fiji was one of the methods employed to keep the secret. There are no cliffs, the herbage everywhere dipping nearly to the sea. Ultimately the seals were destroyed by dogs, but recently the further destruction of native fauna has been prohibited by the Tasmanian Government. Antipodes Island, solitary and mountainous, is now almost deserted by the once numerous seals. The Bounty Islands, a small rocky group destitute of water and herbage, yielded some hundreds of seals during a recent season. The Chatham group, a sealing-ground from its discovery, is still visited by small numbers. The depletion of seals has been due mainly to reckless slaughtering, but the gradual peopling of the coasts has contributed to the result. Once or twice in recent years, when left undisturbed, the seals have returned; but only by an effective protection can there be even a partial restoration of seal-fisheries, and now these can only be established on the desolate islands or the uninhabited western coast of New Zealand.

PHYSICAL AND MATHEMATICAL GEOGRAPHY.

Exploration of the Black Sea.—The last volume of the *Memoirs* of the Novorossian (Odessa) Society of Naturalists (vol. xviii. 1, 1893) contains a further paper by A. A. Lebedintseff, on the exploration of the Black Sea in 1892, on board the transport *Ingul*, accompanied by a very useful map showing the results of all the measurements of depths which have been made during the last few years. The researches of the year 1892, which were carried on with the special purpose of more accurately ascertaining the chemical composition of water at different depths, further confirm the previously obtained results as regards the distribution of sulphuretted hydrogen. No traces of it have been found at depths less than from 100 to 150 fathoms, while its amount gradually increases with the depth. The results may be tabulated as follows, the litre of water containing the following numbers of cubic centimetres of sulphuretted hydrogen at the following depths:—

Fathoms.	Cubic centimetres of sulph. hydr.	Fathoms.	Cubic centimetres of sulph. hydr.
90	0	200	215
110	34	300	392
125	71	500	570
170	140		

It has been further confirmed, moreover, that the sulphuretted hydrogen of the deep waters of the Black Sea originates, not from organic matters, but from the inorganic sulphuric acid anhydride.

The Temperature of Caves.—Probably no one has explored so many caves, abysses, and springs as M. Martel; and during the past five years he has made a thousand observations of temperature during his investigations in France, Belgium, Austria, and Greece. He summarizes the main conclusions he has come to in a note in the *Comptes rendus* (vol. 118, p. 615), reserving full discussion for a chapter in his forthcoming book on his underground discoveries. The temperature of the air in caves does not correspond to the mean annual temperature of the place, for it is not constant through the year, nor even uniform in the same cavern. The temperature of water found in such caves is variable in both of these ways, and often differs somewhat from that of the surrounding air. Water may act in two ways, for if it slowly oozes into a cavern and then evaporates, the air-temperature is lowered; but if it flows in abundantly, then it brings with it all the variations it undergoes in the outer air with changing season. Fissures in the rocks may allow the external air to enter a cave slowly, just as they let water trickle in. The nearness of hot springs, or volcanic centres (even extinct), may help to heat a cave. The form of the cavern is of importance, for currents naturally exist in any hollow with two openings, the temperature is rarely constant in a sand-glass-shaped grotto, and a mass of dense cold air becomes imprisoned by its own weight in some deep hollows.

Variations in the Composition of Lake Waters.—M. A. Delebecque summarizes in the *Comptes rendus* (vol. 118, No. 11) the results of his investigations as to the composition of dissolved salts in the waters of Lakes Annecy, Aiguebelle, Nantua, St. Point, Geneva, and Bourget. He finds the quantity of magnesia constant for each lake at all depths and in all seasons; but carbonate of lime is in defect in the surface waters and to a depth of about 50 feet during the summer, probably owing to the action of living organisms. In autumn the cooling of the surface water causes vertical mixing, and consequently during winter the matter in solution is the same at the surface as it is at the bottom. But the proportion of dissolved matter increases in each lake as the winter advances, and it is suggested that the affluents are richer in such dissolved matter than the lake itself. The effluents have always the same composition as the surface waters, from which they consequently appear to be supplied.

GENERAL.

Physical Geography for Sailors.—In the last number of the *Nautical Magazine*, Captain Wilson Barker publishes an attractive article on "Natural History as a Recreation for Sailors," using the words "Natural History" in the wide sense usually denoted by Physiography. He points out the pleasure which seafaring men might derive from their innumerable opportunities of observing the phenomena of nature afloat and on shore, and strongly urges his fellow-sailors to take up at least one branch of study for their own entertainment.

Death of Colonel Ellis.—We regret to record the death of Lieut.-Colonel Alfred Burdon Ellis, C.B., of the 1st Battalion West India Regiment, who was in command of the recent expedition against the Sofas. He died at Tenerife, on March 5, from fever contracted during the short but arduous campaign which he had successfully conducted. Colonel Ellis was born in 1852, and, entering the army in 1872, he served first in the West Indies, and subsequently for many years in West Africa. Here, while diligent in the discharge of his military duties, he found time to study the native languages and races of the Guinea coast, and to record the result of his researches in a series of valuable books. Of these, the most important from the geographical point of view are those treating of the three main linguistic stocks of Northern Guinea—the Chi-speaking people of the Gold Coast in 1887, the Ewé-speaking people of the Slave Coast in 1890, and the Yoruba-speaking people in 1894. The last book was completed just before the outbreak of the recent hostilities. In addition, Colonel Ellis wrote a 'History of the Gold Coast,' which was published in 1893. He was a fine example of the best type of British officer who is a writer as well as a fighter, and able to take advantage of the unique opportunities for enriching science which border-warfare presents.

Colonial Geography.—At a meeting held in Brussels early this year, an International Colonial Institute was founded, the first public meeting of which takes place in May. The objects of the new institution are stated by the *Bulletin* of the Belgian Geographical Society to be: (1) The comparative study of the governments and legislation and economic conditions of the different colonies of various nations; (2) to facilitate exchange of views between those interested in the colonies of the different colonial powers; (3) the formation of an international bureau for the preservation and publication of colonial information. The office-bearers of this new institution are M. Léon Say (Paris), President; M. Fransen van de Putte (the Hague) and Lord Reay (London), Vice-Presidents; and M. Camille Janssen (Brussels), Secretary. An attempt is also being made at Brussels to form a Belgian Society for Colonial Studies, which is intended to be concerned mainly with the Congo State, but to include also the collection of information as to foreign methods of colonization. The creation of two bodies with similar objects, both having their head-quarters in Brussels, appears somewhat impracticable, although the intelligent study of colonial questions is a matter of sufficient importance to justify almost any attempt in that direction.

Geographical Instruction in American Public Schools.—A paper on this subject by Mr. W. B. Powell, read at the Chicago Conference of American and European Geography, appears in the *National Geographic Magazine* for January. The most important ends in the study of geography are considered to be to train the learner to recognize geographical phenomena, to understand them from symbols and maps, and to impart knowledge, the last purpose being dependent on the first two having been systematically carried out. The methods recommended are essentially those of the *Heimatskunde*. Mr. Powell lays stress on the study of plants and animals in nature, and of atmospheric phenomena. Then he advises the use of a

symbol, the sand-board as an introduction to the map; next comes the effort to read correct maps of parts of the city. This completes the first circle in the teaching of geography in the schools of Washington. The aim of the work is to put the learner's mind in a rational attitude rather than to give mere geographical knowledge; the child, indeed, does not know that he has been studying geography, but he has been growing familiar with natural forms and processes. The second circle of studies begins with humanistic phenomena, such as are presented in the city with its buildings, streets, bridges, and water-system. Then come facts caused by climatic conditions—the growth of flowers, migration of birds; next the child is instructed in the field, shown the decay of rocks, the making of soil, formation of valleys, denuding of hill slopes, until the geographical alphabet is fairly acquired. The child is then prepared to study a section of country, noting the characteristic features and recording them in plastic materials. Then follow the representation from the sand map in pencil, and the translating of wall maps into plastic representations. The child is now fit for the study of the world as a whole, the great land and water divisions, the climatic zones, etc., and after that to follow profitably the study of the world as the home of man. Thus political divisions, commercial centres, character of peoples, natural products, means of locomotion, come in only at the last stage. The whole object of the teaching is to train the children how to study geography, especially the geography of man, as he is related to the activities of the world, and to its ever-changing geographical phenomena.

OBITUARY.

General Sir George Balfour, K.C.B.

ONE of our oldest fellows, General Sir George Balfour, K.C.B., Royal (late Madras) Artillery, died on March 12 at his residence, 6, Cleveland Gardens, Hyde Park, at the age of eighty-four. His father, Captain George Balfour, was also in the service, and the son was educated at the Military College at Addiscombe, entering the Madras Artillery at the age of sixteen. He served with the Malacca field force in 1832 and 1833, in the Karnul (Kurnool) campaign, including the action of Zorapur in 1839, and on the staff throughout the China war, from 1840 to 1842, for which last service he gained the medal. It was not till 1844 that Balfour obtained his captaincy, and three years later he was elected a Fellow of the Royal Geographical Society. In March, 1844, he was appointed Consul in the district and city of Shanghai, where he remained for two years. He was a member of the Military and Marine Boards at Madras from 1851 to 1857, during which period he gained the distinction of the Companionship of the Bath, and for four years subsequently he held the post of Inspector-General of Ordnance and Magazines. He was first a member and then president of the commission on military finance, a branch of administrative work which always occupied his special attention; and he also served on the Royal Commission for recruiting. From 1868 to 1872 he was assistant to the Comptroller-in-chief at the War Office, and during the tenure of this office he was promoted to the honour of the K.C.B. From 1872 to 1892 he sat in the House of Commons as Liberal member for Kincardineshire. He always displayed great interest in Indian topics, and particularly in all matters connected with military finance and sanitation. He retired from the army in 1879.

CORRESPONDENCE.

The Battle-field of Plataea.

M. AMADÉE HAUVETTE, in an interesting paper published in the *Nouvelles Archives des Missions Scientifiques et Littéraires*, 1892, discusses with a certain amount of detail the topography of the field of Plataea, which he had visited in the previous year. He opens his account with an assertion which is rather startling to one who has examined the ground in detail, in that he says that, thanks to the work of Stanhope and Leake, the general topography of the field is a matter of certainty at the present day. It is quite true that Leake's map has been accepted hitherto as an authority on the subject, but it can only have been so accepted because it was practically the only map of the district available. It is on an exceedingly small scale—a scale, indeed, far too small for it to be of any real practical value as a test of the account given by Herodotus. M. Hauvette prints in his paper a map made by the French staff, which is also on an exceedingly small scale of 1 to 200,000, and which is little more than a sketch, and a not very accurate one at that, of the neighbourhood. Important ridges and streams are entirely omitted, and the roads and tracks are sketched in both roughly and inaccurately. M. Hauvette, however, seems to have acknowledged the impossibility of working on the existing maps, and to have merely used them as an aid to his own topographical examination of the field.

It would require more time and space than is at my disposal to follow M. Hauvette's account in detail; and I shall confine myself to a very brief survey of the main questions which he raises, and the decisions at which he arrives respecting them. In the first place, he only spent three days on the field. Can any one pretend to give an authoritative opinion on the details of 20 square miles of complicated country after a stay of only three days upon it? I fancy that M. Hauvette would be the last to make any such claim. M. Hauvette speaks of the American excavations at Plataea, and says that the temple of Hera was not discovered in the course of them. I think, however, that the Americans claim to have discovered the site of the temple in, as far as could be made out from their account, much the same position as Leake conjecturally allotted to it.

The inscriptions relating to the temple of Eleusinian Demeter to which M. Hauvette refers were discovered by Dr. Merethides of Kriekouki, who showed me the spot where he found them. It is within 100 yards west of the direct road from Athens to Thebes, close to an ancient well. Dr. Merethides believed this to be the temple mentioned by Herodotus, but admitted that, if that was the case, Herodotus' account of the action which took place near it, and of the movements which preceded the action, is wholly incomprehensible. I have had occasion to point out in my memoir on 'The Battlefield of Plataea,' published by the Geographical Society, that temples of Eleusinia; Demeter were comparatively common in this region, and that the site of the temple mentioned by Herodotus is to be looked for on the ridges nearer to the Asopus River.

I see that M. Hauvette recognizes the impossibility of reconciling this position with Herodotus' account of the battle.

M. Hauvette has made the mistake which his predecessors have made with regard to the passes leading on to the field from the south. He only recognizes two, whereas there are three, viz. :—

1. Dryos Kephalaë, through which passes the main road from Athens to Thebes.
2. That through which passed the road from Athens to Plataea, which road left the Thebes road on the Attic side of the range near Eleutheræ, passed some way up a valley to the west, and then went over the ridge of Kithæron, debouching

into Bœotia immediately to the west of Kriekouki. The political reasons for the route chosen for this road are obvious.

3. The pass on the Megara-Platæa road, which comes down a valley from one to three-quarters of a mile east of Platæa.

It is curious that all these passes are marked on maps made long before I surveyed the country, but no single map marks all three of them.

M. Hauvette accepts Leake's location of Hysia, and says that "Herodotus states that the Greeks camped first at the foot of Kithæron, at Hysia, and at Eleutheræ." This may be a slip of the pen on M. Hauvette's part, but it is an obvious misstatement of what Herodotus really does say.

M. Hauvette places the temple of Demeter in the position assigned to it by Mr. Irving Hunt. I have pointed out in my paper that the difficulties of so placing it are as follows:—

1. That any combat taking place near it must have been audible and possibly visible to those in Platæa.

2. That cavalry could not have acted on the ground.

3. That the trophy must have been erected near this spot, as Mr. Irving Hunt remarks, but that the spot is only 9 stadia from the point mentioned by Pausanias as being 15 stadia from the trophy.

4. That Herodotus' account of the later events of the battle, which is perfectly in accord with the hard topographical facts, if rightly taken, must be pronounced incomprehensible if the last great fight be assumed to have taken place on this spot.

M. Hauvette apparently assumes that Leake's location of the first position of the Greeks is correct. Leake's conjecture as to this position was due to the fact that he, in the face of what Pausanias says, placed Eleutheræ far away from the Athens Platæa road. Now, if the Greeks took up this position, their retreat, as M. Hauvette admits, was cut off, for they would leave Dryos Kephalaë open to the Persians. This is, to say the least of it, improbable.

M. Hauvette could not find Leake's Gargaphia. The spring is now enclosed in a well; but there is a copious supply of water.

M. Hauvette places the Heroon of Androcrotus on the heights of Platani, *i.e.* beyond the Church of St. John in my map. What about the 6 or 7 stadia mentioned by Thucydides? The position is impossible. There is an evident error in Herodotus' topography of the second position of the Greeks, an error which is by no means inexplicable, and this seems to have misled M. Hauvette. Still M. Hauvette's location of the second position of the Greeks corresponds in the main with that which I believe to be correct.

M. Hauvette accepts unexamined the "Island" of Leake, and says that the generals wished to shelter the army behind the Oeroe. Did it occur to him to consider how it could be possible that the Greek generals, having found the Asopus insufficient protection, should consider any one of the little streams of the Oeroe a desirable line of defence?

From this point our views naturally diverge so widely, owing to the necessities of interpretation laid on M. Hauvette by his acceptance of Leake's Island, that it is impossible for me to follow him.

When all is said, M. Hauvette could not, after three days' stay, pretend to contest seriously the views of his predecessors, though, as a fact, Colonel Leake admits that he did not spend a longer time on the ground.

G. B. GRUNDY.

Peak K₂.

Colonel Godwin-Austen addressed to me, in my capacity as Editor of the *Alpine Journal*, a letter upon the identification by Drew of the peak K₂ in a certain view. He did not inform me that he was sending you an almost identical letter. I have answered—it was not difficult—Colonel Godwin-Austen in the *Alpine Journal*; I do not propose to ask you to reprint my answer in your pages, for the matter under discussion is not important. Suffice it here to say that K₂ is known to have a double summit, because I have seen it from several places and on several occasions, and photographed it; and the double summit appears in the photographs even if it does not appear in Colonel Godwin-Austen's sketches. In Captain Younghusband's sketch of the peak, a copy of which can be seen in your map-room, the double summit is likewise conspicuous. Secondly, I may say that Drew's sketch only shows the top 5000 feet of K₂, the whole of which would be easily visible above everything along the line of the ray drawn by Colonel Godwin-Austen on his map. I may further add, in justice to the printers, that the block of K₂ in question was not printed crooked in the February *Alpine Journal*.

W. M. CONWAY.

**MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY,
SESSION 1893-94.**

Tenth Ordinary Meeting, April 23, 1894.—W. T. BLANFORD, ESQ., LL.D., F.R.S., &c., Vice-President in the Chair.

ELECTIONS.—*Arthur Bellin; Geoffrey Fowell Buxton, J.P.; Thomas Soanes, Cooper, C.E.; John Dale, J.P.; Rev. M. Hill Dana, M.A., LL.B.; B. L. D'Aubigne; Arthur Elstob; Frederick Joseph Ernst; Colonel John Farquharson, C.B., R.E., Director-General of the Ordnance Survey; Richard Hargraves Greenwood; C. Leonard Hocking; Nathaniel J. Lyon (Grenadier Guards); John Charles Morris; Arthur Millington Naylor; Howard Ruff; Joseph Taylor; W. A. Wills.*

The Paper read was:—

“The Face of the Earth.” By Professor C. Lapworth, LL.D., F.R.S.

Eleventh Ordinary Meeting, May 7, 1894.—CLEMENTS R. MARKHAM, ESQ., C.B., F.R.S., President, in the Chair.

ELECTIONS.—*Rev. John Butcher; Adolphus Edward Caddy; Captain W. Fairholme, R.A.; Charles Maidment; V.-Lieut. H. M. Maxwell, F.R.C.V.S.; L. E. North-Tzigertory; George Scriven, M.D.; John Thomas Walsh.*

The Paper read was:—

“The Bakhtiari Mountains and Upper E'lam.” By Lieut.-Colonel H. A. Sawyer.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

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

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

<p>A. = Academy, Academie, Akademie. Ann. = Annals, Annales, Annalen. B. = Bulletin, Bollettino, Boletim. Com. = Commerce, Commercial. C. R. = Comptes Rendus. Erdk. = Erdkunde. G. = Geography, Geographie, Geografia. Ges. = Gesellschaft. I. = Institute, Institution. J. = Journal. M. = Mitteilungen.</p>	<p>Mag. = Magazine. P. = Proceedings. R. = Royal. Rev. = Review, Revue, Revista. S. = Society, Soci��t��, Selakab. Sitzb. = Sitzungsbericht. T. = Transactions. V. = Verein. Verh. = Verhandlungen. W. = Wissenschaft, and compounds. Z. = Zeitschrift.</p>
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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.

EUROPE.

Austria—Olm  tz. *Globus* 65 (1894): 249-252. **Lechner.**
Die deutscher Sprachinsel um Olm  tz. Von Dr. Karl Lechner, Kremsier.

Olm  tz, in the midst of a Chech-speaking population, has two-thirds of its inhabitants speaking German, and the same peculiarity occurs in the surrounding villages.

England—Devon. *Quarterly Review* 178 (1894): 411-481. ———

The Pleasant Land of Devon.

An important article dealing with the characteristics of Devonshire people as related to the geographical conditions of their home.

England—Mersey. **Richards.**

Report on the Present State of the Navigation of the River Mersey (1893), to the Right Honourable the Commissioners for the Conservancy of the Mersey. By Admiral Sir G. H. Richards, K.C.B. With Appendix. London, Eyre and Spottiswoode, 1891. Size 9¼ × 6½, pp. 19. *Presented by the Commissioners.*

England—Somersetshire. **Barrett.**

Somersetshire: Highways, Byways, and Waterways. Written and illustrated by C. R. B. Barrett. London, Bliss, Sands, & Foster, 1894. Size 10½ × 8, pp. xv. and 366. *Price* 21s.

A handsomely illustrated volume in which the chief archaeological remains, ecclesiastical buildings, old manor-houses, etc., of the county are well represented.

France—Flanders. *Rev. G.* 33 (1893); 34 (1894): 31-45, 193-200, 276-282. **Malotet.**
La Flandre Fran  aise. Par A. Malotet.

The paper shows how the low level plain of Flanders, without natural divisions, with an inhospitable coast and damp climate, but covered with a soil which became fertile on cultivation and containing deposits of useful minerals, has exercised an influence on its inhabitants, who were required to be from the first engineers as well as husbandmen, traders as well as manufacturers, and soldiers as well as citizens.

France—Franche-Comt  . *Ann. G.* 3 (1894): 319-345. **Killian.**

Contribution    la connaissance de la Franche-comt   septentrionale. Les Collines pr  jurassiennes et le Jura du Doubs. Par W. Killian.

A good piece of regional geography, with a brief bibliography.

France—Jura. *Tour du Monde* 67 (1894): 273-298. **Renauld.**

Baume-les-Messieurs (sa Grotte, ses Environs). Par M. Edmond Renauld.

A description, with fine illustrations, of the exploration of one of the caverns of the Jura, carried out last year in continuance of the systematic study of underground geography which the enthusiastic researches of M. Martel have set on foot in all parts of Europe.

France—Lakes. *Nouvelles G.* (1894): 33-37. **Delebecque.**

L'Etude des lacs en France. Par E. Delebecque.

An extremely clear and concise statement of the leading results of limnological research in France.

France—Montpellier.**Coste.***B.S.G. Languedocienne* 14 (1892): 351, 599; 15 (1893): 150, 269; 16 (1894): 53, 311.Les Transformations du Montpellier depuis la fin du XVII^e siècle jusqu'à nos jours. Par le Dr. Léon Coste.

This is a remarkably detailed record of the growth of a modern town.

Germany—Baltic Lake Ridge.**Bludau.**

Die Oro- und Hydrographie der preussischen und pommerschen Seenplatte.

Von Dr. Alois Bludau. Gotha, Justus Perthes, 1894. Size 11 × 7½, pp.

ii. and 64. Price 6 marks. Presented by the Publisher.

This forms *Ergänzungshft* No. 110 to *Petermanns Mitteilungen*, and is accompanied by a handsome orographical map of the district. It will be specially noticed.**Germany—Inland Navigation. Deutsche Rundschau G. 16 (1894): 323-325. ———**

Die schiffbaren Wasserstrassen des Deutschen Reichs. (Mit einer Karte.)

The map shows the complete system of navigable rivers and canals which covers the German empire, and the text consists mainly of a table giving the number of kilometers of navigable waterway on the different branches of each river-system.

Greece—Lake Copais. Z. Geo. Erdk. Berlin 29 (1894): 1-90.**Philippson.**

Der Kopais-See in Griechenland und seine Umgebung. Von Dr. Alfred Philippson.

This memoir, illustrated by two plates, gives a full description of Lake Copais, one of the best representatives of the "katavothra" lakes of Greece characterized by an outlet through underground channels, the drainage of which is now a matter of practical engineering.

Hungary. Abregé B.S. Hongrois G. 22 (1893): 121-183.**Janko.**

Die ungarische (Székler-) Bevölkerung von Torda, Aranyos-zék und Zoroczkó. Von Dr. Johann Jankó.

Dr. Janko's original paper in Hungarian forms a volume of 300 pages, published as part of the *Bulletin* of the Hungarian Geographical Society, and illustrated by a map, diagrams, and sketches.**Italy—Waterfall of Marmore.****Pennesi.**

Giuseppe Pennesi: La Cascata delle Marmore. Estratto dalla Rivista Geografica Italiana, marzo 1894. Rome, 1894. Size 10½ × 7, pp. 20.

Presented by the Author.

Montenegro. Verh. Ges. Erdk. Berlin 21 (1894): 112-125.**Hassert.**

Herr Dr. Kurt Hassert: Montenegro auf Grund eigener Reisen und Beobachtungen. With map.

This paper is referred to elsewhere in the *Journal*.**Russia—Steppes. Ann. G. 3 (1894): 296-318.****Krasnov.**

Steppes de la Russie Méridionale, leur origine, leur évolution, leur flore et leurs corrélations avec les steppes et les prairies de l'Asie et de l'Amérique septentrionale. Par A. Krasnov.

Switzerland—Lake Constance.**Penck.**Morphometrie des Bodensees. Von Albrecht Penck in Wien. (Separat-
abdruck aus dem Jahresbericht der Geographischen Gesellschaft in
München, 1894). Size 9½ × 6½, pp. 119-155. Plate. Presented by the
Author.

This paper will be referred to in detail.

Switzerland—Valais. Scottish G. Mag. 10 (1894): 242-252.**Dingelstedt.**

A Quiet Corner of the Alps. By V. Dingelstedt.

The "quiet corner" which Dr. Dingelstedt describes from a summer's residence is the valley of Vièze, in the canton of Valais, at the foot of the Dent du Midi, where many primitive customs survive.

United Kingdom. J. R. Agricultural S. England 5 (1894): 39-59.**Price.**

The Census of 1891 and Rural Depopulation. By L. L. Price.

Mr. Price combats Mr. Cannan's argument that the Census returns show a large reduction of the rate of movement of rural populations to great towns. He considers that the returns prove the continuance of rural depopulation, although acknowledging that there does not appear to be any increase during the decade 1881-1891.

ASIA.

Afghanistan. *Asiatic Quarterly R.* 7 (1894): 312-326. **Raverty**
The Independent Afghan or Patan Tribes. By Major H. G. Raverty.

This paper is accompanied by several others treating of different aspects of Afghan life.

Arabia—Hadramaut. *Verh. Ges. Erdk. Berlin* 21 (1894): 126-136. **Hirsch.**
Herr L. Hirsch: Bericht über seine Reise nach Hadramut.

This paper, which is illustrated by a sketch-map, describes the journey which was noticed in the *Journal* for March, p. 196.

Borneo. *Ann. G.* 3 (1894): 371-381. **Chaper.**
Voyage à Bornéo. Par Maurice Chaper.

The journey took place in 1890-91, and was confined to the western division of the island, particularly along the course of the river Kapocaa.

Celebes—Kajang. *Tijdschrift Indische Volkenkunde* 36 (1893): 247-278. **Wiggers.**
Schets van het Regentschap Kadjang onderafdeeling Kadjang, afdeeling Oosterdistricten, gouvernement Celebes en Onderhoorigheden, door H. D. Wiggers.

Rajang, which is described in this paper, is a small "regency" in the south-east of the southern peninsula of Celebes.

Central Asia. **Popowski.**

The Rival Powers in Central Asia, or the Struggle between England and Russia in the East. Translated from the German of Josef Popowski by Arthur Baring Brabant, and edited by Charles E. D. Black. With a map of the North-Western Frontier of India showing the Pamir Region and part of Afghanistan. Westminster, A. Constable and Co., 1893. Size 9 × 6, pp. xxii. and 235. Price 12s. 6d. Presented by the Publishers.

The first chapter deals with Russia's advance in Asia since the fifteenth century. In the second chapter the author endeavours to prove that Russia aspires to the possession of India. The third chapter deals with the political relations of Russia and England in regard to Asia since the commencement of the present century. The fourth chapter, with the strategical relations of Russia and Great Britain. The fifth and last chapter discusses the importance of Great Britain to the Central-European alliance, with final conclusions. The map accompanying the volume was noticed in the *Journal* for November, 1893, p. 478.

India—Ancient. *J.R. Asiatic S.* (1894): 231-264. **Pargiter.**

The Geography of Rama's Exile. By F. E. Pargiter.

A careful study of the Ramayana with the object of identifying the localities referred to, and, by the names employed and the descriptions given, determining whether the knowledge of the author came from personal experience or vague report, and of fixing an approximate date for the poem.

India—Census.

Census of India, 1891. General Report, by J. A. Baines (London, 1893); General Tables for British Provinces and Feudatory States, 2 vols. (London, 1892-93); Report on the Census of the Districts of Ajmere-Merwara, . . . by B. Egerton (Calcutta, 1893); Census of the Lower Provinces of Bengal, 1891, by C. J. O'Donnell. The Provincial Tables (Calcutta, 1893); Report on the Census of Coorg, by H. A. Stuart (Calcutta, 1893), vol. xv. Madras, . . . by H. A. Stuart (Madras, 1893). Size 13 × 8½. Presented by the Secretary of State for India.

India.

Account of the operations of the Great Trigonometrical Survey of India, vol. xv., Electro-Telegraphic Longitude Operations executed during the years 1885-86, 1887-88, 1889-90, and 1891-92, and the Revised Results of Arcs contained in volumes IX. and X., also the Simultaneous Reduction and the Final Results of the whole of the Operations. Prepared under the direction of Colonel G. Strahan, R.E. Published under the orders of Colonel H. R. Thuyllier, R.E., Debra Dnn, 1893. Size 13 × 10, pp. xv., 38, 447, and (18). Charts and plates. Presented by the Secretary of State for India.

India—Punjab.

Report on the Administration of the Punjab and its Dependencies for 1892-93. Lahore, 1894. Size $13\frac{1}{2} \times 8\frac{1}{2}$, pp. xvi, 357, and clxii. *Map*.

Includes a section dealing with the physical features of the country, area, and climate, etc.

Japan. *B.S.R.G. Anvers* 18 (1894): 330-355. **Marischal.**

Le Japon pittoresque. Par M. Arthur Marischal, ancien professeur à l'École supérieure de commerce de Tokyo.

Persia. *Ann. G.* 3 (1894): 278-295. **Houssay.**

La Structure du Sol et son Influence sur la Vie des Habitants, Etudes sur la Perse méridionale. Par Frédéric Houssay.

A summary of the author's observations on the relation between the soil and the people of southern Persia, made during a journey in 1885-86, will appear in the Monthly Record.

Russian Central Asia. *Ann. G.* 3 (1894): 346-370. **Blanc.**

La Colonisation Russe en Asie Centrale. Par Edouard Blanc.

The description of the spread of Russian inhabitants in Central Asia is accompanied by a summary of the geography of the country, and a bibliography of works bearing on the history of Russian conquests in Turkestan.

Syria. *Verh. Ges. Erdk. Berlin* 21 (1894): 201-218. **Oppenheim.**

Herr Dr. Max Frhr. von Oppenheim: Bericht über seine Reise durch die Syrische Wüste nach Mosul. *With map*.

During the summer of 1893, Baron Oppenheim went from Damascus to the Hauran mountains, and thence north-eastward, through Palmyra and Nesibin to Mosul on the Tigris, subsequently descending that river to the sea.

Sumatra. *Bijdragen Nederlandsh. Indië* 10 (1894): 257-320. **Van der Kemp.**

Eene Bijdrage tot E. B. Kielstra's Opstellen over Sumatra's Westkust, door P. H. Van der Kemp.

Sumatra—Toba-lake. *Tijdschrift Indische Volkenkunde* 35 (1893): 640-657. **Dijk.**

De intwatering van het Tobameer en de Batoe Bongbong, door P. A. L. F. Van Dijk.

Lake Toba lies in the centre of the Battak country in Sumatra.

Syr-darya. *Verh. Ges. Erdk. Berlin* 21 (1894): 150-165. **Hedin.**

Beobachtungen über die Wassermenge des Sir-Darya in Winter 1893-94. Mitteilung von Dr. Sven Hedin.

This paper will be summarized in the Monthly Record.

AFRICA.

Benguella. *B.S.G. Lisboa* 13a. ser. (1894): 1-105. **Pereira do Nascimento.**

Grammatica do Umbundu ou Lingua de Benguella. Por J. Pereira do Nascimento.

The widely-spoken Umbundu language is here made the subject of a close philological study, and its grammar is investigated and illustrated by numerous examples.

Congo State. *Verh. X. Deutschen G.-tages* (1893): pp. 1-28. **Stuhlmann.**

Über die Zwergvölker am Ituri. Von Dr. F. Stuhlmann.

An account of the Pygmy forest tribe first reported by Stanley's expedition.

East Africa. *B.S.G. Marseille* 18 (1894): 111-120. **Pilatte.**

Obock et ses Dépendances. Par L.-W. Pilatte.

An authoritative account of the French colony on the Gulf of Aden.

General. **Lugard.**

East and West Africa in Parliament. By Capt. F. D. Lugard. *From Blackwood's Magazine for January, 1894.*

Madagascar. *B.S.G. Paris* 14 (1893): 289-300. **Grandidier.**

Les Voyageurs Français à Madagascar pendant les trente dernières années. Par Alfred Grandidier.

Contains a number of positions in Madagascar fixed astronomically, and is accompanied by a map of Madagascar in four sheets, showing the itineraries referred to.

Madagascar—Ikongo. *B.S.G. Paris 14* (1894): 301-328. **Besson.**

Voyage au pays des Tanala indépendants de la région d'Ikongo (Madagascar). Par le Dr. L. Besson.

This journey was made in 1890.

Madagascar—Soil. *C.R. 118* (1894): 952-958. **Grandidier.**

Du sol et du climat de l'île de Madagascar au point de vue de l'agriculture. Par M. Grandidier.

The object of this paper is to show that, for tropical agriculture to succeed, the peculiar character of the soil—especially of laterite—and of the climatic conditions, in particular the amount and distribution of rainfall, have to be carefully considered. In parts of Madagascar the soil is said to be so infertile that it merely serves as a pot for holding the prepared earth in which each plant grows.

Madagascar—Western. *B.S.G. Paris 14* (1893): 329-366. **Douliot.**

Journal du Voyage fait sur la Côte Ouest de Madagascar. Par M. Henri Douliot (1891-92).

The first expedition referred to in this paper was in the neighbourhood of Morondava, and the second in the district watered by the river Andranomena.

Seychelles. *Tour du Monde 67* (1894): 65-80. **Alluaud.**

Voyage aux Iles Seychelles. Par M. Charles Alluaud.

A popular and well-illustrated description of the author's scientific visit to these islands in 1892.

Somali Coast. *B.S.G. Italiana 7* (1894): 75-90. **Incoronata.**

Notizie riguardanti il portolano della Costa al Nord del fiume Guiba, del cap. di fregata E. Incoronato.

A detailed account of the coast-line north of the Jub.

South Africa. **Barkly.**

Among Boers and Basutos. The story of our Life on the Frontier. By Mrs. Barkly. Second Edition. London and Sydney, Remington & Co., 1894. Size $7\frac{1}{2} \times 5$, pp. viii. and 270.

An account of experiences in Basutoland and the Orange Free State during the late hostilities, 1879-1881.

South Central Africa. **Johnston.**

Reality versus Romance in South Central Africa. An account of a journey across the continent from Benguela on the West, through Bihe, Ganguella, Barotse, the Kalihari desert, Mashonaland, Manica, Gorongosa, Nyasa, the Shire Highlands, to the mouth of the Zambesi on the East coast. By James Johnston, M.D. London, E. Hodder and Stoughton, 1893. Size 10×7 , pp. 353. *Map and illustrations.* Price 21s.

Contains many useful notes regarding the natives encountered, and remarks on the resources of the country, its availability for development, etc., etc. The illustrations from photographs by the author, of which there are fifty-one, are deserving of special notice, and largely add to the value of the work.

Uganda. **Portal.**

Reports relating to Uganda. By Sir Gerald Portal. Presented to both Houses of Parliament by Command of Her Majesty, March, 1894. London, Eyre and Spottiswoode. Size $13 \times 8\frac{1}{2}$, pp. 56. *Price 6d.*

Zambesi Basin. *J.S. Arts 43* (1894). **Foa.**

Travels in the Basin of the Zambesi. By Edouard Foa. With discussion. Observations on the commercial advantages of the Zambesi valley.

NORTH AMERICA.

Alaska. *U.S. Coast and Geodetic Surv. Rep., 1891, Pt. II.* : 487-501. **Reid.**

Report of an expedition to Muir Glacier, Alaska, with determinations of latitude and the magnetic elements at Camp Muir, Glacier Bay. By Harry Fielding Reid.

Appendix No. 14 to the Report, containing a map of the Muir Glacier.

Alaska—Malaspina Glacier. *J. of Geology* 1 (1893): 219-245. **Russell.**

Malaspina Glacier. By Israel C. Russell. *With map.*

Canada—Déné People. *T. Canadian J.* 4 (1894): 1-222. **Morice.**

Notes, archæological, industrial, and sociological, on the Western Déné, with an Ethnographical Sketch of the same. By the Rev. Father A. G. Morice.

The Dénés are perhaps the most widespread of the North American racial stocks, and the northern branch occupies practically the whole of the Dominion of Canada, except the sea-boards. Father Morice treats the subject very comprehensively, and the memoir is practically a separate book provided with a good index. After discussing the name, characteristics, and philology of the Déné, he devotes a series of chapters to their stone implements and weapons, bone and horn implements, traps and trapping as applied to fish and land animals, wooden implements, bark implements and other vegetable products, copper and iron implements, and the use of skins and textiles. Subsequent chapters are devoted to dress and ornaments, and in conclusion there is an account of their monuments and picturo-writing. The various sections are well illustrated by pictures of implements and dresses, and, in describing the use of each, numerous instances of the peculiar manners and customs of the tribes are cited.

Labrador. *B.G. Club Philadelphia* 1 (1894): 37-86. **Bryant.**

A Journey to the Grand Falls of Labrador. By Henry G. Bryant.

This Journey was noticed in the *Proceedings*, vol. 14, p. 49. The new account of it is illustrated by a map of Labrador from the *Proceedings R.G.S.* for 1888, corrected so as to show the exact position of the falls.

Labrador. **Canto.**

Quem deu o Nome ao Labrador? (Breve Estudo). Por Ernesto do Canto. (Extract from *Arquivo dos Açores* xii., p. 353.) Size 1½ × 8, pp. 24. Ponta Delgada, 1894. *Presented by the Author.*

The author endeavours to show that the name Labrador, equivalent to the Portuguese *Lavrador*, a husbandman, was derived from "João Fernandes, lavrador da Ilha Terceira," who is believed to have sailed with the Cabots on their voyage of discovery to North America.

Lake Erie. *American J. Science* 47 (1894): 207-212. **Spencer.**

Deformation of the Lundy Beach and Birth of Lake Erie. By J. W. Spencer.

A sequel to the author's well-known researches on the evidence supplied by high-level beaches as to the origin and deformation of the basins of the great lakes.

Pacific Coast. *J. of Geology* 2 (1894): 32-51. **Diller.**

Revolution in the Topography of the Pacific Coast since the Auriferous Gravel Period. By J. S. Diller.

This will be referred to in connection with other papers bearing on the same region.

United States—Connecticut. *J. of Geology* 1 (1893): 371-393. **Kummel.**

Some Rivers of Connecticut. By Henry B. Kummel.

An interesting paper giving first a general account of the topography of Connecticut, and then a sketch of its geological history treated with special reference to the original systems of drainage and the changes which have occurred in it.

United States—Florida. **Caravia.**

Eugenio Ruidiaz y Caravia. La Florida. Su conquista y colonización por Pedro Menéndez de Avilés. 2 vols. Madrid, J. A. Garcia, 1893 and 1894. Size 9 × 6, pp. (vol. i.) cxxlii. and 416, (vol. ii.) 804. *Maps and illustrations. Presented by the Author.*

Vol. i. consists of a history of Florida and a lengthy memorial of Dr. Gonzalo Solís de Merás, while vol. ii. is composed of appendices dealing with the maps and other documents of Pedro Menéndez de Avilés.

United States—Massachusetts. *J. of Geology* 1 (1893): 803-812. **Gulliver.**

The Newtonville Sand-plain. By F. P. Gulliver.

Mr. Gulliver describes the method by which he constructed a model of an interesting glacial relic—a sand-plain fed by an eskar—and discusses the formation of such features and their effect on the scenery of the district where they occur.

United States—New York.**King.**

King's Handbook of New York City. An Outline History and Description of the American Metropolis. Planned, Edited, and Published by Moses King. Second Edition, Boston, Mass., 1893. Size 8 x 6, pp. 1008.

A profusely illustrated description of New York City, embracing its area, population, wealth, statistics, etc., water-ways, thoroughfares, public buildings, and other interesting features.

United States—Ohio Basin.**Chamberlin and Leverett.**

American J. Science 47 (1894): 247-283. ;

Further Studies of the Drainage Features of the Upper Ohio Basin. By T. C. Chamberlin and Frank Leverett.

This paper will be referred to in the Monthly Record.

CENTRAL AND SOUTH AMERICA.**Argentina.**

B.S.R.G. Anvers 18 (1894): 414-457.

George.

La république Argentine, son histoire, sa géographie, ses produits. Par M. Louis George.

A compilation strengthened by the experience of three years spent in the Argentine Republic.

Argentina—Pampas. *B.J.G. Argentino* 14 (1893-94): 292-368, 419-466. **Ambrosetti.**

Viaje a la Pampa Central. Por Juan B. Ambrosetti.

An exhaustive account of a long journey through the Pampa territory of the Argentine Republic, with speculations as to the future value of the country when it is adequately exploited and attains the rank of a province.

Bolivia.

B.S.G. Italiana 7 (1894): 61-74.

Balsan.

Da Villa Bella a Trinidad, Relazione, originale di viaggio. Del Prof. Luigi Balsan.

Journal of a journey up the Mamore river in the east of Bolivia.

Bolivia.**Mercier.**

Diario de una Expedicion del Madre de Dios al Acre. Por Victor Mercier. La Paz, 1894. Size 7½ x 5, pp. 16. Presented by the Author.

This memoir is referred to elsewhere.

Brazil.

J. of Geology 1 (1893): 753-772.

Branner.

The Supposed Glaciation of Brazil. By John C. Branner.

Mr. Branner sums up a careful study of the evidence for the former existence of glaciers in Brazil thus: "I did not see, during eight years of travel and geological observations that extended from the Amazon valley and the coast through the highlands of Brazil, and to the headwaters of the Paraguay and the Tapajos, a single phenomenon in the way of boulders, gravels, clays, soils, surfaces, or topography that could be attributed to glaciation."

Costa Rica—Terraba tribe.**Pittier and Gagini.**

A. I. Fisioc-G., Costa Rica 4 (1891): 71-100.

Essayo lexicografico sobre la lengua de Terraba. Por H. Pittier y C. Gagini.

A grammar and vocabulary of the language spoken by the Terraba people of Costa Rica, the native words being given with their Spanish equivalents.

Peru.

J. Tyneside G.S. 2 (1894): 215-229.

Markham.

Peru. By Clements R. Markham.

An address delivered to the Tyneside Geographical Society at Newcastle on October 6, 1893.

South American People. *B. American G.S.* 28 (1894): 1-31.**De Kalb.**

The Social and Political Development of the South American People. By Courtenay De Kalb.

A sketch of the position and progress of the Spanish Americans compared with the people of North America, with the object of showing that the South Americans form a race which, while incapable of becoming assimilated to Anglo-Saxon methods or ideas, has a special destiny of its own, and will before long require to be seriously considered in international relations.

Uruguay. *B.S.G. Paris* 14 (1893): 376-389. **Queirel.**
 Voyage de San Javier au Chutes du Mocana (Haut Uruguay). Par Juan Queirel.

West Indies—St. Bartholomew. *Deutsche G. Blätter* 17 (1894): 43-84. **Ludwig.**
 Geographische und geognostische Umschau auf der Insel St. Barthélemy. Von R. Ludwig. *With map.*

This account of a visit to St. Bartholomew is largely geological, containing several sections illustrating the geological structure of the land; and it also describes the industry of digging phosphates, which is of considerable importance.

AUSTRALASIA.

Australia. *Scottish G. Mag.* 10 (1894): 169-184. **Shaw.**

Australia. By Miss Flora L. Shaw.

An account of the conditions and prospects of Australia at the present time.

Australian Bibliography.

Australian Bibliography. (In three parts.) Catalogue of Books in the Free Public Library, Sydney. Relating to, or published in, Australasia. Sydney, C. Potter, 1893. Size $11\frac{1}{2} \times 10$, pp. ix., 435, 584, and 226. *Price* 10s.

The present catalogue, containing nearly 8000 books and pamphlets, has been brought down to the year 1838. It consists of three parts:—Part I. A complete list of authors, etc., with full title; Part II. Authors of books relating to the Colonies; Part III. A complete classified Subject and Title Catalogue, with a General Index to the subjects.

Australia—Early Discovery. *J. Manchester G. S.* (1892): 238-244 **Morgan.**
 Notes on the Early Discovery of Australia. By Mr. E. Delmar Morgan. *With maps.*

Bismarck Archipelago—New Mecklenburg. *Petermanns M.* 40 (1894): 73-82. **Pfeil.**
 New Mecklenburg. Von Joachim Grafen Pfeil.

Descriptions of the part of New Mecklenburg formerly known as New Ireland; traversed by the author in 1888, and accompanied by a map.

Hawaii. **Marcuse.**
 Die Hawaiischen Inseln von Dr. Adolf Marcuse. Berlin, R. Friedländer & Sohn. 1894. Size $9\frac{1}{2} \times 6\frac{1}{2}$, pp. iv. and 186. *Price* 9s.

Dr. Marcuse, while engaged in astronomical observations at Hawaii for thirteen months, occupied his leisure in studying the Sandwich Islands and their people, and this little volume records his impressions. It is well illustrated from photographs.

New South Wales. **Bladen.**
 Historical Records of New South Wales. Vol. II.—Grose and Paterson. 1793-1795. Edited by F. M. Bladen. Sydney, C. Potter, 1893. Size 9×6 , pp. xxvii. and 936. *Plans.*

The Appendices contain, among other things, extracts from the Journal and Letters of Mrs. Elizabeth Macarthur, 1789-1795; the Journal of Lieutenant (afterwards Governor) P. G. King, 1786-1790; and selections from the Journal and Letters of Daniel Southwell, 1788-1792.

New South Wales. **Hanson.**
 Geographical encyclopædia of New South Wales, including the counties, towns, and villages within the Colony, with the sources and courses of the rivers and their tributaries. Ports, harbours, light-houses, and mountain ranges. Postal, money-order, and telegraph offices, and savings banks. The railways and stations on each line. The public schools, and the county in which each school is located. With a map, and diagram of light-houses on the coast. By William Hanson. Sydney, C. Potter, 1892. Size, $10 \times 6\frac{1}{2}$, pp. 462. *Price* 12s. 6d. *Presented by the Agent-General for New South Wales.*

New South Wales—Climate. **Russell.**
 Hail Storms. By H. C. Russell. [Read before the Royal Society of N.S. Wales, November 2, 1892.] Size 9×6 , pp. 4. *Chart. Presented by the Author.*

New South Wales—Climate.

Diagram of Isothermal Lines of New South Wales.

This diagram is intended to convey a general view of the mean shade temperature in the various districts of the colony of New South Wales.

New South Wales—Meteorology.**Russell.**

Results of Rain, River, and Evaporation. Observations made in New South Wales, during 1892, under the direction of H. C. Russell. Sydney, C. Potter, 1893. Size 10 × 6, pp. xl. and 163. *Maps and Diagrams.* Price 3s. 6d.

Tasmania.*J. S. Arts* 42 (1891): 481-495.**Levey.**

Tasmania, and the forthcoming Hobart International Exhibition, 1894-95. By G. Collins Levey.

A brief history of the colonization of Tasmania, followed by a review of the present industrial position of the colony.

Victorian Year-Book.**Hayter.**

Victorian Year-Book, 1893. By Henry Heylyn Hayter, C.M.G. Melbourne, London: Kegan Paul & Co., 1893. Size 8½ × 5½, pp. 491. *Map.* Presented by the Author.

POLAR REGIONS.**Arctic Voyages.****Christy.**

The Voyage of Captain Luke Foxe of Hull, and Captain Thomas James of Bristol, in search of a North-West Passage, in 1631-32; with Narratives of the earlier North-West Voyages of Frubisher, Davis, Weymouth, Hall, Knight, Hudson, Button, Gibbon, Bylot, Baffin, Hawkrigde, and others. Edited, with Notes and an Introduction, by Miller Christy. 2 vols. London, printed for the Hakluyt Society, 1894. Size 9 × 6, pp. xvi., cccxxi., and 681. *Portraits, facsimiles, etc.* Presented by the Hakluyt Society.

Form Nos. LXXVIII. and LXXXIX. of the Hakluyt Society's Publications.

Greenland. *Verh Ges. Erdk. Berlin.* 21 (1894): 137-150. **Drygalski and Vanhöffen.**

Von der Grönland-Expedition der Gesellschaft für Erdkunde. I. Bericht über die Heimreise der Expedition von Grönland. Von Dr. Erich von Drygalski. II. Biologische Beobachtungen während der Heimreise der Expedition von Grönland. Von Dr. Ernst Vauhöffen.

Greenland.*G. Tidsskrift* 12 (1893-94): —, 113-131.**Ryberg.**

Om Erhervs-og Befolknings-Forholdene i Grønland. Af Carl Ryberg.

Detailed discussion of the people of Greenland, with full statistics.

Greenland—Danish Expedition.**Paulsen.**

Observations Internationales Polaires. 1882-83 Expédition Danoise. Observations faites à Godthaab sous la direction de Adam F. W. Paulsen. Publiées par l'Institut Météorologique de Danemark. Tome I, Première Livraison. Copenhague G. E. C. Gad., 1893. Size 12½ × 9½, pp. 74, 62, 4. *Plates.*

The fasciculus contains separately paged memoirs on Auroras, terrestrial magnetism, and sea-temperatures between the north of Scotland, Iceland, and Greenland.

Greenland—Ruins.*Deutsche Rundschau G.* 16 (1894): 307-316.**Jiriczek.**

Nordische Ruinen in Grönland. Von Dr. Otto Luitpolt Jiriczek.

An account from Danish sources of the existing remains of the early Scandinavian occupation of the northern part of the west coast of Greenland.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.**Alpine Lakes.** *Vierteljahrsschrift Naturforsch. Ges. Zürich* 39 (1894): 66-84. **Heim.**

Die Entstehung der alpinen Rand-Seen. Von Prof. Dr. Albert Heim.

Botanical Geography.*Ann. G.* 3 (1894): 265-277.**Bonnier.**

Leçon d'ouverture du Cours de Géographie botanique à la Sorbonne (1893-94). Par Gaston Bonnier.

This summary of the field of botanical geography will receive further notice in the Monthly Record.

Continental Growth. *Natural Science* 4 (1894): 290-298, 337-343. **Reade.**

Continental Growth and Geological Periods. By T. Mellard Reade.

This paper is noticed in the Monthly Record.

Curvature and Refraction. *Jahrbuch Schweizer Alpenclub* 23 (1892-93): 275-284. **Reber.**

Ueber Erdkrümmung und Refraktion. Von R. Reber.

Contains tables showing the effect of the curvature of the Earth in concealing distant objects, the effect of atmospheric refraction in the opposite direction, and the combined influence of curvature and refraction as actually experienced. For example, at 50 miles distance, the curvature amounts to 1617 feet below the horizon, but refraction raises an object 50 miles distant by 213 feet, so that the lower limit of visibility from sea-level at that distance would be a mountain summit 1434 feet high.

Earth's Mean Density.

Poynting.

The Mean Density of the Earth, an Essay to which the Adams Prize was adjudged in 1893, in the University of Cambridge. By J. H. Poynting, sc.D., F.R.S. *With Illustrations and seven folding Plates.* London, Charles Griffin and Co., 1894. Size 9 × 6, pp. xx. and 156. Price 10s. 6d.

Professor Poynting recapitulates the earlier experiments by which efforts were made to determine the density of the Earth, and describes in detail a new method by which he determined this constant and also the value of gravity, using a common balance and movable attracting masses acting on the balanced weights in the pans. The ultimate result was 5.4934 as the mean density of the Earth, thus confirming the generally accepted value 5.5.

Floating Islands. *Abryé B.S. Hongroise G.* 23 (1893): 75-77. **Hanusz.**

Iles flottantes Par Etienne Hanusz.

The full paper, which occupies pp. 189-195 of the Bulletin in Hungarian, gives some account of floating islands in Russia and Hungary, which appear to have been felt masses of tree-trunks, branches, and marsh plants thinly covered with soil, not blisters of sub-lacustrine turf like the famous floating island in Derwentwater, to which, by the way, no allusion is made in the article.

NEW MAPS.

By J. Coles, *Map Curator, R.G.S.*

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British Isles.

Inglis.

The Bath Road Map. Compiled by H. R. G. Inglis. Scale 1 : 126,720 or 2 stat. miles to an inch.—The Holyhead Road Map. Compiled by H. R. G. Inglis. Scale 1 : 126,720 or 2 stat. miles to an inch. Gall and Inglis, London and Edinburgh. *Presented by the Publishers.*

These maps have been reduced from the Ordnance Survey, they fold into a small space; and as they can be conveniently carried in the pocket, are specially suited for the use of pedestrians and cyclists.

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Carta delle Ferrovie e delle linee di Navigazione del Regno d'Italia. Scale 1 : 1,000,000 or 15·8 stat. miles to an inch. 2 sheets.

London.

Bartholomew.

New plan of East London. By John Bartholomew, F.R.G.S. Scale 1 : 19,800 or 3·2 inches to 1 stat. mile. W. H. Smith & Sons, London. Price 2s., mounted on cloth. Presented by Messrs. J. Bartholomew & Co.

This map is divided into half-mile squares, and extends from Leytonstone to the Crystal Palace, and from London Bridge to Woolwich.

ASIA.

Indian Government Surveys.

Surveyor-General of India.

Indian Atlas. 4 miles to an inch. Sheets: 30, Parts of Districts Lahore, Kapurthala, etc. 73, Parts of Districts Wardha, Amraoti, etc. 76, Guntur, Devarkonda, etc.—Quarter Sheets: 87, S.E. Gonda Fyzabad, etc. 91, N.E. Bilaspur, Raigarh, etc. 129, S.W. Sibsagar, Lakhimpur, etc. 130, N.E. Sibsagar, Naga Hills, etc.—India with Hills, 1 inch to 64 miles, corrections to 1893, 4 Sheets.—India without Hills, 1 inch to 28 miles, additions and corrections to 1893.—Bombay Survey, Sheet No. 274, 1 inch to a mile, Part of District Belgaum. Season 1890-91.—Bengal Survey, 1 inch to a mile. No. 105, Angul Estate (Orissa). Season 1888-89.—Assam Survey, No 114, 1 inch to a mile. Parts of Lakhimpur and Sibsagar. Seasons 1866-73. No. 129, Part of Lakhimpur. Seasons 1867-73. No. 130, Part of Lakhimpur. Seasons 1867-73.—Madras Survey, No. 331, 1 inch to a mile. Parts of Bastar N. State and Jeypore Zemindary. Season 1868-69.—Upper and Lower Burma Surveys, 1 inch to a mile. No. 186, Districts Bassein and Thongwa. Seasons 1881-89. No. 189, Districts Bassein and Thongwa. Seasons 1886-91. No. 264, District Kyunkae. Season 1889-90. Index Map to the Sheets of the Survey of Upper and Lower Burma, 1 inch to 64 miles, 1893.—South Eastern Frontier, 1 inch to 4 miles. No. 1, N.E. Upper Chindwin, etc. Seasons 1886-92.—Provinces of Bengal, Behar, Orissa, and Chota Nagpur, 1 inch to 16 miles, 1892, 2 Sheets.—Provinces of Bengal, Behar, Orissa, and Chota Nagpur, 1 inch to 32 miles, 1892.—His Highness the Nizam's Dominions including the Assigned Districts of Berar, 1 inch to 16 miles, 1891, 2 Sheets.—Benares Division, 1 inch to 4 miles, 1893. 2 Sheets.—Darjeeling District, 1 inch to 4 miles, 1893.—Assam in 9 Sheets, 1 inch to 8 miles. Sheets No. 1, Bhutan, etc. No. 3, Parts of Districts Lakhimpur and Sibsagar, etc. No. 5, Parts of Districts Kamrup, Darrang, etc. No. 6, Parts of Naga Hills. Nos. 7 and 8 (on one Sheet), Parts of Districts Sylhet and Cachar, Manipur, etc., Corrections to 1891-93.—The Province of Assam, 1 inch to 16 miles, Corrections to 1891.—Presented by H. M. Secretary of State for India, through India Office.

AFRICA.

Mozambique.

Comissão de Cartographia, Lisbon.

Cartados Districtos de Lourenço Marques e de Inhambane, Provincia de Moçambique, 1893. Scale 1 : 1,000,000 or 15·7 stat. miles to an inch. Presented by *Comissão de Cartographia, Lisbon.*

On this map all the boundaries of districts in the Province of Mozambique, and the routes followed by Portuguese explorers are laid down, the positions of military posts, missions, light-houses, and villages are shown, and a large amount of detail with regard to the topography is given.

Prince's Island.

Comissão de Cartographia, Lisbon.

Carta da Ilha do Principe—2a edição. Scale 1 : 100,000 or 1·8 stat. miles to an inch. Presented by *Comissão de Cartographia, Lisbon.*

West Africa.

Kiepert.

Die neue Grenze Kamerun's gegen das englische Niger-Bennü-Gebiet (Abkommen vom 14 April und 15 November 1893). Scale 1 : 3,000,000 or 47·8 stat. miles to an inch. Aus R. Kiepert's *Deutschem Kolonialatlas für den amtlichen Gebrauch in den Schutzgebieten*. Geographische Verlagshandlung Dietrich Reimer in Berlin, Inhaber : Hoesfer & Vohsen, 1893.

This is a sheet of Kiepert's 'Deutschen Kolonialatlas,' on which the boundary settled between the English and German territories in the Niger and Benue region. A note on this subject appeared in the *Geographical Journal* for May, 1894.

AMERICA.

Argentine Republic.

Delachaux.

Mapa Mural de la Provincia de Buenos Aires, 1893. Scale 1 : 600,000 or 9·5 stat. miles to an inch. Construido bajo la direccion de Enrique Delachaux. Impreso en los Talleres de Publicaciones del Museo de La Plata (Sección de Cartografía). 6 sheets.

This is a very complete map of the province of Buenos Ayres, on which all the railroads, telegraphs, and roads have been brought up to date; and other items of information with regard to agricultural centres, importance of towns, etc., are indicated by symbols. At the foot of the map a table is given, arranged in alphabetical order, the areas, elevations above sea-level, and population of each division of the province, and insets of the Argentine Republic, the principal lines of ocean steamers which call at Buenos Ayres, and a plan of the port of La Plata.

Mexico and Guatemala.

Sapper.

Krater-Typen in Mexico und Guatemala. Nach Aufnahmen von Dr. Carl Sapper, 1892 und 1893. Petermann's Geographische Mitteilungen, Jahrgang 1894, Tafel 8. Justus Perthes, Gotha. Presented by the *Publisher.*

North American Lakes.

Harrington.

Currents of the Great Lakes as deduced from the movements of bottle papers during the seasons of 1892 and 1893. By Mark W. Harrington, chief of the Weather Bureau. Published by authority of the Secretary of Agriculture. Washington, D. C. Weather Bureau, 1894. Presented by the *Chief of the U. S. Weather Bureau.*

This atlas consists of six maps illustrating, by means of coloured lines, the direction and speed of the currents of the Great Lakes of North America. Early in 1892 the United States Weather Bureau published a wreck chart of the Great Lakes, a striking feature of which was the clustering of wrecks in certain parts of the surface of the lakes. This suggested that unknown currents might play a considerable part in the wreckage, and steps were at once taken to ascertain if such currents existed and what they were. The method pursued was that which has been frequently employed in the study of ocean currents, and is as follows:—A bottle containing a paper on which the date and place were written is thrown overboard at some definite point and left to float freely, and when picked up the enclosed paper is marked with the date and place of finding. In this way two points on the line of current were determined, and by employing a considerable number of bottles the general direction and speed were shown. The maps are accompanied by introductory letterpress containing much interesting information.

United States and Canada.**Rand, McNally & Co.****Indexed County and Railroad Pocket Map and Shippers' Guide of—**

Arkansas,	scale 1 : 850,000 or 13.4 stat. miles to an inch.
Georgia,	" 1 : 950,000 " 14.4 " "
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Kentucky,	" 1 : 1,150,000 " 18.1 " "
North Dakota,	" 1 : 1,350,000 " 21.3 " "
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Ontario,	" 1 : 1,120,000 " 17.6 " "

Rand, McNally & Co., Chicago and New York. New Editions, 1894.

Price 25 cents each. Presented by the Publishers, through E. Stanford, Esq.

These are new editions of a series of maps, which are in course of publication by Rand, McNally and Co. Each map is accompanied by an index containing much information that will be useful to persons visiting the United States on business or for pleasure.

PACIFIC OCEAN.**Pacific Islands.****Pfeil.**

Joachim Graf Pfeils Durchquerungen von Neu-Mecklenburg im Jahre 1888. Nach den Aufnahmen des Reisenden entworfen von P.L. Scale 1 : 200,000 or 3.2 Statute miles to an inch. Petermann's Geographische Mitteilungen, Jahrgang 1894 Tafel 7. Justus Perthes-Gotha. *Presented by the Publishers.*

GENERAL.**Ancient Atlas.****Spruner-Sieglin.**

V. Spruner-Sieglin. Hand-Atlas zur geschichte des Altertums, des Mittelalters und der Neuzeit. I. Abteilung: Atlas Antiquus. Atlas zur geschichte des Altertums. 34 kolorierte Karten in Kupferstech enthaltend 19 übersichtblätter, 94 historische Karten und 73 Nebenkarten. Entworfen und bearbeitet von Dr. Wilhelm Sieglin. Dritte Lieferung. Gotha Justus Perthes. *Price 2 M. 50 Pf. each part.*

The third part of this atlas contains the following maps: Palastina et Phoenice, Græcia quinto a. Chr. saeculo, Italiae pars Septentrionalis, and Hispania. The maps are very clearly drawn, and are excellent specimens of cartography.

Historical Geography.**Schrader.**

Atlas de Géographie Historique. Ouvrage contenant 54 Grandes Cartes doubles en couleurs, accompagnées d'un Texte Historique au dos et d'un grand nombre de Cartes de Détail, Figures, Diagrammes, etc. Par une Réunion de Professeurs et de Savants, sous la direction géographique de F. Schrader Directeur des travaux cartographiques de la librairie Hachette et C^{ie}. Paris : Librairie Hachette et C^{ie}. Part 6. *Price 1fr. 50c. Presented by the Publishers.*

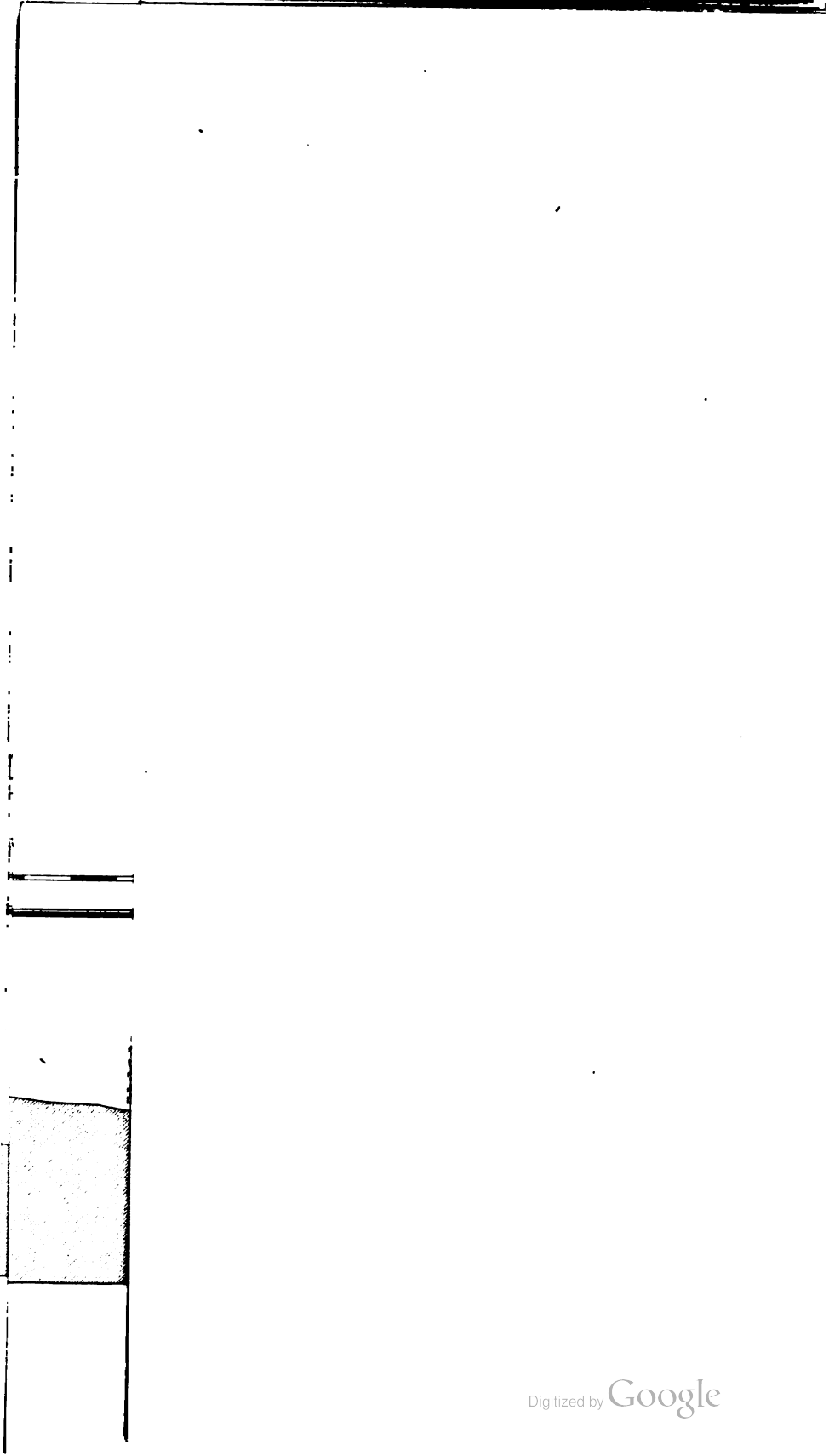
The present issue of this atlas contains a map of the Carolingian Empire, with insets of England under the hegemony of Egbert King of Wessex, and Spain at the death of Alfonso I. The Holy Empire illustrated by three maps. Europe in the time of Napoleon 1810; with insets of France showing political divisions in 1802, and of Germany at the end of 1805. Each map is accompanied by explanatory letterpress, illustrated by small maps and plans.

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

No. 1407, Chiri-Chiri Bay, Pacific Coast of Colombia.—No. 1408, Mandinga Harbor, Gulf of San Blas, Atlantic Coast of Colombia.—1405, Columbia Bay, Gulf of Darien.—1410, San Miguel Bay and Darien Harbor, with the Savannah and Tuyra Rivers.—No. 1400, Pilot Chart of the North Atlantic Ocean, April 1894. Published at the Hydrographic Office, Bureau of Navigation, Navy Department, Washington D.C. Charles Sigbee, Commander U.S.N. Hydrographer. *Presented by U.S. Hydrographic Office.*

PHOTOGRAPHS.

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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